SELF-EFFICACY BELIEFS INFLUENCING PASIFIKA STUDENTS' ACHIEVEMENT IN SCIENCE

BY

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ABSTRACT

Achievement of Pasifika students in science at secondary school has been an enduring problem for many decades in New Zealand, where they occupy the bottom rung of the national achievement ladder. This exploratory study set out to investigate how Pasifika students' self-efficacy may influence their achievement in Year 11 science. Using a qualitative approach this interpretive research, studied Year 11 science students to understand the dynamics between classroom interactions, their self-efficacy and achievement. Self-efficacy being an inner willpower to attempt or not to attempt at achieving a certain goal. The study adapted Albert Bandura's Social Cognitive Theory (SCT model) to the New Zealand context as the theoretical frame. The study explored evidence of the four antecedents of self-efficacy: Mastery, Vicarious Experience, Verbal Persuasion, and Physiological and Emotional arousal. School science is taught within the constructivist science curriculum in New Zealand.

The *Kakala* Research Framework was applied as the methodological guide for data collection. Three schools accepted the invitation to participate in the research and offered a purposive sample of Pasifika students and their science teachers who agreed to participate. Data were collected through classroom observations; student questionnaire; focus group interviews; and teacher interviews. The National Certificate of Educational Achievement (NCEA) Level One science results were then interpreted alongside the identified self-efficacy antecedents.

Mastery was the self-efficacy antecedent most strongly associated with achievement. Students with high Verbal Persuasion and Vicarious Experience as primary or secondary sources of self-efficacy also achieved all the credits they attempted. Verbal Persuasion was an important source of self-efficacy commonly identified by students, who saw teachers as providing this form of support. Generally, student who indicated high levels across the self-efficacy antecedents displayed high levels of achievement, although some indicating high overall self-efficacy in this way did not achieve all their credits due to high Physiological and Emotional needs.

Teachers identified literacy as a problem for Pasifika students in achieving well in science; however, there was no evidence of any attempt to build the students' understanding of

scientific vocabulary or comprehension of scientific text. The common themes identified by students were a fear of failing and disappointing their parents. Students expressed the need for science content to be explained and clarified to help them understand the science ideas underpinning the assessed practical work.

Findings of concern were; the narrow curriculum experienced by the Pasifika students in this study; teaching approaches that chunked the content into small disconnected bits; and providing guidance on what needed to be written to achieve the credits without developing the necessary understanding. Consequently, the learning purpose was reduced to achieving NCEA credits. The unintended result of this narrow curriculum has implications for what science content and procedures these Pasifika students know and can apply. This highlights that student have insufficient content knowledge and understanding to progress to the next level in science education. The internal assessment only in some of these classes reduced the future science learning opportunities for these Pasifika students.

This research extends the Kakala research framework for Pasifika education by introducing the centrality of the *Fau* fibre, which is weak and yet critical to the formation of a strong and attractive lei. It also suggests the inclusion of *Hounga'ia* as a step between *Mālie* and *Māfana*.

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DEDICATION

To my parents Yamasere Haingian Igombi Kuira and Polehau Nanue
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LIST OF ACCRONYMS

ASE	-	Academic Self-efficacy
MOE	-	Ministry of Education
NCEA	-	National Certificate of Educational Achievement. NCEA is the main national qualification for secondary school students in New Zealand.
NOS	-	Nature of Science
NZQA	-	New Zealand Qualifications Authority
NZQF	-	New Zealand Qualifications Framework
OECD	-	Organisation for Economic Co-operation and Development. The OECD is an international organisation comprising 37 member countries that discuss and develop economic and social policy to build better policies for better lives.
PSE	-	Perceived Self-Efficacy
PISA	-	Program for International Student Assessment. PISA is an international assessment that measures 15-year-old students' reading, mathematics, and science literacy every three years.
SCT	-	Social Cognitive Theory
STEM	-	Science, Technology, Engineering and Mathematics
TIMSS	-	Trends in International Mathematics and Science Study

GLOSSARY

<i>Fānau</i>	-	Family or children
<i>Fau</i>	-	The fibre from the <i>Hibiscus tiliaceus</i> tree used for making fishing nets, grass skirts, ornaments, and weaving garlands of flowers.
<i>Hounga'ia</i>	-	Deep appreciation
<i>Kahoa</i>	-	necklace made with special flowers.
<i>Kakala</i>	-	garland of specially picked choice flowers, leaves and berries.
<i>Kahoa kakala</i>	-	Lei or necklace made with special flowers, leaves and berries.
<i>Kāhui ako</i>	-	a cohort or part of group of educators working in partnership with the “Government’s Investing in Educational Success (IES) initiative to help raise the learning and achievement of all children and young people, particularly students at most risk of underachieving” (NZSTA, 2021).
<i>Ko e fau ko e no'o'anga ia 'o e kakala</i>		
	-	“The fibre (fau) holds the flowers together in a lei”.
<i>Loto'aki</i>	-	Determination or Willpower
<i>Maunu e kakala 'oku fī</i>		
	-	Falling off, of the flowers from the garland or lei
<i>Pākehā</i>	-	Māori term for caucasians or People of European origin
<i>Pālangi</i>	-	Tongan term for caucasians or People of European origin
<i>Pasifika</i>	-	Group of people in Aotearoa who migrated from the Pacific Islands
<i>Talanoa mālie</i>	-	Worthy discussion or conversation
<i>Taupulenga</i>	-	Council of advisors
<i>'Umu</i>	-	Ground oven cooking
<i>Vā</i>		a virtual space that operates or exists between or operates and relates “separate entities and things together in the Unity-that-is-All, the space that is context, giving meaning to things. The meanings change as the relationships/the contexts change” (Wendt, 1996).
<i>Waka Hourua</i>	-	Ancient double hulled sea going waka or canoe used by Māori and Pasifika as a vehicle for navigating the stormy waters. The term used here in a science achievement standard for ‘boat’.

CHAPTER ONE

Introduction

1.1 About the researcher

I was born in Papua New Guinea (PNG), the youngest child of a coffee farmer and part-time Linguistics facilitator. Two of my older siblings were teachers, one an English teacher and one a Science teacher so I had a good grounding in the English vernacular. I had high mastery in all my subjects including English and Science so made a choice to pursue a Bachelor of Science in Applied Chemistry at the PNG University of Technology. After graduating, I began working as a technical officer with the chemistry department of the same university.

However, things changed when I got offered a teaching job in the Kingdom of Tonga in 1999 with the Catholic Diocese of Tonga and Niue, to teach science and chemistry to senior secondary students. Plunged into a different culture and without a teaching qualification, I found the journey very challenging in my first year. I tried to teach the language of science in the English language to a group of students whose first language was not English. In my second year I decided to learn their language and by the third year I was teaching science bilingual, in English and Tongan. At that stage I decided to pursue a Post graduate Diploma in Education to give me a better understanding of educational pedagogy and classroom practice. I successfully completed that qualification and went on to be tutor in science at the University of the South Pacific Tonga campus (part-time). During that year, I was invited to participate in educational research by Dr. Anna Taufe'ulungaki from the Institute of Education at the University of the South Pacific, and co-authored my first publication with Falasima Kautoke and Fololeni Fatai (2006).

In 2003, I moved from the church school to the Tonga National Form Seven (State School of Excellence) to teach Seventh Form Biology and later Seventh Form Chemistry at Tonga College (state school) a curriculum under the New Zealand Bursary program in its last year, as New Zealand was already moving to the National Certificate of Educational Achievement (NCEA). At the same time the South Pacific Board of Educational Assessment (SPBEA) was also refining its curriculum structure to mirror the NCEA and Tonga merged with the rest of the South Pacific under the SPBEA based in Suva, Fiji.

In 2006 I was promoted by the Ministry of Education (Tonga) from teaching secondary at Tonga College to the Tonga Institute of Education to become physics and science education lecturer. As a teacher educator, I saw myself from another angle, trying to better my own teaching through this group of student teachers in the classroom. It gave me the motivation to study for an additional 'Advanced Educational Research' paper at the University of the South Pacific. That set the foundation for me to later pursue a Master of Education (by Research) with Victoria University of Wellington in 2013/2014. For my Masters I went back to Tonga under the guidance of Dr. Robert Strathdee and Dr. Louise Starkey examining the Tonga Educational Policy Framework in relation to the recruitment and retention of Tongan science teachers in Tongan secondary schools using the Kakala framework by Helu-Thaman (1992) and Kakala Research Framework by Johansson-Fua (2009) to guide my research. It was in that research that I found that the self-efficacy of a Tongan science teacher was high enough to keep them teaching and achieving the results they were achieving despite all the difficulties of lack of appropriate laboratory equipment, classroom conditions and external pressures. It provided me the opportunity to re-examine my research framework, and in doing so I coined the phrase "*Ko e fau ko e no'o'anga ia 'o e kakala*" (in English: "It is the fiber that holds the lei together"). My desired product is the beautiful lei, but it is not just the art of weaving that produces the lei, the unseen fibre that holds the petals and gives structure and embodiment to the lei is also significant. It is the 'unseen' self-efficacy of a person that drives them to teach the way they teach. This is further elaborated on in Chapter 3.3.2. That experience got me thinking that; if Tongan teachers as adults can persevere in their teaching despite difficulties faced, how do Tongan students in the classrooms persevere and stay in science? That is when I decided to pursue a doctoral study to find out more.

Preliminary discussions with my primary supervisor Professor Azra Moeed led me to understand that in the New Zealand context, Tongan students are part of a bigger group classified as Pasifika. My own children were all part of that cluster having gone through the NCEA system. In my many years of teaching science, I had experienced language difficulties in trying to explain science content and observed the students' point of view difficulties in trying to comprehend and understand content. With my experience of having taught in three education systems (NZ Bursary/NCEA, SPBEA and Tonga School Certificate), I found

one thing was common – internal assessment and external assessment. However, with NCEA came the credits to achieve and I did take part as a teacher of this bigger group (Pasifika) assisting them to successfully earn their credits without really paying attention to their sources of self-efficacy. I thought content delivery and teacher encouragement were sufficient. This is where it becomes personal. Had I done this research before, I would have helped my students better by, understanding their viewpoints, motivational efficacies, and frustrations. To my consolation, I hope this research will contribute to assist teachers of Pasifika students in New Zealand to be mindful of pupils' sources of self-efficacy and to cater for their needs appropriately as they start out on their NCEA journey. In all my secondary teaching career, I have always had a Year 11 class to teach and it is also the formal first year of NCEA contributing towards a national qualification, hence my choice to use Year 11 participants.

1.2 Research Rationale

The achievement of Pasifika students in New Zealand has been an ongoing concern for the Ministry of Education which categorizes them as *priority learners* along with students of Māori descent and those who come from low socio-economic backgrounds (Chu, Glasgow, Rimoni, Hodis, & Meyer, 2013; Cleary & Conner, 2015; Coxon, Anae, Mara, Wendt-Samu, & Finau, 2002; Gorinski & Fraser, 2006; Meissel & Rubie-Davies, 2016). In 2013, the Ministry of Education set a goal “to increase the proportion of learners achieving at or above national literacy and numeracy standards” (Ministry of Education, 2013a). The Education Review Office (ERO) reported that,

to achieve this goal, outcomes must improve for key priority groups, including Māori students that are not achieving well, Pacific students who are not achieving success, special needs students and those from low income families (Ministry of Education, 2013a, p. 1)

Several Literature reviews and reports have highlighted the disparities that exist for this ‘priority group’ of students including Pasifika, especially in engagement and achievement in the New Zealand education system (Bruce Ferguson, Gorinski, Wendt-Samu, & Mara, 2008; Chu et al., 2013; Gorinski & Fraser, 2006). Hence the term ‘*priority learners*’ came to represent the low achieving group of the New Zealand school population. Recent research

also focussed on finding solutions to the problem of underachievement of this group of students (Hynds & McDonald, 2010) and the way this group of students learn (Chu et al., 2013; Cleary & Conner, 2015; Gorinski, Bruce Ferguson, Wendt-Samu, & Mara, 2008; Hynds & McDonald, 2010). Houghton (2015) says the situation is *shocking* and proposes a re-visit of the assessment techniques used in the schools, proposing cultural epistemology to be considered in assessment.

The teaching and learning of science in particular also came under scrutiny as several disparities were observed in the participation and achievement of Pasifika students (Conner & Cleary, 2015). Although there have been marked improvements in achievement by Pasifika students over the years reported, there is still a concern with regards to how pupils from this group respond to lesson delivery methods by teachers and expected learning outcomes in science at secondary level (Education Counts, 2014). Studies carried out by 'Otunuku and Brown (2007) with a group of Tongan students suggested that self-regulation and exercise of control over their beliefs led to greater achievement. They found that students' attitudes and beliefs about their school experiences played a significant part in their academic achievement in the National Certificate of Educational Achievement (NCEA) in English and mathematics.

Even though teaching, learning, and assessment all played some role in performance, much was attributed to student beliefs, suggesting that it would be more beneficial to the students if they were assisted more in ways of improving their 'belief' in themselves as having the potential to achieve (Otunuku, Brown, & Airini, 2013). However, Tongans and Pasifika people in general come from societies where respect for the teacher and elders remains paramount. Often students will blame themselves for their non-achievement out of respect for their teachers (Otunuku et al., 2013; Spiller, 2012). Conner (2015) believes teachers can make a significant difference in the classroom through professional training with the support of the Ministry of Education. Teachers should be able to reexamine the nature and development of their teaching practices so that they are better able to accelerate the progress of this group of students.

The idea of 'self-regulation' as reported by 'Otunuku et al. (2013) and 'self-efficacy' are rooted within Albert Bandura's (1986) '*social cognitive theory*'. Bandura (1986) believes that human behaviour is motivated intrinsically by various needs, drives, impulses and

instincts. He defines self-efficacy as that internal determination to succeed in whatever the endeavour; an individual's self-belief that they can achieve whatever task they set their minds to (Bandura, 1994, 1997). Self-efficacy takes charge and controls one's belief system propelling people to function as they anticipate, make purposive decisions, and self-evaluate their proactive regulators to motivate their actions (Bandura, 1993). Self-efficacy influences career choices (Hackett, 1995); it is relied upon in stressful life situations (Jerusalem & Waldermar, 1995); and cross cultural perspectives of self-efficacy also exist (Oettingen, 1995). Self-efficacy plays a vital role in personal goal setting to motivate someone in academic attainment (Zimmerman, 2002; Zimmerman, Bandura, & Martinez-Pons, 1992). Studies have also shown that students with high self-efficacy tend to do better academically, especially in the sciences (Jansen, Scherer, & Schroeders, 2015; Lent, Brown, & Larkin, 1984; Wong, 2016). Self-efficacy has been identified by Gibbs and Poskitt (2010) as an important and highly influential aspect of a pupil's belief system and attitude in terms of classroom engagement and achievement.

Pasifika people left their islands to come to New Zealand to find better learning opportunities for their children and now find themselves on the bottom rungs of the education ladder. This has prompted me into this research to contribute to literature on Pasifika students' learning in New Zealand. This research explores the self-efficacy beliefs that influence the learning behaviours of Pasifika learners in Year 11 in their engagement in science leading towards their NCEA achievement. Chapter 2.1 provides further discussion on *priority learners*.

1.3 Purpose of the Research

This research has considered the recommendations made by the writers in Section 1.2 regarding Pasifika learners and also the future research initiatives and suggestions made by the Pasifika Education research priorities and the Pasifika Education Plan (Education Counts, 2020b; Ministry of Education, 2013b, 2016a, 2016b).

The resulting purpose of this study was threefold:

- Firstly, to explore factors affecting the self-efficacy of Pasifika students and influencing their achievement in science at NCEA Level One.

- Secondly, to add to literature and the body of knowledge on factors affecting the achievement of Pasifika students in Science in New Zealand.
- Thirdly to inform policy and practice with current research data for professional development of teachers for lifting Pasifika achievement in Aotearoa.

1.4 Significance

The problem of underachievement among Pasifika students is a matter of concern for educators and the Ministry of Education, and education providers, and will affect many government decisions in New Zealand in future. This study contributes towards understanding and suggests possible explanations that may contribute towards improving teaching practices and achievement of Pasifika students in Science.

1.5 Thesis Outline

This thesis comprises nine chapters. Chapter one has provided some background about the researcher and the rationale for this doctoral study.

Chapter Two will provide a review of literature and a background to the study.

In Chapter Three I present the literature on self-efficacy, while Chapter Four describes my research design and methodology and how this research was carried out.

Chapters Five, Six and Seven present the findings of this study. Chapter Five presents findings from Grace College; Chapter Six presents the findings from Mercy College and Chapter Seven the findings for Leep High School.

Chapter Eight offers a discussion of my findings and the thesis concludes with Chapter Nine, where the limitations of the research design and implications of the research findings for education policy and practice are shared; it ends with my recommendations for future research.

CHAPTER TWO

Literature Review and Background to the study

Introduction

This chapter provides the literature on Pasifika achievement in New Zealand and the context of the study. The term Pasifika is used by the Ministry of Education to group people who have migrated to New Zealand from the Pacific Islands and their descendants who now live in Aotearoa (CORE, 2014, 2016; Coxon et al., 2002). Originally Pasifika was used to describe Polynesian peoples (Samoa, Tonga, Cook Island Māori, Niue, Tokelau, Tuvalu) but now includes Melanesia (Fiji, Vanuatu, Solomon Islands, Papua New Guinea, West Papua) and Micronesia (Federated States of Micronesia) as more and more of these people move to and live in Aotearoa to either study or work. Not all Pasifika people come from one Pacific Island nation nor speak the same language however there are intermarriages between the peoples of these islands and they share similar cultural values and practices (Averill & Rimoni, 2019; CORE, 2014; Spiller, 2012).

The Pasifika population in New Zealand has been increasing every year as shown in Figure 2.1 (Department of Statistics, 2018).

Figure 2.1 Growth of Pasifika population in New Zealand (Department of Statistics, 2018).

By 2013, the Pasifika population had increased by almost 30 thousand from the year 2006 and by the 2018 census, by over 115,000 people. Those statistics are presented in Table 1.0 below.

Table 2.1 Population of Pasifika People compared to other New Zealand ethnic groups, 2006 – 2018 censuses

Year	2006 Count	2013 count	2018 count
Pasifika Peoples	265,974	295,941	381,642
NZ population	3,860,163	4,011,399	4,699,755

(Statistics New Zealand, 2021)

With an increase in population, the concern for educational achievements has also increased. Currently Pasifika makes up more than 10 percent of New Zealand’s schooling population (Averill & Rimoni, 2019). However, Pasifika and Maori occupy the bottom rungs of the achievement ladder in New Zealand as *‘Priority learners’*. Section 2.1 discusses some of the concerns that have been raised about Pasifika students among the ‘Priority Learners’ in Aotearoa.

2.1 Pasifika as Priority Learners

The term *‘priority learners’*, has been used and cited by many authors and in many Ministry of Education reports and refers to Māori, Pasifika, and special needs learners especially those who come from low income families (Anae, Anderson, Benseman, & Coxon, 2002; Bruce Ferguson et al., 2008; Gorinski & Fraser, 2006; Ministry of Education, 2013a).

Stemming from reports like those of the Education Review Office (Coxon et al., 2002) and (Gorinski & Fraser, 2006), the Ministry of Education through the Pasifika Education Plan (PEP) 2013-2017 identified several goals and objectives to create conditions for a strong and vibrant Pasifika community through various initiatives to improve the achievement of Pasifika peoples in Aotearoa (Matua, 2016; Ministry of Education, 2016b). Hunter (2013) proposed that more needed to be done to appreciate the differences between Pasifika cultures especially how it may affect those children born in New Zealand and the islands and those with a hybrid identity (mixed parentage or NZ born Pasifika). Hunter (2013) also challenges teachers to adopt culturally responsive teaching that links familiar core Pasifika values of respect and to include teaching materials that reflect Pasifika students’

experiences and lifestyles. Hunter (2013) believed that when students feel that their experiences and perspectives are valued, that may lead to a sense of belonging and pave the way for improved achievement. Efforts were made through the 'Achievement in Multicultural High Schools program' for the Pasifika student voice to be heard (Hawk & Hill, 2003), but were not received well by teachers (Spiller, 2012). While Pasifika student achievement ranks at the bottom of the NZ achievement scale along with Māori; the low socio-economic backgrounds they come from may be difficult to change overnight, but believes psychological beliefs, values and attitudes can be changed (Spiller, 2012).

While some efforts indicated positive directions for change, the 2018 New Zealand census data reported that nearly 25% of Pasifika people with either a 'No qualification', or whose highest qualifications were at Level 3, Level 2, Level 1 (Statistics New Zealand, 2021).

Figure 2.2 Highest qualifications of Pasifika peoples in New Zealand (Statistics New Zealand, 2021).

Comparatively fewer Pasifika students have been progressing to educational levels higher than Level Three.

The Pacific Education Plan (PEP) 2013-2017 identified several goals and objectives to create conditions for a strong and vibrant Pasifika community through various initiatives to improve achievement of Pasifika pupils in Aotearoa. The aim of the PEP is to assist Pasifika communities to achieve the best desired educational outcomes by aligning compatibilities between the learner's educational environment and their home taking into account their cultural environment (Matua, 2016). Since then, several intervention programmes have been put in place. One such is in conjunction with the Language Enhancing Achievement Programme for Pasifika known as LEAP (Ministry of Education, 2020b). LEAP is aimed at supporting the learning of Pasifika students who are bilingual especially those who can still speak and relate to their indigenous Pasifika language as well as English. The resources put out by LEAP aim to assist teachers of Pasifika students to plan and incorporate culturally responsive ways of teaching to meet the needs of a diverse range of Pasifika students (NZCER, 2020). In advocating for bilingual teaching to speakers of a second language, (Franken, 2005) states that a bilingual student can best achieve educational success if he or she is fluent in a first language other than his or her second language (NZCER, 2020).

Even the Tertiary Education Commission (TEC) reports that the number entering tertiary colleges "is still below that of Māori and non-Māori/non-Pasifika" (Tertiary Education Commission, 2017, p. 6). Therefore, when considering best practices for teaching Pasifika learners, the question still arises, as to why the system is failing too many Pacific learners (Education Counts, 2020b). Another development is the Action Plan for Pacific Education 2020-2030: Supporting Research and Community Voice (Education Counts, 2020a). A sentiment that arose from the Action Plan for Pacific Education, video transcript reads:

When Pacific learners and their families across Aotearoa feel safe, valued and equipped to achieve their education aspirations, we know we have made the system shift in the right direction (Korero Maturanga, 2020).

In my opinion, the action plan was too broad and did not address the specific low achievement of Pasifika secondary students at Levels One and Two. There was a need expressed for highly competent teachers, leaders and educational professionals to be culturally responsive, and particularly to be aware of bilingualism with diverse Pacific whakapapa. Although the need for acknowledging Pasifika whakapapa was raised, it missed

the concern put forward by Averill and Rimoni (2019), about fewer New Zealand teachers with either Māori or Pacific heritage in the classroom especially at the secondary school level. However, in terms of this research, one of the most promising key messages is that “further research is required to strengthen knowledge and experience about good practice” (Education Counts, 2020b Para. 15).

Even though the gap closed considerably with Level One literacy and numeracy since 2009, Pasifika remained below all other ethnicities except for Māori over the 10 years from 2009 to 2019 as shown in Figure 2.3 below (Education Counts, 2021a).

Figure 2.3: Percentage of total school leavers with NCEA Level 1 literacy and numeracy by ethnic group (2009 to 2019) (Education Counts, 2021a)

More recently, in their research into what Pasifika students’ value in their mathematics learning, Hill, Hunter, and Hunter (2019) found that values frequently espoused by participants were utility, peer collaboration, group-work, effort, practice, and family support. Could the same be true of Pasifika students in science?

2.2 Academic Achievement of Pasifika in New Zealand

Academic achievement is a collective term encompassing the overall performance outcomes indicating the successful accomplishment of specific educational goals. It applies across several domains and subject areas and reflects the instruments used for measurement. Academic achievement determines whether someone qualifies to undertake study at a higher institution and whether they have the knowledge and skills for a particular vocation (Steinmayr, Meißner, Weidinger, & Wirthwein, 2017). Academic achievement is an important indicator of a nation's wealth and prosperity as it portrays a strong socioeconomic outlook globally. In New Zealand, achievement of secondary students in Years 11-13 is monitored using the NCEA Achievement Standards, with records maintained by the New Zealand Qualification Authority, NZQA. The National Monitoring Study on student Achievement (NMSSA) that has recently replaced the National Educational Monitoring Programme (NEMP) monitors student achievement in Science in New Zealand for Years 4-8 (Asil, 2017).

Periodically, international studies are also carried out on academic achievement. The PISA (Programme for International Student Assessment) is conducted and administered by the OECD (Organisation for Economic Co-operation and Development) of which New Zealand is a member. The results of these studies provide a participating nation with specific indicators of its education system's strengths and weakness and may influence policy decisions (Steinmayr et al., 2017). May, Flockton, and Kirkham (2016) reported that between 2006 - 2015, New Zealand 15-Year olds (Year 9s) performed above the OECD average for science literacy (Figure 2.4). However, Pasifika students scored below the OECD and New Zealand averages (Figure 2.5).

Figure 2.4: New Zealand Mean Performance Compared to OECD Average (2006-2015) (Education Counts, 2018b).

Figure 2.5 shows Pasifika performed at the bottom of the New Zealand and OECD ranks in science from 2006 to 2015 (May et al., 2016).

Figure 2.5 New Zealand PISA Average compared with Pasifika and OECD, 2006-2015 (May et al., 2016).

Within that same group, a comparison of the performance of the different ethnic groups in New Zealand showed Pasifika still with the lowest average in science literacy as shown in Figure 2.6 (Education Counts, 2018b).

Figure 2.6 New Zealand PISA Science Literacy Mean Scores, by Ethnic Group (2006-2015) (Education Counts, 2018b).

The situation did not improve between 2015 and 2018. May, Jang-Jones, and McGregor (2019) reported that, despite the low achievement on average in school, “Pasifika students reported positive experiences in school, saying they have good relationships with their peers and teachers” (p. 50). Even though 92% of Pacific students studied reported they had the resilience to cope in school, they also reported slightly lower self-efficacy when compared with non-Pacific students, before and after controlling for gender, socio-economic and immigrant background. A large majority of 93% reported they were well supported and encouraged by their parents from home (Education Counts, 2018a). Jang-Jones and McGregor (2019) noted a ‘fear of failing’ among many New Zealand 15-year olds. However, for Pasifika particularly, while they had lower self-efficacy compared to other non-Pasifika groups, Pasifika and Māori also scored a lower ‘fear of failing’ factor (p. 57).

Figure 2.7 shows that the mean science scores for Pasifika was lower in 2018 compared to 2015 (May et al., 2019).

Figure 2.7 New Zealand PISA Average Overall Science for Pasifika, 2018

(May et al., 2019).

The overall picture of Pasifika students' achievement according to the OECD science literacy proficiency levels also do not look very promising. Figure 2.8 shows this proficiency levels where most Pasifika are achieving compared to other students in their age bracket in New Zealand.

Figure 2.8. OECD Scientific Literacy Proficiency Levels for NZ ethnic groups (Education Counts, 2018b).

Figure 2.8 shows majority of Pasifika 15-year-olds achieving at Levels one and two of the OECD science literacy proficiency levels than their cohort at the same level in school (Years 10 and 11) (Education Counts, 2018b). Even among the high performing New Zealand group in the OECD, Pasifika students still performed lower than other ethnicities in their cohort (Education Counts, 2021b).

New Zealand is also a member and takes part in TIMSS (Trends in International Mathematics and Science Study) for Years five and nine. TIMSS is conducted on a four-yearly cycle under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), managed by the Ministry of Education (Education Counts, 2021c). Caygill, Hanlar, and Singh (2016) reported Pasifika students scoring lower average science achievement than non-Pasifika in the Trends in International Mathematics and Science. However, Medina, Sutcliffe, Marshall, and Rendall (2020) again reported Year 9 Pasifika scoring decreasing average science achievements between 2011 and 2019. One of the key findings by Medina and Sutcliffe (2020) was that;

15% of students reported that most, all, or almost all their teachers had lower academic expectations for students of some cultural groups. Māori and Pacific students reported significantly greater discriminatory school environments compared with non-Māori and non-Pacific students, respectively (p. 3).

They also reported that those who were confident in science had a higher achievement (Medina et al., 2020). Studies (TIMSS) and much was linked to socio-economic factors. Even though there have been improvements through several intervention programs, Pasifika students are still performing in the lower rungs of the achievement ladder in science (Medina et al., 2020).

2.3 New Zealand Qualifications Framework

The New Zealand Qualifications Framework (NZQF), established under section 248 of the Education Act 1989, was unified as a single framework on 1 July 2010 under the former section 253 (1) (c) of the Education Act (NZQA, 2021c). It was “designed to optimise the recognition of educational achievement and its contribution to New Zealand’s economic, social and cultural success” (NZQA, 2021c, p. 2).

Certificate level One aims to provide individuals with the basic knowledge and skills for work, further learning and/or community involvement. The outcomes include being able to:

- demonstrate basic general and/or foundation knowledge
- apply basic skills required to carry out simple tasks
- apply basic solutions to simple problems
- apply literacy and numeracy skills for participation in everyday life
- work in a highly structured context
- demonstrate some responsibility for own learning
- interact with others (NZQA, 2021c, p. 10).

More specifically relevant to this study is the National Certificate of Educational Achievement (NCEA), the national qualification for secondary students which is managed by NZQA (Mutch, 2012). NCEA and other Level One certificates are recognised and used as benchmarks for selection by employers and other tertiary institutes throughout New Zealand.

2.3.1 National Certificate of Educational Achievement (NCEA)

The National Certificate of Educational Achievement (Level One) [Ref: 0928] is the first of three National Certificates of Educational Achievement (NCEA), designed to recognise the general achievement of 16 to 19-year-old learners, especially at secondary school. It is New Zealand's main secondary school qualification, introduced between 2002 and 2004 to replace the former "School Certificate, University entrance, Sixth Form Certificate and University Bursary qualification" (NZQA, 2021e).

NCEA (Level One) is designed to:

- acknowledge achievement across a range of learning fields, particularly those identified in the New Zealand Curriculum and Te Marautanga o Aotearoa, and to attest to minimum levels of literacy and numeracy
- act as a learning goal
- attest to the ability to participate in, and benefit from, further study thereby promoting lifelong learning
- motivate learners to achieve to their potential and help them market their achievements
- assist institutions to guide students and monitor achievement, and

- provide data to assist government and providers to monitor progress in relation to qualification-related education policies (NZQA, 2021e, p. 1)

2.3.2 Assessment Policy and Practice in Schools

The New Zealand Curriculum states that,

“the primary purpose of assessment is to improve students’ learning and teachers’ teaching” (Ministry of Education, 2007a, p. 39).

The Ministry of Education through its website (Te Kete Ipurangi, 2021a) provides guidelines for teachers to monitor student progress and achievement across the curriculum. In this way the Ministry of Education justifies the clause in the National Curriculum (Ministry of Education, 2007a) that schools need to know the impact the programmes are having on their students’ learning (Mutch, 2012).

Assessment is a judgement made of a student’s learning informed from a process of gathering specific information in relation to achievement of learning objectives or set goals. One way of doing this is by looking at the achievement credits gained by the students and comparing them against national standards (Ministry of Education, 2007a; Te Kete Ipurangi, 2021c). This means, students’ learning is measured against the learning outcomes of the tasks completed. Data is collected using multiple and diverse sources to gauge or develop an understanding of what students know, understand and can do with the acquired knowledge (Moeed, 2010; Taras, 2005).

Mutch (2012) cites three purposes of assessment: assessment for learning, assessment of learning and assessment as learning. Firstly, assessment for learning plays a crucial role in improving student learning as formative assessment. In formative assessment, the strategies are at a teacher’s disposal to gauge where a student’s ideas and experiences in science are to be able to facilitate that student’s learning. It calls for agency by both the teacher and the student for improved learning (Taras, 2005).

This type of assessment is to inform the teacher about the expected outcome, (where the student is going), the progress made (where the student is); and how to assist the student to meet the expected goals. Sometimes it takes probing to establish and evaluate the progress of the student. In the context of science education, this strategy is

very important in enquiry learning as teachers need to elicit where students are in terms of progress (National Research Council, 2007; Te Kete Ipurangi, 2021c). This is meant to happen as an ongoing process in which the teacher assesses through interactions during the teaching and learning process. This diagnosis often allows to adjust lesson delivery strategies to benefit the students as planned communication as feedback. The support provided is aimed at informing students where they are in their learning in achieving the learning goals (Ministry of Education, 2007a; Te Kete Ipurangi, 2021c).

The second purpose described by Mutch (2012) is the assessment of learning which is summative and plays a role in accountability. Taras (2005) describes summative assessment as the process that leads to a final judgement which encapsulates all the evidence of whether a student has achieved all the learning goals. Summative assessments are usually made at the end of teaching a unit or program. It is a measure of performance and does not impact learning (National Research Council, 2007). However, Moeed and Hall (2011) argue that it does affect learning as the choices students make for future learning are based on the results of the summative assessment. For example, if the student gains a low grade in the summative assessment in science, they may well decide not to carry on studying science in future.

NCEA uses an accumulation of achievement credits of both internal and external standards where students are required to complete a range of assessment tasks to gain the qualification. Each task has a detailed achievement criterion that requires careful diagnostic and formative assessment. This is because students tend to focus more on exactly what they need to learn to achieve that standard. The emphasis is then on the provision of clear information to the students about the learning goals and expected outcomes; by providing appropriate feedback which can be motivating (Mutch (2012).

The third purpose Mutch (2012) explains is, assessment as learning for a sustainable educational practice. This is “about embedding assessment into student, teacher, school and system-wide practices” (p. 376). Mutch (2012) says, the curriculum allows teachers of individual schools the flexibility of selecting specific learning outcomes rather than prescribing content. The teachers therefore have the autonomy to select the appropriate “curriculum content, teaching resources, learning strategies and assessment tools” (p. 377).

Here, students are expected to monitor their own learning, progress and achievement and teachers to use reflective skills to assess how their practice is enabling students to do that. Schools in turn build internal evaluation processes and examine whether their school culture is one that fosters self-reflection, self-accountability and “use the assessment information from students and teachers to make effective strategic decisions” (p. 380).

From these three purposes, it can be deduced that assessment affects a student not only at individual level to gain the credits, but from the teacher’s perspective whether the students are achieving the desired learning outcomes. For the school the sustainability perspective would be to meet Education Review Office (ERO) expectations. To attain NCEA Level One, students are required to earn 80 credits overall including literacy and numeracy (NZQA, 2021b).

2.4 Teaching and Learning Science in New Zealand

The New Zealand Curriculum (Ministry of Education, 2007) has eight levels of attainments students should strive for and achieve by the time they leave secondary school after Year 13 (Te Kete Ipurangi, 2021c). The expectation is that by the time students reach Year 11, they should be at Level Five going into Level Six of the curriculum as indicated in Figure 2.9. (Ministry of Education, 2007a).

Figure 2.9 Achievement Levels for the New Zealand Curriculum (Ministry of Education, 2007a, p. 45)

Science education aims for students to develop an understanding of science ideas (conceptual understanding), processes (procedural understanding), and of how science works (nature of science). Learning science in school has long been held as very important because it allows for scientific knowledge and concepts to be passed on and for the expansion of those ideas through hands-on testing and practical work. This is mostly because children are often curious and want to explore and discover the world around them which makes science an ideal subject (Singh, 2014). Learning science also involves learning another language – the language of science. Students are required to learn new names, certain way to pronounce a word, learn symbols, and formulae for example (NZCER, 2020).

Millar (2004) states that science education should be aiming to help students to:

- gain an understanding of scientific knowledge, appropriate and applicable for their needs, interests, and capacities.
- develop an understanding of the methods used in science to place confidence in the knowledge it provides and our grounds to claim that confidence (Millar, 2004, p. 1).

In the New Zealand science curriculum, there is an overarching Nature of Science strand through which students learn what science is and how scientists work. The intention is for the development of skills, attitudes, and values that help students to understand the natural world and how scientific knowledge is created, tested, and communicated. There are four contextual strands: The Living World; the Material World; Planet Earth and Beyond; and the Physical World. These provide the contexts to develop knowledge about the Nature of Science (Ministry of Education, 2007a; Te Kete Ipurangi, 2021c).

The learning area within the New Zealand Curriculum sets out the following goals for science education. By studying science, students

- develop an understanding of the world built on current scientific theories.
- learn that science involves particular processes and ways of developing and organising knowledge and that these continue to evolve.
- use their current scientific knowledge and skills for problem solving and developing further knowledge.
- use scientific knowledge and skills to make informed decisions about the communication, application, and implications of science as these

relate to their own lives and cultures and to the sustainability of the environment (Ministry of Education, 2007a, p. 28).

The Ministry's first goal aligns with Millar (2004) first goal, while goals two and three align with Millar's second goal. The fourth goal is the application of science in everyday life which covers all the three first goals. Therefore, an overall aim of school science is for students to become scientifically literate so that they can make informed decisions about socio-scientific issues that are important for their everyday life (Hodson, 2014). For these goals to be achieved, teachers could use one or more approaches to deliver content and practical experiences required for student engagement and overall learning experiences.

The teaching and learning of science in school is a much-researched area internationally. Bennett (2003) summarises it as: the early 1980s research in science education sought to give science a central place in the school curriculum, so that it provided for all pupils to learn a whole and balanced science by making science compulsory. In doing so, it was necessary to give consideration to the purposes of school science. Thomas and Durant (1987) divided these arguments into three groups, asserting that the benefit of a greater public understanding of science provided for socio-cultural, democratic, and utilitarian arguments (Bennett, 2003). Harlen and Qualter (2017) state that promoting the teaching and learning of science in primary school helps in "developing general scientific literacy and fostering the ability to learn and the motivation to continue learning" (Para. 1). They assert that science helps in cognitive reasoning and helps students lead better physically and emotionally healthier lives. Research interest in the later 1980s interrogated curriculum design especially in children's ideas about science. What children learn; what they need to identify misconceptions and how they could be changed is underpinned in the view that "knowledge cannot be transmitted but is constructed" (Driver, Asko, Leach, Mortimer, & Scott, 1994, p. 5). Osborne and Freyberg's (1985) research had revealed that only a very small minority of secondary students could show an understanding of the most elementary ideas in science.

In the 1990s research focussed on implementation of the curriculum and its impact on teaching and learning. This was the decade of learning by doing; hands-on became a catch phrase. Practical work and how students learn by doing became popular until Hodson (1990)

argued that practical work conducted in schools was unproductive, and confusing. Tobin (1990), however, suggested that practical laboratory work appealed as a promising way to learn with understanding and constructing knowledge by doing science.

When describing the goals of twenty first century science, Millar (2006) suggested a focus on scientific literacy and developed two alternative pathways for secondary science education. The first one was beginning from a broad scientific literacy goal for all and secondly, two alternative pathways for those who will continue in science and those who will not. However, without waiting for the research findings of this large- scale study involving 12000 students in 78 schools across the UK, the British government made the political decision to retain the status quo. Other prominent areas of science education research internationally focussed on teaching and learning about the Nature of Science (Lederman, 2014; Lederman & Lederman, 2019).

Pedagogical approaches to science teaching are important, with science holding a key place in the curriculum, as much of our society nowadays is oriented towards science and technology and people need the basics of science to survive in today's world (Osborne & Dillon, 2010). Relevant to this thesis, was a study in the UK about the assessment of the practical component and its assessment for qualification, particularly the General Certificate of Secondary Education – GCSE (Roberts & Gott, 2006). This assessment component makes up part of the student's overall assessment in science. However, Roberts, Gott, and Glaesser (2010) argue that though it is desirable for students to be taught procedural knowledge in science investigations, it would be difficult if they do not understand the content. They assert that, there needs to be an "understanding of concepts such as; reliability and validity, measurement and calibration, data collection, measurement uncertainty, the ability to interpret evidence and the like" so that these ideas can be applied to open-ended practical investigations. Not understanding the subject content would most likely lead to an inability to "actively carry out an open-ended investigation", especially "without knowing what constitutes evidence and how to draw conclusions from the findings of an experiment " (Roberts et al., 2010).

However, in New Zealand much of school science learning has been aimed at engaging students to understand science concepts, develop procedural understanding and

gain an understanding of the nature of science (Moeed, 2013b). After a substantial review of science education literature, Hipkins et al. (2002) reported in the Learning in Science Project at Waikato University, that children's alternative conceptions, form a constructivist approach to learning. With reference to secondary school science, they summarised that practical work as conducted in schools was mainly in the form of 'recipe practicals' (pre-prepared practical instructions for students to follow as a recipe), a practice that persists.

Following the work of Black and William (2004, 2009) on formative assessment in the first decade of this century, formative assessment has also been an area of research in New Zealand (Cowie, 2009). New Zealand had made a significant change in assessment from norm-based to standards-based assessment in 2002 and mandated a new curriculum in 2007. The influence of both the changed assessment system in 2002 and the new curriculum in 2007 have been much-researched areas in secondary science education (Hume & Coll, 2009, 2010). The research of 2010 is important for the present research as it deals with the learning and internal assessment of science investigation, which is the context in which Pasifika students learning, assessment and achievement is studied in the present research.

Hume and Coll (2010) found that what students were learning and achieving about science enquiry was exactly matched to what their teachers intended - 'fair testing'. The planning of carrying out a practical investigation was generic, by completing and reporting from a template provided by NZQA and the MOE. The language and terminology used by the students were associated with the prescribed assessment schedules indicating as influence of the assessment tasks and schedules on the students' learning with little evidence of open-ended planning and investigation. They called this a mismatch between the intended curriculum and experienced curriculum (Hume & Coll, 2010).

Motivating students to be interested and engaged in science has been widely researched and held as very important both internationally and in New Zealand (Abrahams, 2009; Woods-McConney, Oliver, McConney, Schibeci, & Maor, 2014). A recent study in the United States investigated mathematics and science self-efficacy and achievement and explored the relationship between English proficiency and mathematics and science achievement (Sandilos, Baroody, Rimm-Kaufman, & Merritt, 2020). They found that less English proficient students showed lower achievement and self-efficacy when it came to

both mathematics and science compared to the students who were English proficient or were reaching proficiency. They conclude:

among students with limited proficiency, high self-appraisal of their own efficacy may serve as a strength and bolster their science performance. Although we cannot presume causal inferences, the present investigation suggests the value of future studies of practices and programs that provide students with high quality instruction and verbal feedback to enhance their self-efficacy in this content domain (p. 15).

Chapter 3 describes self-efficacy further. To understand some of the dynamics of a science classroom, we may need to consider best practice between ‘teacher-centred and student-centred’ approaches to teaching and learning science. The approach each teacher chooses to use and how it influences learning depends on the requirements in each segment of the curriculum.

2.5 Pedagogical Approaches to Teaching Science

Children come to school with powerful resources on which science instruction can build (National Research Council, 2007, p. 251).

Over the past decades, science education scholars have been promoting a shift from teacher-centred lecture-style teaching to an emphasis on practical, hands-on student-centred approaches. Both approaches differ in their own ways but each have their own strengths and weaknesses as summarised in Table 2.2 (Al-Zu'be, 2013).

Table 2.2 Summary of Teacher-Centred versus Student-Centred approaches

Task Required	Teacher-Centred (Traditional)	Student-Centred (Constructivist)
Classroom Communication Language Building	<p>* Teacher takes time to listen, monitor speech and corrects pronunciation where appropriate</p> <ul style="list-style-type: none"> • Instructor in control, does not give room for interactive discussions 	<p>* Teacher does not listen to pronunciation. Teacher only corrects when a question arises</p> <ul style="list-style-type: none"> • Student discussions held and students learn collaborative and communicative skills from each other
Source of Information	<ul style="list-style-type: none"> • Teacher is the source. Teacher provides • Teacher chooses content and plans around what needs to be delivered, not on students' understanding and engagement 	<ul style="list-style-type: none"> • Students act as the source to each other • Students choose the content and teacher plans around what students choose to learn.
Teacher Responsibility	More responsibility placed on teachers e.g., passing on content knowledge to help them benefit from the curriculum	Teacher responsibility is less demanding as teacher only provides the information required by the students
Learning Responsibility	<ul style="list-style-type: none"> • Teacher only facilitates and meets needs of the students depending on individual abilities. • Teacher needs to know each of his/her students' abilities to be able to help them • Teacher only addresses issues raised by the students that may seem challenging to them • Teacher sees individualism as students challenging each other 	<ul style="list-style-type: none"> • Rests on the students to drive their own learning • Students learn from each other (friends) and group mates • Provision of support for collaboration and cooperation in group learning
Motivation	<ul style="list-style-type: none"> • Extrinsic • Teachers might use external rewards to motivate the students • Use guided questioning to gauge students' understanding of topics covered 	<ul style="list-style-type: none"> • Intrinsic • Students regulate their own internal desires as they gain satisfaction through accomplishment (raising their self-efficacy) and develop essential skills. • Students discover on their own without the guidance of the teacher

(Al-Zu'be, 2013)

Various approaches have been tried in the latter part of last century including discovery learning, a process approach, and teaching science as inquiry or investigative approach; each have their benefits and limitations (Abrahams & Millar, 2008). These changes in approach reflect theoretical developments in the teaching and learning process on themes central to both education and science (Newton, Driver, & Osborne, 1999). Typical approaches have been the constructivist approach, the conceptual change approach, the constructivist/conceptual change approach, the interactive approaches (Tytler, 2002), the process approach (Nay & Associates, 2006), and lately Ambitious Science Teaching (AST). The underpinning idea of the latter is that

if we are going to turn a corner on how science is taught, we have to be serious about including every learner in the classroom and recognising that children have many legitimate ways of making sense of the natural world. Traditional teaching does not often accommodate diverse pathways to deep understanding (Windschitl, Thompson, & Braaten, 2020, p. 2).

Ambitious science teaching begins with planning for engagement with important science ideas, eliciting students' ideas, supporting ongoing changes in thinking, and pressing for evidence-based explanation. This approach requires intellectual engagement and pays attention to equity.

Brown and Ryoo (2008) found the teacher-centred, content-first approach very effective in terms of student achievement. Osborne (2014) argues that pedagogic approaches needed for teaching science include, doing science, talking science, writing science, and representing science. He agrees with Hodson (2014), that practical work is essential for doing science but if the students are to develop science understandings then multiple teaching approaches are needed. Practical work or doing science has been a preferred pedagogical approach to teaching science and research suggests that teachers engage their students in practical work more for motivational reasons and students consider it a better alternative to written work (Abrahams, 2009).

Abrahams and Millar (2008) assert that, there is presently little research that shows students learning what the teachers intend them to learn through engaging in practical work. They explain, practical work, inquiry, experiments, and investigations are some of the terms used interchangeably for hands-on doing of science in the classroom. Hodson (2014) argues that different teaching approaches are needed to help with the intended learning.

For example, an activity that is designed to illustrate a scientific concept may not be the best approach for developing procedural understanding.

Hawk, Cowley, Hill, and Sutherland (2002) suggested a culturally responsive pedagogy be used in classrooms where there are Māori and Pasifika children. One such is the *Appreciative pedagogy* by of Chu et al. (2013). It stems from the Pasifika ideology that '*it takes a village to raise a child*'. Appreciative pedagogy encompasses interpersonal commitment to learning through family support and a learning village. Teaching and learning is committed to nurturing the child for adulthood through respectful relationships between teacher and pupil rather than *educating an adult child*, where dynamics between teacher and pupil are quite different (Chu et al., 2013). Reynolds (2017) describes it as '*vā*', the Samoan word that describes the space and dynamism between two people. Here it describes the teacher-student or student-student peer relationships and dynamics. To become change agents, teachers may need to adopt a socio-cultural perspective recognizing the individual in his or her cultural context (Houghton, 2015), instead of the deficit perspective focusing on students' weaknesses rather than their strengths claiming that poor people are intellectually deficient because they are poor (Collins, 1988; Gorski, 2008).

The next section highlights some of the concerns raised as to why a culturally responsive pedagogy should be considered.

2.6 Culturally Responsive and Appreciative Pedagogy

The literature review by Gorinski and Fraser (2006) highlighted the disparities that exist for Pasifika students in terms of their engagement and benefiting from the New Zealand education system. Houghton (2015) expresses the problem as 'shocking' and proposes a re-visit of the assessment techniques used by teachers in the school, suggesting that cultural epistemology should be considered in assessment techniques used .

Cohen (2013) offers a dynamic mode of reasoning as social inclusion and exclusion which might be worth considering to explain social behaviour and practices in contemporary globalized societies and why Pasifika children might not be achieving. Houghton (2015) explores possible reasons why there is so much disparity in the achievement of Māori and

Pasifika students compared to students of other ethnicities in Aotearoa. He suggests it might be due to the current form of summative assessment which is a measure of 'success' and that might not be working well for pupils of these two groups. A far more culturally responsive formative assessment may offer a better environment to capture the engagement of these two groups of learners. Teachers need to realise the importance of being culturally sensitive and that the cultural beliefs of these two groups of students are 'ubiquitous'. To become change agents, teachers need to adopt a socio-cultural perspective recognising the individual in his or her cultural context (Houghton, 2015).

Reynolds (2017) noted that Pasifika students in New Zealand schools are taught by *Pālangi* (European origin) teachers in a system that was originally designed to meet the perceived educational needs of European settlers. He notes the importance of considering the value of "the dialogic way relationships between *Pālangi* and Pasifika worldviews play out in educational contexts" (p. 226). He suggests one way is through the personality of individuals and a greater understanding of the space '*vā*' between peers or the student-teacher relationships (Reynolds, 2017).

2.7 The Constructivist Approach to Teaching Science

The New Zealand Science curriculum statement provides a learning context which can be seen as underpinned by constructivism (McPhail, 2017; Ministry of Education, 2007a; Moeed, 2010). Constructivism stems from the work of Jean Piaget and Lev Vygotsky and is defined by Fosnot and Perry (2005) as based on psychology, "the way learning is defined, studied, and understood"...(p. 8). Much of it underlies "the curricular and instructional decision-making that occurs" in an educational setting... (p. 8). Constructivism is further extended by cognitive scientists based on how students are affected by the goals which teachers set for their students (Fosnot & Perry, 2005).

The Constructivist theory of learning posits that children develop knowledge in the same way as adults through social interactions (environment) and active participation using their intrapersonal and cognitive skills. Therefore, in order to assist learners to develop a positive attitude towards achievement, what we can control are environmental factors which learners find themselves in everyday, like a formal education setting (Edosomwan, 2016). As achievement is the result of well-constructed meaning of a topic in a subject such

a science, the way the subject matter is introduced or delivered (teaching) and the attitudes and beliefs of the learners (students) during that time is worth investigating.

Constructivism is a learning theory centered around how teachers teach and learn how to teach, focusing on student-centered learning (Bada, 2015). Bada (2015) explains that constructivism is based on the idea of cognition or learning as a result of mental construction. It occurs when students shift around new ideas or information with what they already know to make it fit in their understanding and this is affected by the context in which the idea is presented as well as the students' own attitudes and beliefs (Bada, 2015).

The Ministry of Education has provided the guidelines for assessment, so the focus becomes student-centered learning with the teacher role being that of a facilitator. The general key principle of the approach is to be mindful of learners' prior knowledge. The New Zealand Curriculum expects the teaching activities in the 'Nature of science' strand to provide learning experiences with examples so that students can:

- understand about science,
- do Investigations in science,
- communicate in science and
- participate and contribute by applying ideas and constructed meanings (Ministry of Education, 2007a, p. 28).

Rather than teaching these separately, most teaching activities are likely to involve students in more than one of these aspects. Thinking about the aims helps us give a focus to our teaching of the Nature of Science. However, Gilbert (2017) suggests that "constructivism has been pushed to its limits as a framework for thinking about teaching, learning and/or knowledge development in 21st century schools, and another idea is now needed" (P. 1). Gilbert draws on McPhail (2017) who states that, there has been a conflation to some degree of the meaning and a confusion in the way the term constructivism has been used in education. There needs to be some "distinction between the curriculum (what we teach) and pedagogy (how we teach it)" (McPhail, 2017, p. 32). He explains:

The New Zealand Curriculum (Ministry of Education, 2007) talks of students "constructing" and "creating" knowledge. This is not particularly helpful, because these words have different meanings. Are the references here to students developing *understanding* of knowledge that already exists (i.e., learning), or will students actually create new knowledge? (P. 30).

McPhail (2017) clarifies that there is a distinction between psychological constructivism (the theory of learning) and social constructivism (theory of production of knowledge). Psychological constructivism as the theory of learning; is concerned with how students make cognitive connection linking prior knowledge with new ideas presented. So, the teacher's role is to connect students' everyday experiences with the new material that he or she provides.

Social constructivism as the theory of production of knowledge deals with bodies of knowledge and draws on all knowledge being constructed by humans through social interactions as being subjective than objective. McPhail (2017) notes that many in education think that "students' everyday knowledge (social and cultural) is important not only as a means to enhance self-efficacy and self-esteem, but also as a source of knowledge content for the curriculum" (p.31).

2.8 Deficit Theorising

'Deficit thinking' refers to the notion that students (particularly those of low income, racial/ethnic minority background) fail in school because such students and their families have internal defects (deficits) that thwart the learning process (for example, limited educability, unmotivated; inadequate family support) (Valencia, 1997 Para.1).

According to Valencia (1997), deficit theorising in education is an endogenous theory based on racial and class bias. This 'thinking' tends to blame the minority victims rather than the system. It alleges that poor schooling performance (achievement) is rooted in the students' cognitive and motivational deficits or the fact that they may be from low socio-economic backgrounds rather than examining the institutional structures and schooling arrangements that could be inequitable and hindering students from learning and achieving. Teachers' beliefs play a significant role in the achievement of their pupils. Schmid (2018) expands on the work of Vartuli (2005) and writes that; "teacher beliefs are a mixture of thoughts, beliefs, perceptions, and values about their roles as educators, education, and about how students learn" (Schmid, 2018, p. 3).

Vartuli (2005) asserts that teacher beliefs influence their perceptions, judgements, and influence how they act towards their students. She also states that teacher self-efficacy influences the way they treat their students. This theory of deficit theorising has been noted in New Zealand by Bishop, Berryman, Tiakiwai, and Richardson (2003) who have reported

that deficit theorising by teachers is the major impediment to Māori students' educational achievement as teachers have low expectations of their Māori students. Bishop et al. (2003) describe this as creating a “downward spiralling, self-fulfilling prophecy of Māori student achievement and failure” (p. 2).

Gorinski and Fraser (2006) acknowledge that many international writers identify deficit theorizing as a probable cause of this low achievement due to the lack of literature refuting that theory. They believe that low-income families may not be able to afford school materials for their children, which may be contributing to low achievement in school. In education, it appears that the ‘deficit’ perspective sees the factors that students have no control over as weaknesses rather than the strengths that they bring to the classroom.

Deficit theorizing is an extension of that idea, saying poor people are intellectually deficient because they are poor (Collins, 1988; Gorski, 2008). Gorinski and Fraser (2006) suggest that in an inclusive education system, parents are expected to engage to some degree in their child’s or children’s educational experience suggesting, they should play a part in their children’s education. However, Mather, (2013) cites Anae et al. (2002), that Pasifika parents do support their children’s education whole heartedly.

While Pasifika students rank at the bottom of the NZ education system’s achievement scale, they are constantly reminded by the system as ‘low achievers’ that they come from low socio-economic backgrounds. Studies carried out with Tongan students by ‘Otunuku et al. (2013) suggested that beliefs exercised in a self-regulating manner can lead to greater achievement. This suggests the importance of investigating Pasifika students’ self-efficacies in science, as it could impact on the prospects of future science-related career pathways.

Diverting from the notion of ‘deficit theorizing’, Hunter (2013) and Houghton (2015) both believe that by facilitating teachers to understand life from Pasifika perspectives and incorporating some of their Pasifika values into everyday practice they could improve the achievement of young Pasifika students. They also suggest developing positive views among teachers and ways the teacher can help raise student achievement as part of mainstream teacher education. Hunter (2013) proposes more needs to be done to appreciate the differences between Pasifika cultures especially how it may affect those children born in

New Zealand and the islands and those with a hybrid identity (mixed parentage or NZ born Pasifika). She strongly believes in the importance of culturally responsive teaching with clear links to core Pasifika values listing the challenges for teachers as:

- Respect for the respectful attitudes the parents have towards education
- Making a conscious effort to include teaching materials that reflect Pasifika students' experiences and lifestyles.

Houghton (2015) suggests that Māori and Pasifika pupils may not be responding to the current assessment system which is more summative in approach under the structure of standardised testing. Teachers need to work towards fostering a 'culturally responsive learning environment' for these priority learners incorporating formative assessment tasks. Other Pasifika researchers like Chu et al. (2013) posit a more emotional cause for low achievement. They say that when students feel their experiences and perspectives are valued, that leads to a sense of belonging and paves the way for improved achievement levels (Chu et al., 2013).

This leads to consideration of the concept of ethnic identity which Phinney (1992) describes as 'multidimensional'. People identify themselves by self-categorizing, and forming an attachment or commitment to a group, upholding certain values and beliefs associated with the group. Ethnic identity has been related significantly to general self-efficacy, decision-making processes, and career goals (Phinney, 1992). Hackett and Campbell (1987) agree that deficits in ethnic identity further complicate the problem for minorities. Studies in New Zealand by Rubie-Davies et al. (2012) found teacher expectations of ethnic minority groups like Māori and Pasifika affected how well those groups performed. For science in particular, concerns have been raised in the United Kingdom by Wong (2016) using the metaphor 'leaky pipe' to describe students of ethnic minorities' low participation and achievement in science. Similar concerns were shared by O'Brien, Kopala & Martinez-Ponz (1999) who proposed that a central factor contributing to low representation in science and engineering among members of minority groups is ethnic identity.

Strathdee and Cooper (2017) reported that the Vocational Education and Training (VET) policy in New Zealand, which was formulated to assist in the achievement gap and ethnic representation, did little. There was still under-representation of Māori and Pasifika ethnicities. Statistics showed Pasifika still ranked lowest in representation among the

Natural/Physical sciences, Health, Engineering and Architecture beyond Level Three (Strathdee & Cooper, 2017). In 2020, the Ministry of Education reported the Vocational Education and Training (VET) enrolment statistics from 2010 to 2019 (Education Counts, 2020c). Even though Pasifika ranked lowest (average of 9.6%) over the ten years, that statistic is consistent with Pasifika making up 10% (Averill & Rimoni, 2019) of New Zealand's general population (See Appendix A).

2.9 Chapter Summary

This chapter highlighted the disparities among Pasifika students as '*priority learners*' over the past two decades reported from the many Ministry of Education reports on achievement at the various levels, particularly Level One. The New Zealand Qualifications Framework through the NCEA specifies that students are required to earn 80 credits overall including literacy and numeracy to successfully attain Level One. With the New Zealand curriculum being underpinned by constructivism, teacher perceptions of their Pasifika students become important as they would be expected to provide learning opportunities for the students to unpack and build on the science knowledge they already know, from a constructivist perspective.

However, with Pasifika students' poor performance over the years raised questions around low socio-economic factors, and the need to consider alternative pedagogical approaches to teaching away from deficit theorizing. Suggestions have been made to incorporate culturally responsive practices and appreciative pedagogy into teaching. The discussion on culturally responsive teaching and alternative pedagogies aim to modify teachers' approaches however at the end of the day, Pasifika are not taught a different science from that studied by students of other ethnicities. Even though the negative undertones of Pasifika underachievement and negative views of Pasifika students' learning may sound depressing, they will still have to learn the same science as all students from other ethnicities and completing assessment tasks that will earn them the same credits as all the other students. While it is important to discuss how these students are taught if we see them as different (deficit theorizing), it is also important to research how they learn and what affects their learning so that the correct intervention approaches could be utilized.

While Pasifika students rank bottom of the NZ education system's achievement scale, they are constantly reminded that they are *low achievers* and they come from low socio-economic backgrounds (Spiller, 2012).

That raises the following three questions.

- Are the constant reminders of low achievement impacting on Pasifika students' self-efficacy?
- Are they seeing the situation as being hopeless and giving up?
- Where does this leave these students?

Studies like that of 'Otunuku and Brown (2007) indicate that even though teaching, learning, and assessment all played some role in performance, much of the students' achievements were attributed to their own beliefs. This suggests that it would be more beneficial to the student if they were assisted more in ways of improving their 'belief' in themselves as having the potential to achieve (Otunuku et al., 2013). Hence, their self-efficacy.

CHAPTER THREE

Conceptual Framework and Theoretical Positioning

Introduction - Self-Efficacy

“Whether you think you can, or that you can’t you are usually right”. Henry Ford

This chapter defines the *concept of self-efficacy* and my theoretical positioning of this study. The content of this chapter is presented under the following sub-headings.

- 3.1 Definition of Self-Efficacy
- 3.2 Social Cognitive Theory (SCT)
- 3.3 Classroom application of SCT
- 3.4 Sources of self-efficacy
- 3.5 Academic self-efficacy
- 3.6 Factors affecting students’ self-efficacy in a school
- 3.7 The relationship between the Kakala Framework of Education and self-efficacy
- 3.8 Chapter summary and Research question.

3.1 Definition of Self- Efficacy

Albert Bandura (1986, 1994, 1997) defined self-efficacy as a concept related to one’s inner belief in their own abilities necessary to achieve their goals. Self-efficacy drives that determination to take the necessary steps to accomplish a specific task. It reflects on a person’s confidence in their ability to control their own motivation, and behaviour, utilizing their social environment (Bandura, 1997, 2002b; Zimmerman, 1989, 1995).

Many researchers agree with Bandura (1994, 1995, 1997) that self-efficacy is very important as it can have an impact on psychological states of mind enabling one to self-organize and achieve goals (Zimmerman, 1995); it also drives academic motivation (Schunk, 1991) and effects a change in the behavior of a person (Bandura, 1994; Hurst, 2017a; Schunk, 1989). Self-efficacy takes charge and controls one’s belief system (Flammer, 1995;

Schneewind, 1995); it may influence one's career choice (Hackett, 1995); it is relied upon in stressful life situations (Jerusalem & Waldermar, 1995). Some cultures value individual appraisals, others value a group appraisal. Past successes in any of these value systems are the best source of self-efficacy (Oettingen, 1995). The conviction that one has in themselves to repeat a past success builds self-efficacy (Bandura, 1997).

3.2 Social Cognitive Theory (SCT)

The ontology of self-efficacy stems from a neo-behaviourist view of human behaviour and sits in the center of a Triadic Reciprocal Determinism of Social Cognitive Theory or SCT (Bandura, 1989). SCT began as Social Learning Theory (SLT) by Bandura in the 1960s but he later advanced it to Social Cognitive Theory in 1986 positing that learning occurred in a more social context within a dynamic triadic interaction between intrapersonal factors interacting with environment and behavior (Bandura, 1986, 1989).

A further development of the SLT is that by observing a social model in the social or learning environment or receiving certain feedback reinforces certain behaviours. Others may be influenced cognitively to learn new behaviours by observing a social model or interaction with the environment (Bandura, 1986). McLeod (2016) claimed that in Bandura's SLT, the emphasis was on the importance of observing, modelling and imitating behaviours, attitudes and emotional reactions. Bandura asserts that SCT gives a better explanation than SLT for human behaviour (human agency) as a model of causation involving a three-way (triadic) determinism shaped and controlled either by environmental factors or by intrinsic dispositions (Bandura, 1989).

Bandura (2001) says, in SCT the triadic construct acts in this reciprocal manner either influencing or being influenced by the three interacting factors bilaterally (Bandura, 1986; Hurst, 2017b). In SCT one's ability (intrapersonal and cognitive factors) to construct meaning and draw knowledge by making sense of environmental experiences, gives rise to one's behaviour, or it could be making sense of how one's behaviour influences the environment (Bandura, 1989). Figure 3.1 illustrates that triadic relationship.

Figure 3.1a Triadic Reciprocal Determinism (Adapted from Bandura, 1986)

Figure 3.1 above illustrates that within the triadic reciprocity is a driving desire to learn or strive to accomplish a goal. That triadic reciprocity known as *self-efficacy* is the core of SCT, affected by the interactions of intrapersonal and environmental factors influencing the individual's behaviour response within this triadic relationship (Bandura, 2002a, 2005).

Bandura (1989) explains, that there are two ways in which an individual carries out cognitive processing of efficacy information. The first way is the type of information that will be attended to by someone as personal indicators, and the second is the rules by which people use to weigh up and select efficacy information from different sources and construct beliefs about their own self-efficacy. Hence, the conception of SCT was founded on agency being crucial to human development, adaption, and change. Agency or an agentic notion refers to a person's power to control his or her goals to take actions to achieve those goals and control his or her destiny within his or her own capacity.

3.2.1 Self-efficacy and Pedagogy

This section proposes a likely relationship between self-efficacy and pedagogy. Fenci and Scheel (2005) report that teaching approaches have a demonstrated effect on student self-efficacy in science. Teacher beliefs about what is important to teach in science, students' capability, and how students learn influence the pedagogy used in the classroom (Anderson, 2012). These beliefs lead to teacher decisions about which pedagogical approaches they will use in

the classroom environment for the desired learning behaviour. The students in turn draw on their innate sources of self-efficacy to engage or participate in that activity. Figure 3.1b proposes a possible relationship between pedagogy and self-efficacy.

Figure 3.1b Proposed Pedagogical Relationship based on Triadic Reciprocal Determinism

Figure 3.1b shows five pedagogical approaches that a teacher may choose from which include constructivist, reflective, integrative, inquiry-based, collaborative or a combination of these. Applying this to Bandura's triadic relationship, the Personal and Cognitive factors may be influenced by the student; belief about their ability to learn science, their prior knowledge, and what they think is important to learn in science. The main Environmental factor here are teacher beliefs about; what is important to learn in science, purpose of practical work, students' prior knowledge, their relationship with the student. Students have their sources of self-efficacy to draw upon for the required behavior. The interaction between the above factors is likely to influence student learning behaviour. Their task engagement and learning behaviour may also be influenced by their relationship with the teacher, and their preferred ways of learning.

3.3 Classroom application of SCT

This section presents the classroom application of the SCT model according to Bembenutty, White, and DiBeneditto (2016) Chapter 3.1 has described how a person's intrinsic motivation is triggered by his or her personal interest; the environmental and cognitive aspects as well as the perceived value in engaging in an activity. Engagement in an activity may be triggered by a situational interest that is presented by the learning environment. Situational interest is a relatively transient reaction to highly stimulating factors in the immediate environment (Palmer, Dixon, & Archer, 2017), whereas individual interest is likely to be more long-term (Palmer et al. 2017). It is likely to arise from the personal and cognitive aspect of the triad as a personal preference for a particular subject or activity. If the situation is friendly and inviting, it may draw interest that promotes engagement (Palmer, 2009). Engagement is both a pre-requisite and a co-requisite for learning (Palmer, 2005); where there is learning, there is more likely to be achievement (Kang & Keinonen, 2018). When a student sees that he or she has accomplished results and has achieved, it may boost his or her self-efficacy and confidence to repeat the same success (Motlagh, Amrai, Yazdani, Abderahim, & Sour, 2011). The confidence to repeat prior successes builds Mastery, the most powerful antecedent of self-efficacy (Bandura, 1994, 1997).

In a study using SCT particularly looking at self-regulated learning, Bembenutty et al. (2016) found the classroom interactions operating in the same way for self-efficacy. Bandura's triadic determinism of self-efficacy explains the reciprocal relationships of intrapersonal factors, environmental factors and behavioural factors, while Bembenutty et al. (2016) aligns Bandura's SCT in a classroom environment. Figure 3.2 presents a model adapted from Bembenutty et al. (2016) explaining the dynamics of the SCT model in a classroom environment.

Figure 3.2 Classroom application of SCT-Adapted from Bembenuddy et al. (2016).

3.4 Sources of Self-efficacy

Bandura (1994) asserts that people's efficacy beliefs can be developed by four main sources of influence; Mastery, Modelling, Persuasion and Physiological factors. Bandura's self-efficacy theory postulates that people will raise their efficacy levels as a result of their performance accomplishments, vicarious (observational) experiences, forms of persuasion, and physiological indexes. These four sources of self-efficacy advocated by Bandura and supported by other writers are described below (Bandura, 1994, 1997; Cherry, 2016; Zimmerman, 1995; Zimmerman et al., 1992).

3.4.1 Mastery

The best way to develop self-efficacy with a task is through mastery of the subject or skill. If one achieves a task successfully, one is likely to attempt it again based on previous success, and a failure can cast doubt on the outcome of future attempts (Cherry, 2016). However, Usher and Pajares (2008) concur with Bandura (1997) that self-efficacy beliefs can change during one's development and mastery experiences become powerful when individuals overcome challenges and obstacles to succeed. A simple example of self-efficacy through mastery is that of a student who has performed well in science throughout school – he or she will believe themselves capable of handling science in future (Usher & Pajares, 2008). Efficacy beliefs are also linked to different domains of functioning; efficacy beliefs in science may be different from those of mathematics or English. Hence, students themselves judge their capabilities to fulfil assigned tasks, or career pathways (Hackett, 1995) not on the basis of who they are ethnically or how they generally feel about themselves (Zimmerman, 1995).

3.4.2 Vicarious Experience through Modelling

Knowing that a task is doable is key to successfully completing it. Most people are unlikely to undertake activities they believe are impossible but seeing others similar to yourself succeed in something reinforces the belief that you can accomplish the same task (Bandura, 2002b; Fritz, 2017). These are known as vicarious experiences, where one builds one's own self-efficacies by observing the accomplishments of others similar to oneself (Usher & Pajares, 2008). Young students look to find role models in their lives and social

models play a powerful part in influencing young people's self-efficacy, when they compare themselves to classmates, peers and even adults (Schunk, 1991; Usher & Pajares, 2008).

Another aspect of modelling is the practical demonstrations and experimentation in a science class as a potential pedagogical approach. Science practical work is a way of developing scientific ideas and showing how scientists perform in the outside world. Incorporating practical demonstrations in teaching models key ideas of the content knowledge by not being limited to an activity for assessment. Through practical classes and scientific investigations, pedagogical knowledge and interest in the subject can be modelled (Moeed, 2013a; Moeed, Anderson, Rofo, & Bartholomew, 2016).

3.4.3 Verbal Persuasion

Bandura (1997) states that Verbal Persuasion and positive feedback are effective ways to build self-efficacy. People who provide Verbal Persuasion are known as efficacy builders, who do more than convey positive appraisals. While raising people's beliefs in themselves and their capabilities, they structure situations for them to succeed in their goals rather than to fail. One is more likely to remember encouragement or praise for a job well done and to repeat the activity in future. Verbal Persuasion is powerful and encourages students to measure their success in terms of self-improvement. It enables them to believe in themselves and drives their intrinsic interest to pursue a task and accomplish it (Cherry, 2016). Bandura (1997) asserts that negative feedback is more likely to lower self-efficacy making people give up quickly in the face of difficulties. In the classroom situation, Verbal Persuasion could be a way of encouraging students to participate in more challenging activities (Bandura, 1997; Otunuku et al., 2013). Verbal Persuasion may be offered through teaching and instruction and provision of teacher feedback (Schunk, 1995), or as encouragement from peers and family (Wang & Wu, 2008).

3.4.4 Physiological/Emotional Factors

Physiological factors including the emotions play influential roles, in health, athletics and other physical activities (Cherry, 2016; Usher & Pajares, 2008). It is not just the intensity of emotional and physical reactions that are important, but also how one perceives and interprets them. People who have a high sense of efficacy are likely to view their state of

affective arousal as a stimulating facilitator of performance; conversely, self-doubt can debilitate learning (Bandura, 1997).

Schunk (1991) examined how personal and environmental (instructional, social) factors affect self-efficacy and how self-efficacy influences learning, motivation and achievement. However few studies have investigated the relationship between self-concept and achievement within the specific subject area of science (Doran & Sellers, 1978). Doran and Sellers (1978) state there is agreement among self-concept theories that behavior helps shape one's self-perception. They suggest that due to the unique nature of science education with its 'hands-on' activities and laboratory practices/investigations, it may be a fruitful area in which to conceptualize self-concept with respect to practices and behaviors.

3.5 Academic Self-efficacy (ASE)

Schunk (1991) describes self-efficacy as academic motivation which is an individual's personal judgement of his or her strengths and capabilities to undertake a task with confidence. Schunk (1984) says that, because educational settings differ in so many ways, students will find out if they are efficacious or not in achievement situations. In some institutions, they might say that the student is becoming more confident, or skillful or capable. If they successfully achieve their goal, their self-efficacy is raised; if they do not achieve it successfully, their self-efficacy is lowered (Bandura, 1994; Schunk, 1991). Doménech-Betoret, Abellán-Roselló, and Gómez-Artiga (2017) assert that there is an "Expectancy-Value belief between self-efficacy and the achievement/satisfaction relationship..." (p 3).

When faced with a new assessment or academic task, students often call on their self-efficacy (Can I successfully perform this task?) rendering self-efficacy as "a direct predictor of a task-value" (Doménech-Betoret et al., 2017, p. 3). The view held by Doménech-Betoret et al. (2017) is not surprising due to the expected outcomes of students' achievements plus the beliefs they hold in themselves as they move through school level by level. Fritz, (2017) proposes that just as a person can have different degrees of motivation depending on the nature of the task so can an individual have different levels of self-efficacy. For example, a person may have high self-efficacy when it comes to a certain task because

they have done it for a long time. Self-efficacy plays a vital role in personal goal-setting to motivating someone towards academic attainment (Zimmerman et al., 1992)

Studies have also shown that students with high self-efficacy tend to do better academically, especially in the sciences (Lent et al., 1984). An individual's own physical and emotional capabilities often offer the most reliable guide for assessing self-efficacy. Success raises self-efficacy and failure lowers it, but once a strong sense of efficacy is developed, a failure may not have much impact (Oettingen, 1995; Schunk, 1991). Self-efficacy may influence academic performance. For example, student may have low self-efficacy in schoolwork if they struggle to make passing grades (Usher & Pajares, 2008).

Adeyemo (2007) found that “academic achievement is affected by several factors, of which emotional intelligence and academic self-efficacy are critical components” (p. 210). The level of self-efficacy they have when they begin a task has a great deal to do with whether they will successfully complete it (Bandura, 1994; Fritz, 2017).

3.5.1 Self-efficacy and Learning approaches in science

Ardura and Galan (2019) suggest there is an “interplay of learning approaches and self-efficacy” (p. 1) for academic achievement in science among students at secondary school. This ‘interplay’ of self-efficacy is between mediating variables called ‘surface strategy’ and ‘deep motive learning approaches’ influencing academic achievement. They define academic achievement from a student’s performance as outcomes in accomplishing specific aims. Those outcomes are influenced by personality traits or how students approach their learning which includes motivation and self-efficacy as predictors of one’s academic performance (Ardura & Galan, 2019; Schunk, 1984).

Entwistle (2005b) defines the features of deep and surface approaches to learning as follows:

Deep Approach

- Intension to understand material for oneself
- Interacting vigorously and critically on content
- Relating ideas to previous knowledge/experience
- Using organizing principles to integrate ideas
- Relating evidence to conclusions
- Examining the logic of the argument

Surface Approach

- Intension simply to reproduce content
- Accepting ideas and information passively
- Concentrating only on assessment requirements
- Not reflecting on purpose or strategies in learning
- Memorising facts and procedures routinely
- Failing to recognize guiding principles or patterns (p. 3)

A deep approach is linked to academic interest in the subject and with self-confidence, and a surface approach is linked to anxiety and fear of failure. Mastery goals have been found to be most beneficial and are related to deep learning as opposed to performance goals that lead to a surface learning approach (Palmer, 2005).

Margolis and McCabe (2006) assert that self-efficacy is “a key to improving the motivation of struggling learners” (p. 162). Struggling students with low self-efficacy often avoid difficult tasks however, helping to raise their self-efficacy may set them on a right path for achievement. Studies by Margolis and McCabe (2003) showed that when they applied intervention methods to raise struggling students’ self-efficacy, they actually achieved better. Among many positive aspects, self-efficacy influences motivation, task choice, effort, persistence, and achievement (Margolis & McCabe, 2003; Schunk & Zimmerman, 2007).

3.5.2 Self-Efficacy and Achievement in science

Science educators have long examined a wide range of factors that influence academic choices and performance in light of science attrition at senior high school levels and fewer students taking additional science courses (Britner, 2002; Britner & Pajares, 2006). One potentially powerful influence is the confidence with which students approach science. Motivation researchers have also established that students' self-efficacy beliefs affect their confidence levels, academic capabilities, and outcomes (Britner, 2002). A study by Britner and Pajares (2006) also investigated the degree to which Bandura's (1997) hypothesized sources of self-efficacy predict the science self-efficacy beliefs of middle school students. The study found self-efficacy to be a strong predictor of academic achievement, course selection, and career decisions across the domains and age levels studied. Due to self-efficacy influencing academic achievement, a drop in confidence during

the middle school years can have a negative influence on students' high school and college achievement (Britner & Pajares, 2001).

Studies by Andre et.al (1999) in middle school children (N = 262) found self-efficacy as the only motivation variable to predict the science achievement of girls, boys, and white students. The results interpreted from the perspective of Bandura's social cognitive theory reported girls with a stronger science self-efficacy and self-efficacy for self-regulation, resulting in higher grades in science. Boys however had stronger performance-approach goals and white students had stronger self-efficacy and achievement than African American students who reported stronger task-oriented goals. Self-efficacy and self-concept predicted the science achievement of African American students (Andre et al., 1999). O'Brien and Martinez-Pons (1999) suggested that because mathematics skill is required for work in science and engineering, lowered mathematics self-efficacy is a likely contributor to low numbers of women in those fields, which may be an additional factor influencing some students' self-efficacy in science. However, the present study did not consider gender as a factor of self-efficacy in science.

3.6 Factors Affecting Students' Self-efficacy in a School

Bandura (1993) states that, the higher the Perceived Self-Efficacy (PSE), the better students are able to perfect their cognitive capabilities. Even though self-efficacy is influenced by skills acquisition, children with the same level of cognitive skills may differ; their performance will depend on the strength of their PSE. According to Bandura (1993), PSE operates at three different levels in a school setting contributing to students' academic development and achievement:

- (i) Students' own beliefs in their ability to regulate and be in control of their own learning.
- (ii) Their teacher's belief in their ability to promote and facilitate learning environments.
- (iii) A school's faculty or academic department's beliefs in their programmes meeting the requirements contributing to the overall school achievements and accomplishments (Bandura, 1993, p. 1).

In the following sections, I will describe those three levels beginning with students' own PSE.

3.6.1 Perceived Self-Efficacy

Students need to have a belief in themselves to regulate and be in control of their own learning to master the activities including their motivation and academic accomplishments. Bandura (1993) claims that PSE contributes to cognitive development and function through four major processes: cognitive, motivational, affective and selection. The following provides a detailed description of these processes.

(i) Cognitive processes. According to Bandura (1991, 1993), self-efficacy beliefs about cognition are centred around the human mind and purposive human behaviour. People often think about what they want and set goals towards. This kind of personal goal setting brings out their self-appraisal capabilities; whether they have achieved those goals or not. If their PSE is strong, they tend to set higher goal challenges for themselves and make firm commitments to achieve them.

Much of the time self-doubt gets in the way, making achieving those goals difficult. Hence, someone's ability to achieve something is not fixed but rather a generative capability depending on cognitive, motivational, cognitive and behavioural skills which one needs to organise and orchestrate to serve its purpose known as perceived control (Schunk, 1991). Perceived control involves managing emotional reactions that might impair one's quality of thinking, to be able to differentiate between possessing skills and knowledge about something and to be able to successfully use them. That means a person with the same skills and knowledge might perform differently from another depending on each individual's self-efficacy thinking process (Bandura, 1991, 1993; Schunk, 1991).

(ii) Motivational processes. Bandura (1991) advocates that since self-efficacy plays a key role in one's ability to regulate their own motivation, then it is cognitively generated in the human mind. People will form beliefs about what they can do and what they cannot do. Their goal setting along with their motivation and course of action to achieve those goals is generated with forethought known as cognitive motivators. They are known

as; causal attributions, outcome expectations and cognised goals (Bandura, 1991; Schunk, 1984). This means, PSE affects pupils motivation to learn (Schunk, 1991).

(iii) Affective processes. The affective process is one's belief in their ability to cope and exercise control over negative stressors such as threats and anxiety, known as *perceived coping efficacy* (PCE) (Bandura, 1993). When people don't trust their own self-efficacies and try to cope in situations like this, they can experience symptoms such as a rise in blood pressure, heart rate accelerating, activating stress hormones and a general decline in immunity. PCE regulates one's anxiety and regulates one's behaviour to avoid doing something they are not confident about doing. Often PCE controls stress and disturbing thoughts, through *thought control efficacy* (TCE). Often this is strengthened by taking them through some mastery experiences to restore their confidence that they can handle the same tough situations without being too stressed. Anxiety and avoidant behaviours are reduced when both PCE and TCE operate together. PCE predicts behaviour when there is no anxiety but anxiety does not predict avoidant behaviour (Bandura, 1993).

(iv) Selection process. Bandura (1993) says that people's personal efficacy beliefs can influence their choice of activities and their environments. People will try to avoid difficult situations that exceed their ability to cope and look for situations they are able to handle. The choices people make affects their competencies, interests and social networks and life courses. In many environments, there are social networks and circumstances that place individuals in those environments. They become part of that environment sharing common competencies, values, interests, and long-term self-efficacy.

One example is career choice and development, where the power of self-efficacy beliefs affects a life path. The stronger their efficacy beliefs are the longer they will persist and succeed in difficult career options (Bandura, 1993; Hackett, 1995; Lent & Hackett, 1987).

3.6.2 Teacher Perceptions or belief in their students

In many educational settings, teachers are often tasked with the responsibility to provide an environment conducive to learning. Often teachers set up their classroom and organise it in a way that works with their belief system known as *Instructional efficacy*, IE (Bandura, 1993). Pajares (2002) believes that self-efficacy is a predictor of teaching performance. Teachers

with high self-efficacy will create mastery experiences for their students whilst teachers with low self-efficacy tend to undermine their students' cognitive capabilities as a result of their own self-efficacy (Bandura, 1995). Teachers with high self-efficacy tend to have a high confidence in themselves and general orientation towards the teaching and learning process (Pajares, 2002; Vaka-Vivili, 2014). Bandura (1993) says teachers with a high sense of 'instructional efficacy' devote their time to academic learning, making time for and providing the help their students need to succeed and offer praise for successful accomplishments. Teachers with low instructional efficacy tend to give up on their students if they see their students are not getting quick results and shift the blame onto the students for their non-achievement. Bandura (1993) asserts that students with high self-efficacy who end up being taught by teachers with low self-efficacy themselves suffer losses to the perceived self-efficacy they had (Bandura, 1993; Pajares, 2002). Hackett (1995) noted that if attention is not paid at this stage, future career choices may be affected.

3.6.3 Faculty or academic department's beliefs in their programmes

The school is a social system in which teachers interact and operate as a collective rather than individually. Each school has their own value system by which they operate, a school culture. Staff members judge themselves capable of promoting academic success as a collective, 'collective efficacy'. So academic success does not just appear as individual class attainments but that of the whole school achieving when students achieve (Bandura, 1993).

Chapter 2.3 discussed how the Ministry of Education under the national curriculum provides guidelines for schools. The credits needed and assessment activities are also included in those guidelines. Heads of departments and the teaching staff then plan the strategies to be used to deliver the curriculum and assist the students to carry out their assessment tasks for the credits on offer.

Each school has autonomy to adapt those guidelines while upholding their school's values, so the self-efficacy of staff and students of each school is different, reflecting each school culture. Guidelines include curriculum standards for each year level and the expected outcome for participating students. To achieve those curriculum standards or 'achievement standards', students are required to participate in activities set out by the teacher.

Margolis and McCabe (2006) acknowledge that teacher perceptions are personal, however teachers may need to adjust their instructional criteria and learning activities in a way that addresses the needs of struggling learners. This means that, teachers may need to adjust their actions to help raise the self-efficacy of these groups of students to improve their learning approaches by making changes to the environmental factors that would strengthen and encourage their students' values and expectations of academic success (Ardura & Galan, 2019; Margolis & McCabe, 2006).

3.7 The relationship between *Kakala* framework of education and the *Fau* concept of Self-efficacy

The *Kakala* is a Tongan metaphor and framework for education introduced in the early 1990s, by Konai Helu-Thaman (1992). *Kakala* depicts 'education'; the teaching and learning process as the construction of the fragrant garland. Choice flowers, leaves and berries are collected and carefully woven, with the support of a fibre. The strands of support fibers are overlaid with each other to hold the flowers in place until the desired pattern and length are achieved (Helu-Thaman, 1992). *Kakala* may represent the education of a child, a group of children, the teaching practice of a teacher, an institution or an education system. In the case of a child, or group of students, the flowers depict the subject content of their education years, and the final lei is their achievement. In the case of a teacher, the teacher becomes the weaver of the flowers (students) in front of him or her for that group achievement as the lei. In the case of an institution or education system, the flowers would be the students and the weaver may be the institution or ministry of education as a collective.

The *Fau* concept was theorized in context of this metaphor to depict *self-efficacy* (Vaka-Vivili, 2014) and is used in this thesis as a Pasifika conceptual framework. *Fau* parallels the fibre used for holding the flowers together in a lei as *self-efficacy* in Bandura's triadic reciprocity within the Social Cognitive Theory (SCT) model. Although *fau* was conceptualized when analyzing Tongan science teachers' self-efficacy, the parallels with students are apparent. The following section explains the *fau* concept as a Pasifika epistemology of self-efficacy.

The 'Fau Concept': *Ko e fau ko e no'o'anga ia 'o e kakala.* In English this means, "The *fau* (fibre) fastens and holds the fragrant flowers into place in a garland (*Kakala*). Figure 3.3 shows a picture of the fibre (*fau*) commonly used for weaving garlands or leis (*kahoa kakala*).

Figure 3.3 The *fau* fibre (*Hibiscus tiliaceus*)

Fau is a light porous fibre obtained from the inner bark of the beach hibiscus tree, *Hibiscus tiliaceus* (Whistler, 1992). It has many other uses such as making nets, baskets, and mats; the fibre is the dominant unseen element in a Tongan garland - the *kakala*. The primary role of this fibre is to hold the flowers when woven and the secondary role is to provide structural support to the garland. A *kakala* weave is typically a three, or four-strand braid in which fragrant flowers are inserted as the strands of fiber are woven together. Figure 3.4 shows a four-strand braid or weaving action in a *kakala* braid.

Figure 3.4 A four-strand braid or weave

Source: <https://images.app.goo.gl/G1Fxxh2ATXRgGwQ37>

Metaphorically, *fau* represents self-efficacy – that inner drive or willpower to attempt to achieve or not to attempt a task. I have chosen the four-strand braid to represent the four antecedents of self-efficacy explored in this research. The four pieces of fibre depict the four antecedents or sources of self-efficacy; Mastery, Vicarious Experience, Verbal Persuasion and Physiological/Emotional. The four antecedents compliment one another in an overall perceived self-efficacy or willpower to achieve set goals. That translates into Tongan as *loto'aki*. *Fau* parallels self-efficacy as that delicate, yet strong intrinsic driver towards successful achievement of goals.

Just as the *fau* holds the flowers in place in the weave, when the four antecedents of self-efficacy function together they give the confidence to the students to grasp and master the academic material presented. The expected product is the beautiful fragrant garland which metaphorically depicts the 'achievement' of a student.

Figure 3.5 shows a typical finished product, a Tongan *kahoa kakala* (fragrant garland) ready to be gifted (*luva*).

Figure 3.5: A Tongan kahoa kakala (Source: <https://images.app.goo.gl/3ga6bPyPLKWsX94o7>)

As a research framework, the original Kakala framework had only three stages; *toli*, *tui* and *luva*, and additional stages have been added by Tongan academics that are *teu*, *mālie*

and *māfana*. which are attributed to Johansson-Fua (2014) and Manu'atu (2001) cited by Sanga and Reynolds (2017).

Kakala as a research framework based on Tongan reference. Kakala has the potential to unsettle the dominance of the researcher over community and to challenge the modernity of research by valuing Tongan relationality, time honoured practices and value (Sanga & Reynolds, 2017, p. 199).

Sanga and Reynold (2017) explain that the Kakala as a framework pioneered by Helu-Thaman (1992) has continued to grow and evolve with new metaphorical references to Pacific life as ways of understanding research becoming increasingly evident. In the methodology Chapter 4.5, the *Kakala* research framework that aligns with this theoretical frame is explained. This research proposes *Hounga'ia* as a concluding chapter of the thesis *as Māfana takes place after the thesis is examined and accepted*. *Hounga'ia* is explained in Chapter 4.5.6.

3.8 Chapter Summary and Research Questions

The literature on the concept of self-efficacy in this chapter was presented in three major parts. The first presented the concept of self-efficacy by first defining it within Albert Bandura's triadic reciprocity of the Social Cognitive Theory (SCT) (Bandura, 1986, 1994, 1997) and the classroom adaptation model of SCT.

For the purpose of this research, I adapted a model by Bembenutty et al. (2016) in which they applied Bandura's SCT model in a classroom setting.

The second part described the sources of self-efficacy: Mastery, Vicarious Experience, Verbal Persuasion and Physiological and Emotional factors and how this relates to academic self-efficacy. Academic self-efficacy is influenced in three ways: the student's own perceived self-efficacy, their teacher's perception of their self-efficacy and the academic department or school's beliefs in the success of their programs. Perceived self-efficacy involves the cognitive, affective, motivational and selection processes. In a school setting, student's success in achieving their academic goals is in their own perceived self-efficacy and ability to weave the subject content through interactions within their classroom environment in line with school expectations. This was presented in sections 3.4, 3.5 and 3.6 respectively.

The final part was relating and aligning self-efficacy with a Pasifika theoretical framework of education to guide this research in section 3.7. In conclusion, I present the research question and the research sub-questions that have ensued from the literature.

Research Question

WHAT ARE THE FACTORS THAT INFLUENCE PASIFIKA STUDENTS' SELF-EFFICACY BELIEFS AND ACHIEVEMENT IN SCIENCE?

To explore self-efficacy beliefs and factors influencing Pasifika students' achievement in science, the following sub-research questions were asked.

Sub-Research questions (SRQ)

1. What are students' views about factors that support their learning in science?
2. What are the main sources of self-efficacy in Pasifika children's science learning?
 - 2a. What are students' views about their self-efficacy?*
 - 2b. What are science teachers' views about Pasifika students' self-efficacy?*
 - 2c. What teacher actions or approaches during the teaching of science support the development of Pasifika students' self-efficacy?*
3. Is there a relationship between self-efficacy and the overall science achievement of Pasifika students?

CHAPTER FOUR

Research Design and Methodology

Introduction

This chapter presents the research design and the methodological approach used for the collection and analysis of data. The content is presented under the following headings:

- Section 4.1 Selecting a Research Paradigm
 - 4.2 Research Design
 - 4.3 Theoretical Framework - Social cognitive theory (SCT)
 - 4.4 Methodological Adaptation of SCT for this research
 - 4.5 Kakala Research Framework
 - 4.6 Research Process
 - 4.7 Data Analysis Process
 - 4.8 Trustworthiness – Reliability and Validity
 - 4.9 Ethical Considerations
 - 4.10 Limitations and Delimitations

4.1 Selecting a Research Paradigm

(Understanding Science, Science Knowledge and Science Literacy)

The aim of this research was to explore, seek understanding and interpret whether the factors affecting Pasifika students' self-efficacy have an influence over their achievement in science. Te Kete Ipurangi (2021d) defines science as “a systematic process used to discover how the universe works and what it is made of” by testing ideas with evidence gained from rigorous testing. Wood (2020) places emphasis on the process of understanding the world rather than a body of knowledge. He claims that “scientific knowledge is what we learn from the scientific process which involves experimenting and collecting data” (Para. 1).

When it comes to school science, the National Research Council (1996) says, students should “develop an understanding of what science is, what science is not, what science can and cannot do, and how science contributes to culture” (P. 21). Understanding science will require a knowledge of science ideas. “Scientific knowledge refers to the facts, concepts,

principles, laws, theories and models” (p. 23) and those can be acquired in many ways. Understanding encompasses the ability to use the knowledge including those science ideas to explain, predict and draw relationships between those ideas. To develop an understanding means students need to be actively engaged with the ideas of science and have many experiences with the world around them (National Research Council, 1996).

Te Kete Ipurangi (2021d) states that “scientific knowledge builds on previous ideas and innovations and is continually being updated and expanded as new evidence comes to hand” (para. 2). It is not certain where those ideas will come from: either through teaching and instruction or the students’ own ideas through their explorations or both.

Scientific literacy implies that a person can identify an issue and can express their position based on the scientific and technological knowledge they have. The National Research Council (1996) defines scientific literacy as “the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity” (P. 22). That means a person can communicate their ideas, ask questions, explain, predict, and evaluate the quality of scientific information at hand. Scientific literacy has many different forms, not just in high school. It grows and deepens as a child grows; the attitudes are shaped from early years in school over time (National Research Council, 1996).

The above clarifications framed the selection of the research paradigm. A research paradigm is defined as a worldview, a perspective or belief-system by a certain community of researchers based on viewpoints, assumptions, concepts, values and practices they have in common regarding its design that guides the research process in a field of study (Johnson & Christenson, 2008). Self-efficacy is a concept that leads to agency (Bandura, 1994); it involves human thought, emotion, and action, hence a need to be objective.

Objectivism as an epistemology assumes a realist ontology, meaning that a reality exists out there, whether we are conscious of it or not, and that discovering the truth about that reality is best achieved through an accumulation of carefully planned observations (Hiller, 2016).

According to Hiller (2016), “objectivism holds that we may come to know the truth about reality through repeated observations of it in highly controlled situations” (p. 102). Since the research was about establishing an understanding of thoughts (views) of students and

teachers about their 'actions' that led to learning and achievement, that paradigm leaned towards pragmatism.

Rai and Lama (2020) describe pragmatism as "an educational philosophy that says education should be teaching students the things that are practical for life and encourage them to grow into better people" (p. 2320). They assert that the theory and practice of pragmatism in education has two main principles, namely

- (i) Education should have a social function and
- (ii) Education should provide real life experience to the child (Rai & Lama, 2020, p. 2321).

The above two principles are underpinned in many science curriculum frameworks as the idea that science need to be taught in ways that impact lifelong learning (National Research Council, 1996; Rai & Lama, 2020). However, human emotions, perceptions and worldviews are fluid and cannot be quantified, therefore an interpretivist framework was needed to study and interpret what was going on among my participants. An interpretivist worldview posits that no one held view is dominant over another. The goal is to understand the social phenomena and dynamics in the context of the situation (Rehman & Alharthi, 2016). Since humans interpret their worlds differently, there are diverse ways of seeing things as people have different experiences, contexts and cultures (Lan, 2018). The approach selected to carry out the research would utilize multiple tools to collect multiple perspectives in the methodology (Hofer, 2001). The data collected using these multiple tools would be triangulated for interpretation (Guba & Lincoln, 1984).

4.2 Research Design

Based on the above definitions, the research settled for a Qualitative-Interpretivist-approach for the research design and methodology. The following major advantages and disadvantages of the Qualitative approach by Rahman (2016) were considered.

Advantages:

- (i) Can provide a detailed description of participants' feelings, opinions, and experiences; and interprets the meanings of their actions (Denzin, 1989).

- (ii) Provides a multidisciplinary, holistic human understanding of a specific setting (Denzin & Lincoln, 2002).
- (iii) Enables understand of specific case events (Klein & Myers, 1999).
- (iv) Reveals participants' inner experience, and reveals how meanings are shaped and applied through context and culture (Corbin & Strauss, 2008).
- (v) Allows for real-time participant-observation, flexibility around structure of interviews, and direct observation. Observational records are most commonly used for data collection (L. Cohen, Manion, & Morrison, 2017).
- (vi) Allows flexibility with structure; design can be constructed and reconstructed to a greater extent (Maxwell, 2012).

The following disadvantages were also considered.

Disadvantages:

- (i) Qualitative research sometimes leaves out contextual sensitivities and focuses more on meanings and experiences. It attempts to uncover, interpret and understand the participants' experience (Rahman, 2016).
- (ii) Policymakers tend to prefer quantitative research and may give low credibility to results from a qualitative approach (Sallee & Flood, 2012).
- (iii) A smaller sample size may raise the issue of generalizability to a larger population (Vasileiou, Barnett, Thorpe, & Young, 2018).
- (iv) Data analysis can be quite ambitious and may take a considerable amount of time, with lengthy reports (Creswell, 2007).

After considering the above advantages and disadvantages, I settled for the qualitative approach because of the benefits of the detailed insights provided into individuals' perspectives, and the value of multiple tools for data collection and data triangulation for interpretation (Guba & Lincoln, 1984; Hofer, 2001).

The research had three foci. The first focus was aimed at understanding students' views and perceptions about their self-efficacy in science through a written questionnaire (Fraser, Treagust, & Dennis, 1986) and a focus group interview (Gill, Stewart, Treasure, & Chadwick, 2008; McLafferty, 2004).

The second focus was to explore teacher perceptions of their students' self-efficacy in science through a semi-structured interview (De Boer, Timmermans, & Van Der Werf, 2018; Van Uden, Ritzen, & Pieters, 2013).

The third focus was an in-situ classroom observation of discourse and interaction between teacher and students (Bryman, 2006). The third focus took an ethnographic approach studying the participants in their natural classroom setting as a participant observer (Allen, 2017). Being a participant observer meant being engaged with my participants while studying their interactions at the same time. It meant they did not see me as an abstract researcher, they would be familiar with me, and not shy to speak with me freely during one or more of our sessions. A bonus was to observe firsthand which self-efficacy antecedent/s participants were likely to display; Mastery, Vicarious experience, Verbal persuasion, or Physiological/emotional aspects. Additionally, their responses in the Student questionnaire would confirm or raise questions about some of the observations. These three foci called for a multiple data collection method and interpretation of emergent themes to answer the research question (Hofer, 2001).

Figure 4.1 illustrates the research design: the research questions are repeated here for ease of interpreting the figure which shows the relationship between the questions and the data collection tool.

Research Question:

WHAT ARE THE FACTORS THAT INFLUENCE PASIFIKA STUDENTS' SELF-EFFICACY IN SCIENCE AND THEIR ACHIEVEMENT IN SCIENCE?

Sub-Research Questions (SRQ):

1. What are students' views about factors that support their learning in science?
2. What are the main sources of self-efficacy in Pasifika children's learning in science?
 - 2a. What are student's views about their self-efficacy?
 - 2b. What are science teachers' views about Pasifika students' self-efficacy?
 - 2c. What teacher actions or approaches during the teaching of science support the development of Pasifika students' self-efficacy?

3. Is there a relationship between self-efficacy and the overall science achievement of Pasifika students?

Figure 4.1 Research Design

Although the research paradigm was qualitative and interpretative, the student questionnaire was analysed quantitatively. The small quantitative phase drawn from the student questionnaire was developed and adapted for New Zealand schools as per Bandura's guide for developing a Likert-type questionnaire for perceived self-efficacy (Bandura, 2006b) to answer SRQ1 and SRQ2a. Quantitative analysis was conducted concurrently with the qualitative analysis (Venkatesh, Brown, & Bala, 2013).

SRQ 2b and SRQ 2c were answered from the Teacher semi-structured interview and the classroom observation adapted from O'Loughlin (1992) and Moeed (2010). SRQ 3 was answered by examining and comparing NCEA external results with the student self-efficacy from SRQ 1 and SRQ 2. The data collected was analysed and interpreted to provide an overall perspective to contribute to answering the first sub-research question about students' perspectives of their own self-efficacy. The next section presents the theoretical framework of the study.

4.3 Theoretical Framework - Social Cognitive Theory (SCT)

According to Bandura (2001), Social Cognitive Theory or SCT

“distinguishes among three modes of agency; direct personal agency, proxy agency that relies on others to act on behalf to secure desired outcomes and collective agency exercised through socially coordinative and interdependent effort” ... (Bandura, 2001, p. 1).

Chapter 3.2 described Bandura’s SCT model where the three modes of agency operate in a reciprocal manner, all interacting with each other: personal or intrapersonal factors, environmental factors, and the behavior of the individual. Self-efficacy is the product of that triadic reciprocal determinism and the construct of the SCT influenced by the three interacting factors at the same time (Bandura, 1986; Hurst, 2017b). Chapter 3.4 described the four sources or antecedents of self-efficacy people draw from as “people to strive to exercise control over the events that affect their lives” (Bandura, 1995, p. 1). This unique reciprocal relationship within the Social Cognitive Theory (SCT) framework is the concept of *reciprocal determinism* (also called *triadic reciprocity*) known as self-efficacy (Bandura, 1994, 1997). Bozack (2011) illustrates that three-way interaction as follows in Figure 4.2.

Figure 4.2 The three-way triadic interaction (Bozack, 2011).

In a classroom situation, Chapter 3.3 had described some interactions students encounter between peers and their teacher in that environment. Their personal cognitive factors encounter the environmental factors of the classroom and this affects their behaviour or, their behaviour in that classroom situation, and affects their cognitive beliefs

and attitudes (Bembenutty et al., 2016). Figure 3.1. shows how a person's motivation to achieve is triggered by an interplay of the situational interest and their personal interest from their level of engagement in a learning environment. A person's intrinsic motivation is triggered by his or her personal interest (Hidi, 2001), which includes; emotional and cognitive aspects as well as the perceived value in engaging in an activity (Bandura, 1995). Engagement in an activity is triggered by a situational interest that is presented by the learning environment (Hidi, 2001). If the situation is friendly and inviting, it may draw interest that promotes engagement, and where there is engagement, there is more likely to be learning; and where there is learning, there is more likely to be achievement (Bandura, 1993; Bembenutty et al., 2016; Hidi, 2001). When a student sees that he or she has accomplished results and has achieved, it may boost his or her self-efficacy and confidence to repeat the same success (Bandura, 2010). Hence out of this three-way interaction or interplay of personal factors, environmental factors and behaviour arises *self-efficacy* as discussed in Chapter 3. 2.

Self-efficacy beliefs are established through the four sources or antecedents of self-efficacy: Mastery, Vicarious Experience, Verbal Persuasion and Physiological or Emotional arousal affect learning (Bandura, 1997; Bozack, 2011). Figure 4.3 presents a schematic representation of the four antecedents affecting one's overall self-efficacy from the core of SCT in Figure 3.1.

Figure 4.3 The core of SCT

According to Bandura (1997), “Mastery experiences are the most effective way to boost self-efficacy because people are likely to believe they can do something new and if it is something similar to what they have done well” (p. 16). However, one can also build self-efficacy through observations (modelling), by verbal encouragements and by being aroused by physiological and affective states (emotional) as motivators or stressors (Bandura, 1994, 1997).

4.4 Methodological Adaptation of SCT for this Research

Alt (2015) describes self-efficacy for learning as a student’s own abilities and beliefs in self-regulating their own learning that could determine their motivation and academic achievement. Hence a cyclic effect is suggested where academic motivation or self-efficacy stimulates a student’s intrinsic motivation and enhances personal interests to utilise the extrinsic factors and situational interest of the classroom scenario offered by the teacher to engage in the learning opportunities provided. This engagement in turn can lead to learning and then achievement, thereby allowing their self-efficacy to act all over again building on their Mastery and confidence for future successes. Figure 4.2 presented that triadic or three-way interaction and Figure 3.2 illustrated Bembenuddy et al. (2016) classroom application of Bandura’s SCT model (Bandura, 1997).

Having considered the above two models closely, I then combined and adapted them to fit the purpose of this research. In a New Zealand secondary school context, the intrapersonal factors and extrinsic motivation affecting a student are likely to include the NCEA achievement credits. Situational interest would be created from the classroom environment, for example an engaging practical activity is likely to lead to learning. Learning leads to achievement and when students achieve, according to Bandura (2006), they have accomplished a task. That can increase academic motivation and self-efficacy (Britner & Pajares, 2001). When their self-efficacy is raised, they can be intrinsically motivated to achieve higher achievements (Pajares, 2002), resulting in a cycle. The high self-efficacy prepares them for the next learning opportunity. Figure 4.4 presents a schematic diagram of what I have described as a self-efficacy cycle.

Key: ↑ Possible pathways

Figure 4.4: Proposed Self-efficacy cycle in a New Zealand classroom (Adapted from (Bembenutty et al., 2016)).

Figure 4.4 shows that, theoretically in a New Zealand classroom, students come with an intrinsic motivation of achieving the Level One NCEA credits. The situational interest presented to them in the classroom plays a major part in their learning to achieve those credits. When they achieve a certain standard, it is a success, thereby raising their self-efficacy and academic motivation to attempt the next standard with high self-efficacy and confidence. The environment also presents them with a situational interest in terms of the NCEA credits and learning is done to achieve those credits. With this theoretical approach, I set out using multiple tools to research what was really happening in the classrooms.

4.5 Research Framework – Applying the Kakala Research Framework (KRF)

The research framework of the present study was the Kakala Research Framework by Johansson-Fua (2009), with contributions from Dr. Linita Manu'atu and Dr. 'Ana Taufe'ulungaki. KRF is an adaptation from the original Kakala framework for education by Helu-Thaman (1992). Helu-Thaman's framework (*Toli, Tui and Luva*) has been used and adapted by many Pasifika researchers, one of which is the KRF with the inclusion of; *Teu*

(preparation), *Mālie* and *Māfana* (finding relevance and application of the findings) (Johansson-Fua, 2009, 2018; Sanga & Reynolds, 2017). Allowing KRF to guide this exploratory research with Pasifika student participants signifies it as a Pasifika cultural and epistemological context. The three additional steps added make a total of six steps of the KRF framework as: *Teu* (Preparation), *Toli* (Data collection), *Tui* (Data analysis), *Luva* (Presentation of findings), *Mālie* (Discussion) and *Māfana* (application) (Johansson-Fua, 2009, 2018). However, this research proposes *Hounga'ia* as a step between *Mālie* and *Māfana* that include; implications, recommendations and suggestions for future research. It would seem inapplicable for *Māfana* to happen at the end of a thesis as *Māfana* only happens after the thesis has been examined and accepted. *Hounga'ia* is explained in section 4.5.6.

4.5.1 *Teu* - Preparation.

Teu means 'preparation'. In preparation to make a *kahoa kakala* (garland) the first step of the process, is a mental one. At the *Teu* stage, the type of garland to be woven is decided upon so that the desired flowers are collected for the garland to be made just the way the weaver wants it. Next is the gathering of the flowers for the construction of the garland.

In research contexts, at this preliminary stage, the research design was considered and the appropriate research method, and research instruments chosen for the study. At the *teu* stage, the research problem was identified, and the background literature was investigated and presented in Chapter 2. That was followed with the literature on the concept of self-efficacy in Chapter 3 and positioning myself in this research. Theoretical positioning and designing the research process including the selection of research tools can be included as *teu*.

4.5.1.1 Selection of Research Tools. Using the KRF (Johansson-Fua, 2009, 2018) as my guide, the tools I chose for gathering the flowers (data collection) were to reflect the exploratory nature of the research (Given, 2008). To answer the above sub-research questions in Section 4.2, the following multiple tools were used to collect the Data. Table 4.1 provides the research tool selected to answer each sub research question with each justification presented in Table 4.2.

Table 4.1 Research Question Vs Research Tool Used

SRQ	Sub-Research Questions	Research Tool used for Data Collection
1	What are students' views about factors that support their learning in science?	Student Focus Group Interview
2	What are the main sources of self-efficacy in Pasifika student's science learning?	Student Questionnaire
2a	What are students' views about their self-efficacy?	Focus Group Interview and Student Questionnaire
2b	What are science teachers' views about Pasifika children's self-efficacy in science?	Teacher Interview
2c	What teacher actions or approaches during the teaching of science support the development of Pasifika students' self-efficacy?	Teacher Interview and Classroom Observation
3	How does self-efficacy affect the overall science achievement of Pasifika students?	All the above and National Certificate in Educational Achievement (NCEA) results

Table 4.2 Justification of Research Tools

SRQ	SRQ - Sub-Research Question	Tool Used	Justification
1	What are students' views about factors that support their learning in science?	Focus Group Interview (Appendix V)	Easy to organise and execute. Focus group interviews create an informal friendly environment with closer interactions where students could freely express themselves with their peers around them (Roller & Lavrakas, 2015). Larger groups would be harder to manage the overwhelming amount of data that might be forthcoming (Moeed, 2015).
		Student Questionnaire (Appendix T)	Student responses to the statements on the Questionnaire were designed to capture their self-efficacy perceptions and views about their learning in science and their self-efficacy. All students were exposed to the same questions and analysis was carried out under the same themes (Siniscalco & Auriat, 2005) and treatment was uniform for all students.
2	What are the main sources of self-efficacy in Pasifika student's science learning? Analysis of student questionnaire revealed sources.		
2a	<i>What are students' views about their self-efficacy?</i>	Student Questionnaire (Appendix T)	As above. Students' selection of a number as a Likert scale indicated their view or degree of agreement to the statement. Each degree of agreement captured as a Likert score translated to the participant's view of their self-efficacy. The mean scores were then plotted using Microsoft Excel to determine each participant's main sources (antecedents) of self-efficacy.
2b	<i>What are science teachers' views about Pasifika children's self-efficacy in science?</i>	Semi-structured Teacher Interview (Appendix X)	Teacher interview was used to align and understand teacher perceptions of their students to triangulate with student responses in the questionnaire and focus group interview. Provides the opportunity for Researcher to probe to obtain in-depth information (Adams, 2015).

2c	<i>What teacher actions or approaches during the teaching of science support the development of Pasifika students' self-efficacy?</i>	Classroom Observations (Appendix Z)	<p>These provided Real-time data in order to validate some of the other data obtained from other methods (Kawulich, 2005).</p> <p>Observations are useful for closing the gap between what is said and what is practised (Creswell & Poth, 2016; Moeed, 2010). This meant, thorough investigation and conceptualizing to help assess what happens during part of the student's schooling in the classroom (Lorsbach & Jinks, 1999).</p> <p>Classroom Observations made note of student behavior, to read and follow through with instructions, student engagement, teacher input and student interaction. Studying the students' learning environment (classroom) enabled me to observe and make sense of students' responses in the student questionnaires. It provided clarity on students' views in the focus group interview and teacher responses in the teacher interview.</p> <p>Unluer (2012) concurs with Bonner and Tolhurst (2002) that there are three advantages of being an insider-researcher or participant observer.</p> <ul style="list-style-type: none"> (a) Being Pasifika myself, I had a greater understanding of the culture of the student participants under study (b) By blending in with the lesson, the flow of the lesson was not altered in any way between teacher and students and (c) Having experience of teaching Year 11 science, enabled me to make sound judgements on the content delivered and dynamics of the lesson.
3	How does self-efficacy affect the overall science achievement of Pasifika students?	All the above and National Certificate in Educational Achievement (NCEA) results	<p>The NCEA results provided the official overall achievement of the student participants. It is the official Level One science results that allow achievement comparisons to be made in Aotearoa at a national level. This was supplied by the teacher.</p> <p>My reason for doing so is that participants are likely to be assessed for Level One of NCEA and the concerns raised about Pasifika student's underachievement are often from their NCEA results.</p>

4.5.1.2 Selection of Participating schools. *Teu* also required the selection of secondary schools and an invitation to them to participate in the research. Ten North Island schools in New Zealand were invited to participate in the study of which only four accepted the invitation. Care was given to invite schools across the whole decile spectrum particularly those that had high a Pasifika student population. The decile system in New Zealand schools is a measure of the socio-economic background of its student population relative to other schools in the country. Deciles are calculated every 5 years using population census data and range from 1-10. For example, Decile 1 schools are 10% of NZ schools that have most of their student population coming from low socio-economic communities, whereas Decile 10 schools have the lowest proportion of its students coming from these communities. A school's decile is used to calculate the funding each school may receive from the Ministry of Education but does not indicate the quality of education the school provides and does not indicate an overall socio economic mix of that school Ministry of Education (2020a).

Care was also taken to invite schools representing, State, State integrated, Co-educational and single-sex schools with high Pasifika student numbers. The invitation (Appendix B) included an information package, that included the following documents explaining the research:

Attachments:

1. Information sheet for Participating principals (Appendix C).
2. Information sheet for teacher participants (Appendix D)
3. Information sheet for parents (Appendix E).
4. Information sheet for Pasifika Parents (Appendix F)
5. Information sheet for Students in Participating class (Appendix G)
6. Information sheet for Pasifika students (Appendix H)
7. Principal's consent (Appendix I)
8. Teacher's consent (Appendix J)
9. Teacher's consent for interview (Appendix K)
10. Parental consent -whole class (Appendix L)
11. Parental consent -Pasifika (Appendix M)
12. Student consent -Whole class (Appendix N)
13. Student consent – Pasifika (Appendix O)
14. Student consent for Focus Group Interview (Appendix P)
15. Classroom Observation schedule (Appendix Q)
16. Classroom Observation – Running record (Appendix R)
17. Classroom Observation – running record sample (Appendix S)

18. Student Questionnaire (Appendix T)
19. Teacher Interview schedule (Appendix U)
20. Student Focus Group Interview schedule (Appendix V)
21. About the Researcher.

The information sheets explained the research to each consenting participant and all participants consented voluntarily. Signed documents were returned before data collection began. Out of the four schools that accepted the invitation, the first school to accept the invitation was treated as a pilot school while the remaining three schools became study schools.

4.5.1.3 Consent. The four consenting North Island school Principals communicated their approval through the consenting science teacher. Parental consent was sought with the assistance of that science teacher (Appendix L). All the students of the participating teacher were invited and consented to be observed in the classroom but only Pasifika students were invited to participate in the whole study. However, not all Pasifika students consented to participate in the whole study; some consented only to be observed in class but opted out of the Student Questionnaire and the Focus Group Interview. All Pasifika students who consented were included as participants in the study (Appendix I to P). All parents consented to their children participating in the study (Appendices L and M).

4.5.1.4 Selection and nature of Participants and sample size. Research participants included five science teachers and their classes of Year 11 (NCEA Level 1) science. All participants were purposive; all teachers and students who consented were included in the study. There was no pre-selection of participants. Student participants were both male and female, aged between 15 and 16 years, whose parents were of Pasifika origin namely: Samoa, Tonga, Fiji, Cook Islands, and Tokelau. Table 4.3 shows that the sample size included five science teachers and 30 Pasifika students from four North Island secondary schools. One teacher and eight students were from the pilot school, so the findings reported in this thesis are only from three study schools, three science teachers and 22 student participants.

Pseudonyms were given to all schools and participants to maintain anonymity and are used throughout the thesis. Maui High School was the first school to accept the invitation to

participate and became the pilot school. Piloting is further discussed in section 4.5.1. 5. Table 4.3 provides the background information about my participants.

Table 4.3 Background information about the participants

No.	School	Decile/Demographics/Islands represented	No of Student Participants	No of Teachers
Pilot	Maui High School (Pilot)	A decile 6 state single-sex secondary school Samoa, Tonga, Fiji	8	1
1	Grace College	A co-educational decile 8 state secondary school with students from a mixed socio-economic background. Samoa, Tonga, Fiji, Cook Islands, Tokelau	8	1
2	Mercy College	A co-educational decile 5 state school. Samoa, Tonga, Tokelau, Cook Islands	6	2
3	Leep High School	A single sex, decile 8 church school Samoa, Tonga, Cook Islands	8	*1

- *Teacher was not available for a Teacher Interview*

4.5.1.5 Pilot Study. Maui High School being the first school to accept the invitation to participate in the study was asked and agreed to contribute to the research as a pilot school. I carried out Classroom Observations for five lessons, conducted a Focus group Interview and interviewed the science teacher. The whole class in the pilot school consented for classroom observation while all eight Pasifika students consented to complete the student questionnaire and focus group interview.

Piloting allowed me to:

- (i) Edit my Focus Group Interview questions by removing repetitive questions and making my interview questions shorter allowing for more time to probe the students to elaborate their answers.
- (ii) To keep within time. To make sure students have enough time to complete the questionnaire without being distracted. Practice taking notes quickly, correctly, and systematically as the lesson progressed.
- (iii) Have the teacher complete a form with their personal background before the interview to save time to discuss other aspects of the interview.

4.5.2 Toli -Gathering or collecting (Data Collection).

Toli is described in Section 4.5 as gathering of flowers in Pasifika epistemology. Section 4.5.1.1 described the selected research tools and Table 4.2 presented the justification for each tool. This section describes the process that was used to collect the Data.

4.5.2.1 Site and location. During my preliminary visit and meeting with the participating teacher of each of the schools, I was introduced to office staff and signing-in, signing-out processes as school protocol. Data collection did not start until a week later. That allowed time for the teacher to inform the students about my visit and send out student and parental consents.

On the first day of formal data collection, the teacher introduced me to their class. That gave me the opportunity to explain the research and arrange to meet with the Pasifika participants. The teachers allowed me to interact with the students during class and the students quickly adapted to having me in their classroom as a participant observer. Data collection was conducted simultaneously involving both teacher and student participants. Figure 4.7 below provides a flow chart of the Data collection process with the three study schools.

4.5.2.2 Data collection process. The two data sources were from Student participants and Teacher participants. Figure 4.7 shows the sequence in which data collection tool was applied. The same data collection process was followed for all the three study schools.

Figure 4.5 Flow diagram of research data collection process

Classroom observations were made simultaneously for both students and teachers and recorded on the same capture sheet (Kawulich, 2005). Data was separated as student data and teacher data during analysis. Students' NCEA results were made available by the teachers and the National Averages for each standard were made available by NZQA. The following section will detail how the data was collected and stored for analysis.

4.5.2.3 Classroom observations. To answer SRQ 2c, five of the participating teacher's science lessons were observed per study school. Field notes were collected using a classroom observation schedule (Appendix Z). A running record of the entire class session

was recorded as field notes on the running record sheet at 5-minute intervals. All the classes were audio recorded for back up to my field notes during analysis.

Table 4.2 explained, classroom observations as being useful for closing the gap between what is said and is practised (Creswell & Poth, 2016; Moeed, 2010). This meant, thorough investigation and conceptualizing to help assess what happens during part of the student's schooling in the classroom (Lorsbach & Jinks, 1999).

Classroom Observations made note of both student behavior, and reactions and interactions of teacher with student. Emphasis was placed on student's ability to read and follow through with instructions, student participation and engagement, teacher input and student interactions with teacher and with other students. As explained in Table 4.2, studying the students' learning environment (classroom) enabled me to observe and make sense of students' responses in the student questionnaires. It provided clarity on students' views in the focus group interview. Being a participant observer meant, I was now familiar to them and they were not shy to speak their minds freely with me. It also meant understanding teacher responses in the teacher interview.

Unluer (2012) concurs with Bonner and Tolhurst (2002) that there were three advantages of being an insider-researcher or participant observer in my case.

- (d) Being Pasifika myself, I had a greater understanding of the culture of the student participants under study
- (e) By blending in with the lesson, the flow of the lesson was not altered in any way between teacher and students and between students themselves.

Having experience of teaching Year 11 science, enabled me to make sound judgements on the content delivered and dynamics of the lesson. Each school was different, but the data collection method was the same for all schools.

4.5.2.4 Focus Groups Interview. To answer SRQ 1, a Focus Group Interview was conducted with consenting student participants. The Focus Group Interviews considered points raised by Krueger and Casey (2001).

- All participants were Level One science students with similar cultural backgrounds, characteristics, experience, and knowledge and provided honest and rich information on the questions raised.
- Size of the group was to six to eight people. My participants were not many so gave the opportunity for all of them to have a say.
- There were no power differentials among participants as all group members were either in the same class or Year Level. Therefore, an environment was created where they should feel comfortable talking with one another
- The Focus Group was held in a room assigned by the teacher at their own school so there was no need for transportation or time inconvenience.
- The Interview was conducted in English so there was no language bias. They sat facing each other and were comfortable about speaking. That way, before we moved on to the next question, they would confirm and reaffirm each other's' comments and agreed on a certain point before moving to the next question (Krueger & Casey, 2001).

In the interview, students were asked questions centred around their learning in science and behaviour observed during Classroom Observation. One thing the Focus Group allowed for was cohesive interaction between the participants. When one said something, it stimulated another to add to it or give another perspective for me to prompt and probe further. Even though they seemed homogenous, yet each responded quite differently to the questions (Roller & Lavrakas, 2015). The same interview schedule was used for all schools including the pilot school. Appendix T provides the Focus Group Interview schedule used in this research.

4.5.2.5 Student Questionnaire. Self-efficacy, like other emotions is hard to measure, therefore the range of students' responses on the rating scale was meant to capture their views and alignments in response to the questions. The design of the questionnaire was to reveal their pattern of thought when analysed (Carugi, 2016).

The student questionnaire was used to answer SRQ2 and SRQ 2a. The questionnaire comprised a series of statements of Likert-type questions developed and adapted to Pasifika

students' context according to T-J. Lin and C-C Tsai (2012), Ferlaa, Valcke, and Cai (2009). Bandura's Guide for constructing self-efficacy scales (Bandura, 2006a) was used to cross-check the five-point Likert scale. The Likert scale provided a range of agreement 'strongly agree' to 'strongly disagree' to which students selected from. Table 4.4 shows a section of the student questionnaire they used as guide to indicate their inclination. Scores were accorded accordingly as indicated for analysis.

Table 4.4 Likert Scores Given Per Statement

Strongly agree	Mostly agree	Somewhat agree	Disagree	Strongly disagree	No Response
5	4	3	2	1	0

Appendix Z provides a copy of the questionnaire.

4.5.2.6 Semi-Structured Teacher Interview. Interviews are used in qualitative research to understand a subject world from several different points of view. Interviews attempt to:

- unfold the meaning of peoples' experiences.
- uncover their lived world (Dejonckheere & Vaughn, 2019).

The most common form is the semi-structured interview which,

- is flexible and Interactive
- can be used with individuals or groups
- is scheduled with prior notice
- gives insight into participant perspectives
- gathers information from key informants on the topic
- allows deep exploration of participant thoughts and experiences
- provides Data for a qualitative study (Dejonckheere & Vaughn, 2019).

A 30-minute interview was conducted with the participating teacher to explore teacher perceptions of their Pasifika students learning and self-efficacy. Appendix B1 provides a copy of that interview schedule. All the interviews were audio-recorded with a

digital voice recorder. The recordings were replayed, transcribed, and analyzed.

4.5.2.7 NCEA Level One Results. The NCEA science assessment resources are made available online as a teaching resource. All Level One achievement standards are NZQA approved, both internally assessed standards (Te Kete Ipurangi, 2021b) and externally assessed standards (NZQA, 2021d). They clarify the standard and provides and provide assessment tasks which teachers can adapt to their need. Internally assessed standards are coordinated by the teacher during the academic year while the external standards are controlled from NZQA at the end of the year.

The Directory of Assessment Standards lists all the quality assured unit and achievement standards known collectively as 'assessment standards'. The assessment standards listed on the DAS can contribute to national qualifications (NZQA, 2021d Para.1)

For this research, results of the participants were furnished by the participating teacher while the national averages were furnished by NZQA. The achievement results of the standards attempted were compared to answer SRQ3. The results were used for triangulation of the overall perspective to answer the research question.

4.5.2.8 Labelling and storage. For ethical reasons pseudonyms are used throughout to ensure and maintain participant anonymity and the privacy of students, teachers and schools according to Cohen et al. (2017). All data were dated and coded in their respective pseudonyms and was kept confidential and stored in a locked cabinet at the Victoria University of Wellington, Faculty of Education.

4.5.3 Tui (Weaving) – Data Analysis Process

Tui is the weaving process where the collected flowers are woven into a garland. In research contexts, *tui* is the data analysis process where the collected or gathered information is categorized, grouped into themes or relationships, and drawn together to produce the generalizable findings and overall viewpoints. It is a dual process of data arrangement, drawing meaning and understanding from the data presented. Data analysis followed the two pathways outlined in Figure 4.5. Figure 4.6 below provides the general Data analysis pathway for each research tool for student data.

Figure 4.6 Data Analysis Pathway for Student Data

4.5.3.1 Analysis of Classroom Observation. Analysis of Classroom observations followed the pathway outlined in Figure 4.8. Summaries were drawn from notes from Classroom observation schedules and other field notes to capture a snippet of what was happening in a science classroom of the participating teachers. A transcript of a typical lesson observed at Grace College is given in Appendix Y. The transcripts were read and re-read before codes were allocated to the events of the class. From these codes a self-efficacy antecedent was identified. (Refer to Appendix Y).

Patterns of specific behavior that supported student learning and self-efficacy were coded and recorded as Teacher Data. Student behavior aligning with self-efficacy antecedents evident during each class session was also coded and recorded as Student Data.

4.5.3.2 Analysis of Focus Group Interview – Student Data. The audio recordings of the Focus Group Interviews were firstly played back and transcribed double checking with field notes. Appendix U provides a sample of the transcribed interview from Mercy College. The transcripts were read and re-read to confirm dominant emergent themes before aligning and coding for self-efficacy antecedent present or supported.

4.5.3.3 Student Questionnaire – Student Data. Likert-type psychometric scale as a test tool was developed and adapted to Pasifika children's context according to Lim (1999) and Ferlaa et al. (2009). Students were given an opportunity to agree with a statement and align their agreement ranging from 'Strongly agree' to 'strongly disagree'. The following section describes how the student questionnaires were analysed.

The first step was to categorise the statements in the questionnaire into the four self-efficacy experiences: Mastery, Vicarious Experience, Verbal Persuasion, Physiological/Emotional experiences. The second step was to create a Microsoft excel spreadsheet and each of the participants' selection of Likert values. Thirdly, averages were calculated per antecedent and Microsoft excel charts created determine sources of self-efficacy through interpretation (Vaka-Vivili, 2014). Due to very small sample sizes, statistical interpretation and validation could not be performed. Figure 4.7 provides a flow chart of that process.

Figure 4.7 Data analysis Process for Student Questionnaire

4.5.3.4 Teacher Interview - Teacher Data. Teachers' Data were analyzed and reported as teachers' perceptions of their students' self-efficacy in science. Analysis followed the following flow diagram.

Figure 4.8 Teacher Interview Analysis pathway

The audio-recorded interview was treated in the same way as the Student Focus Group Interview. The audio-recordings were firstly transcribed. The transcripts were read and re-read for emergent themes. Not all themes were coded for self-efficacy, some remained as student needs or teacher concerns.

4.5.3.5 Comparison of NCEA Results of Participants with sources of self-efficacy

The participants' NCEA Level One science assessment results were made available by the participating teachers upon previous consent to participate in the study. The results were used to compare each participant's overall credits with their primary or secondary source of self-efficacy. Emergent patterns were triangulated and are discussed in each respective school's Findings Chapters.

4.5.4. Luva – Presentation of Findings

The beautiful garlands are often made to be given away and this happens during special occasions and ceremonies, where the leis are presented as gifts honoring a special recipient or distinguished guest. This is called *luva*.

In research contexts, this is the presentation of findings. The findings from this study are presented in Chapters five, six and seven. *Luva* can also signify the overall findings of a study or research to the relevant bodies or for public consumption. The findings of this research are be presented in Chapters five, six and seven.

4.5.5 *Mālie* - Finding Relevance through Discussion.

Appreciation of the garland by the recipient, as honored enjoying the sweet fragrance released by the flowers.

In research contexts, that is when the research findings find relevance (Johansson-Fua, 2009). To the researcher, it can be the discussion or critique or to a receiving body, the appreciation of a completed document or study. Chapter Eight offers the *Talanoa mālie* or Discussion of findings from this research. It is hoped that this research will add new knowledge to literature on self-efficacy beliefs that affect Pasifika children's learning and achievement in science.

4.5.6 *Hounga'ia* – Conclusion (Implications & Recommendations)

The adornment with a garland during a special occasion in the cultural context distinguishes the wearer as special or having prominence. *Hounga'ia* is a state of deep appreciation, culminating to an outward display of that appreciation through speech or dance. *Hounga'ia* can be felt bothways, by the weaver of the garland and by the recipient. The weaver would be extremely pleased and appreciative (*hounga'ia*) of their handiwork being gifted to a distinguished person. The recipient feels honoured of being adorned in such a way with a garland of pleasant fragrance. *Māfana* (celebration) becomes the action of that *hounga'ia* (*appreciation*). On the part of the recipient, it allows them to appreciate the gift and think about how to respond or express that gratitude. The recipient may stand up to address the crowd if they are a member of the royal family. For a commoner or member of a dance crew, they may feel adequately adorned to dance. This research proposes *Hounga'ia* as that necessary step to signify that deep appreciation of the gift before *Māfana*.

In the research context, *Hounga'ia* allows the researcher to reflect on the findings in *Luva* and appreciate the discussions in *Mālie* and set the stage for a positive outcome and meaningful contribution of the research in education. With *Hounga'ia* as the concluding chapter of a thesis provides the space for the implications of the findings to be made, and future action or possible future research to be proposed. *Māfana* is the action or application of the recommendations. Chapter Nine presents the *Hounga'ia* as the concluding chapter of this thesis.

4.5.7 *Māfana* - Application

Māfana is reached once the research findings and recommendations are accepted and actioned by the relevant authorities. *Māfana* signifies the output or product of the research. Whether the findings will have a tangible and practical application depends on the receiving body. *Māfana* may include:

- actioning the recommendations from the findings of the study
- Implementing a policy change for practice
- the recommendations serving as vital information to be relied upon for change, or
- general insight into further research

Mālie and *Māfana* often complement each other as an evaluation and monitoring process in policy processes (Johansson-Fua, 2009). However, this research proposes that since *Hounga'ia* takes place before *Māfana*, should it be considered as a step within the KRF applicable in scholarly research?

4.6 Trustworthiness - Validity and Reliability

Validity refers to the credibility of research as believable or not and reliability is defined as the dependability, and consistency of the method as yielding similar results each time the method is used (Cohen et.al, 2017). Validity was maintained by using multiple data sets to avoid bias towards one method. Content validity was maintained within the instrument construct (Student Questionnaire) by asking the same question in more than one way and comparing the answers across the four themes of self-efficacy. The use of multiple tools; Classroom Observation, Student Questionnaire, Student Focus Group Interview and Teacher Interview, allowed for cross-checking of the information collected. The Teacher Interview enabled double checking some of the observed behaviours of both teacher and students during the Classroom Observations. I asked the students about certain behaviours in class checked and the behavioural characteristics that students displayed in the classroom with them directly in the Focus Group Interview.

4.7 The Question of Bias

Since this research was exploratory, and to avoid bias, there was no prior arrangement of selection of participants; all schools, teachers, and student participants were all voluntary and written consent was sought and obtained. Although my sample size was small, all my participants represented five Island groups, that are identified as Pasifika by the Ministry of Education, hence a balanced representation (Table 4.3). This gives me the confidence that the findings reported in this research is a Pasifika voice representing our *fanau* in New Zealand secondary schools.

Additionally, there is no gender bias and I have allowed for State, State integrated, Co-educational and Single sex schools all to be included through the invitation process to eliminate bias. I was introduced to the participants and had been present in the class questions face to face so that they did not view me as an abstract researcher behind a questionnaire schedule (Cohen et.al, 2017).

Reflexivity was an essential feature this qualitative research as I placed myself in the environment I needed to collect data from (Creswell, 2015). This meant careful consideration of the phenomenon I was studying and the research process which requires what Creswell calls good data (Watt, 2007). As the achievement of Pasifika students, the topic of this research was personally important to me, I had to take care to constantly reflect on my own assumptions and behaviours as a researcher. Having explained my choice of being a participant observer (as described in Section 4.5.2.3), I had to constantly reflect on the data collection process and my own assumptions, data analysis process and my beliefs and assumptions for reflexivity. I also used this action of stopping and thoughtfully consideration as a critique when drawing conclusions from the analysis. This process was time consuming, but I felt necessary for the validity of my research.

4.8 Ethical Issues

This research was approved by the Victoria University of Wellington Human Ethics Committee (Victoria University of Wellington, 2018), approval number 0000026833. All care was taken in the invitation to provide all necessary documentation explaining the research

and seeking consent before introducing myself to the participants. Piloting of the research tools began as soon as ethics approval was granted. All participants, including the schools gave voluntary and informed consent. Pseudonyms have been used throughout protecting the anonymity of the schools and the participants.

4.9 Limitations and Delimitations

There were a few limitations noteworthy in the method.

Firstly, the time spent in each school was limited to five lessons per school. A longer period would have provided a bigger spectrum of classroom interactions between teacher and students for a richer perspective.

Secondly, this study was limited to only three schools; a larger sample size across more than three schools would have enabled more confidence in generalizability for Pasifika learners of Level One science.

Thirdly, the student questionnaire comprised only 30 statements to allow for time for students to complete. Increasing the number of statements and asking the same question in several ways might allow us to find deeper insights into the students' self-efficacy antecedents.

CHAPTER FIVE

LUVA: Presentation of Findings

Grace College

Overview

Grace College is an urban high decile co-educational secondary school with over 1450 students and over 100 staff. The students come from diverse cultures including international students and from varied socio-economic backgrounds. The school's core value of social justice promotes striving for excellence through high academic achievement and inclusive, active participation by all students. All 22 students in Ms Smith's Level One Science class consented to me being present in their class during my five-day visit. Ms Smith, a Pākehā (European New Zealander) female senior science teacher in her fourth year of teaching, was kind and approachable and introduced me to her class. She had no teacher aide to support. In a teaching week, there were four 50-minute periods of science. The class was diverse, comprising ten Pasifika, and the rest were Māori, Pākehā and one student of Asian origin. Out of the ten Pasifika students, only eight consented to participate in the whole study.

5.1 Student Data

Chapter 4.5.2.2 explained the sources and tools used to collect student Data. The first, tool was Classroom Observations, second tool was Focus Group Interview followed by Student Questionnaire. Classroom observation data was captured on the same capture sheet (Appendix Q) at the same time for both students and Teachers. The data was separated as student data and Teacher data during analysis.

Secondly, students' views about their learning was collected in two ways; one was through a semi-structured Focus Group Interview, in which they verbally shared their views relating to factors that supported their classroom learning. That data is presented in section 5.1.1.

Thirdly, their views about the antecedents of self-efficacy that may influence their overall self-efficacy. That data was determined from analysing their responses on a Student Questionnaire using Microsoft Excel. Those findings are presented in section 5.1.2.

5.1.1 Focus Group Interview

The semi-structured Focus Group Interview was conducted following five observed lessons with the eight consenting participants. Table 5.1 presents the list of student participants and the Pacific Island of origin of one or both parents.

Table 5.1 List of Student Participants from Grace College

No.	Participant	Gender	Island of Origin of parent/s
1	Maikolo	M	Fiji
2	Matai	M	Cook Islands
3	Kolo	M	Tokelau/Fiji
4	Nunu	M	Samoa
5	Keasi	F	Samoa
6	Hema	M	Tonga
7	Fatai	M	Fiji
8	Tole	M	Samoa

Key: M – Male; F - Female

They were friendly and happy to participate. During our conversation, prompts were used where necessary to focus the response. Some of the prompts were based on observed classroom behaviour of the students. Student responses to the Focus Group Interview questions were collated and summarised and codes allocated to the responses for each question. Appendix U provides a sample of the analysis codes. The emergent self-efficacy antecedents were identified and tabulated (Appendix V). The processed data for Grace College is presented below in Table 5.2

Table 5.2 Table of Student Responses, Codes allocated and Emergent Antecedents for the Focus Group Interview

Student responses to Focus Group Interview questions	Codes allocated per question	Self-efficacy antecedent identified
<p><i>What Grace College students like most about science</i></p> <p>All students agreed that they like doing experiments to find answers to their questions. They liked gathering data, were enjoying learning about metals and their uses as well as things that will help them in future.</p>	Hands-on, developing procedural knowledge; contextual knowledge for example, about metals; and future utility	Vicarious Experience
<p><i>Students' views about usefulness of science in their everyday life</i></p> <p>Students said they think science has to do with everything around us, for example, energy, the human body, finding out new things, knowing about metals and their uses.</p>	Nature of science; future utility	Vicarious Experience
<p><i>Science ideas the students said they could explain to others</i></p> <p>They understood and could explain the safe laboratory practices of not running, no eating, wearing safety goggles. They said they knew about the human body and could help someone who needed help. e.g., with food poisoning.</p>	Awareness of hazards and safe practices	Mastery
<p><i>What did the students do if they could not observe a teacher demonstration?</i></p> <p>Students were quick to answer that they could change their position to be able to see, might ask a friend who was able to observe and sometimes ask the teacher to repeat the demonstration.</p>	Usefulness of modelling; seeing it being done	Vicarious Experience
<p><i>Students' views about group work</i></p>	Preference for working with others and learning together	Vicarious Experience

All students said they preferred working in groups. This had also been observed in the class.		
<i>Students' views about friendship</i> This was a prompt question as it was observed that during the class the students liked being with and doing things with their friends. Students placed friendship as very important.	Friendships; relationships with peers and working and learning with others	Vicarious Experience
<i>Did the students need reminders from the teacher?</i> When asked if they needed reminders from the teacher to get on with the practical, there was a split response. Some said no and others said sometimes	No coded as Mastery and sometimes as Verbal Persuasion	Mastery, Verbal Persuasion
<i>Students reported enthusiasm for the lesson</i> When asked if they always felt energetic and enthusiastic in class. Some students said they did, and others said they did not.	Yes, indicated Mastery and others needed some modelling or encouragement	Mastery, Vicarious Experience
<i>What students did to catch up when they missed a class?</i> When they missed a class, the students said they asked the teacher for help or took the notes from their friends. This they said would be helpful in future tests.	Ask the teacher; friendship; manage themselves	Physiological/Emotional
<i>Did students seek feedback?</i> Those students who needed help said they asked for feedback, others who could manage themselves said, sometimes.	Yes, response indicated need for verbal encouragement and sometimes as confident they can follow instructions.	Verbal Persuasion, Mastery
<i>What motivated the students to learn science?</i> Students said they were motivated to learn to pass and get credits. Encouragement from mum or other family members.	Grades and credits and family encouragement	Physiological/Emotional, Verbal Persuasion

<p><i>What was a practical investigation they had done recently?</i></p> <p>Hema replied; “metals” and Keasi echoed ‘metals’ after him. They all recalled the research assessment they were working on. Tole recalled the energy/heat transfer practical.</p> <p>When prompted if they planned it or was the instructions given by the teacher; they replied the instructions were given by the teacher.</p>	<p>Following instructions given by the teacher</p>	<p>Vicarious Experience</p>
<p><i>Students said they carried out multiple trials</i></p> <p>When asked if they repeated the experiment all students said yes and offered several reasons for doing so including: to get proper average; to get Fair results; to get a fair test; to get the true result.</p>	<p>Awareness of fair testing.</p>	<p>Mastery of Fair testing and multiple trials</p>
<p><i>When asked if there were any changes, they would recommend</i></p> <p><i>Tole replied No, and the others agreed with him. Keasi said better to follow the instructions given by teacher</i></p>	<p>Need awareness that they can make changes to the method</p>	<p>Need for Vicarious Experience</p>
<p><i>Students’ views about how the teacher could help them better</i></p> <p>The students wanted the teacher to explain more, and in detail, provide guidance through the experiments, ‘get us started’.</p>	<p>Need for more simplified content and modelling of classroom science</p>	<p>Verbal Persuasion and Vicarious Experience</p>
<p><i>Was there anything the students did not like about science?</i></p> <p>All agreed they liked science.</p>	<p>Happy to stay with science for future learning</p>	<p>Physiological/Emotional need being met</p>

Summary

The participants in the Focus Group Interviews openly said they were happy to be in science. They viewed science as having future utility and may have an influence in their everyday lives. Apart from the Vicarious Experience outside of the classroom, some of the factors that kept them in science were; the instruction and modelling of science demonstrated by their teacher, their teacher's Verbal Persuasion and encouragement by providing them with regular feedback; Vicarious Experience from social relationships learning from each other (friendships with each other); and the fear of failing in case they disappointed their family members by not achieving the required credits. The fear of failing inclining towards the Physiological/Emotional antecedent.

Students like Tole and Kolo admitted they still needed teacher support and Verbal Persuasion throughout an activity even though their instructions for a practical was given to them. Keasi said she could get a head start with any practical and only checks with the teacher when stuck (Mastery). Some students still needed the teacher's support (Verbal Persuasion) throughout. Hema said that he did not like too much theory but enjoyed the practical work, however he had to internalise it all before he made a move to attempt anything. Asking for more practical work perhaps indicates a desire to have more Vicarious Experiences in science.

The common self-efficacy antecedents that emerged from the Focus Group Interview were Vicarious Experience or wanting to see more of the science being modelled; and Verbal Persuasion perhaps helping them to become more skillful and thereby enhancing their self-efficacy of Mastery.

5.1.2 Sources of self-efficacy

The Student Questionnaire comprised 30 statements that were adapted from Tzung-Jin Lin and Chin-Chung Tsai (2012) to suit the year level and context of Pasifika students in New Zealand (Appendix W). The participants indicated how those statements applied to them by placing a tick under the appropriate column as instructed (Table 4.4). That 'degree of agreement' corresponded to a Likert score that was aggregated and plotted against the statements for every antecedent explored. A Likert score of 5 was allocated to strongly agree, 4 to mostly agree, 3 to somewhat agree, 2 for disagree and 1 for strongly disagree. A score 0

was allocated for a No response. A Likert score higher than 3 was considered high and a Likert score lower than 3 was considered low for that antecedent. (See Table 4.4).

The statements were firstly separated into the four categories of antecedents of self-efficacy before Likert scores were aggregated.

5.1.2.1 Mastery. There were ten statements relating to the Mastery antecedent which provided an opportunity for them to rate their own Mastery based on each statement. Figure 5.1 presents an overall profile of participant responses to Mastery statements.

Figure 5.1 Grace College responses to statements on Mastery

Figure 5.1 shows that most participants scored themselves 3 and above for this antecedent. Keasi and Kolo scored mostly between 4 and 5 while Nunu scored himself between 3 and 4 in all the statements. Matai did not rate his Mastery any higher than 3 by scoring 2s in four statements. By scoring 2s, Matai probably views his Mastery as low. To obtain a clearer perspective, a frequency chart was created from a tally of responses and is presented as Figure 5.2.

Figure 5.2 Grace College- Frequency of responses on Mastery

Figure 5.2 shows the collective perspective of the participants' responses in Figure 5.1 with most participants rating themselves with scores of 3s for Mastery. The Mean, Median, Range and Mode of the responses were calculated and presented in Table 5.3 as a class summary for this antecedent.

Table 5.3 Summary of Frequency Data for Mastery

Mastery	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole	Group
Mean	3.2	2.6	4.2	3.5	4.7	3.3	3.3	3.2	3.5
Median	4	3	4	3.5	5	3	3	3	3.5
Range	5	1	2	1	1	1	2	1	1.4
Mode	4	3	5	4	5	3	3	3	3.7

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode: Score that appeared most frequently in the cluster.

According to Table 5.3 Keasi rated herself very highly with a mean average of 4.7, while Matai gave himself a low mean average of 2.6, which was under the class average of 3.5. Matai mostly scored 3s with a range of 1 indicating low Mastery or a high need for the Mastery antecedent. A Group mean and median of 3.5 means most of the group scored themselves above 3.0 which is the theoretical mean, for the Mastery antecedent.

5.1.2.2 Vicarious Experience. There were six statements in the questionnaire exploring the Vicarious Experience antecedent. All the statements were related to science practical work and practical investigation experiences in the classroom. Figure 5.3 shows the class responses to the statements.

Figure 5.3 Responses to statements on Vicarious Experience .

Figure 5.3 shows most participants scoring themselves 3 and above for Vicarious Experience. Noticeable here is Matai, who scored himself 3 and under in the Mastery antecedent and now scored mostly 5s in this antecedent. It is probable that Vicarious Experiences stimulates his self-efficacy. The two disagreements from Kolo may indicate high Mastery and he probably does not need those two aspects. The one disagreement from Keasi may also indicate she does not need Vicarious Experiences to build her self-efficacy. However, Keasi still scored high 5s in the rest of the statements for this antecedent. Fatai seemed unsure and scored himself 3 for all the statements. In terms of specific statements, most of the participants indicated they would like to do more practical work and that they are getting a lot of help from their friends.

A frequency chart was created from a tally of these responses and presented in figure 5.4.

Figure 5.4 Frequency of responses on Vicarious Experience Antecedent

Figure 5.4 shows most participants scored themselves 3 and above. As in section 5.1.2.1 class frequency calculations of Mean, Median, Range and Mode were performed and are presented in Table 5.4.

Table 5.4 Summary of frequency data for Vicarious Experience

Vicarious Experience	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole	Group
Mean	4	4.7	3.5	3.7	4	3.7	3	3.5	3.8
Median	4	5	4	4	4.5	3.5	3	3	3.9
Range	5	2	3	1	3	2	0	2	2.25
Mode	4	5	4	4	5	3	3	3	3.9

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode: Score that appeared most frequently in the cluster.

According to Table 5.4, everyone scored means of 3 and above for Vicarious Experience. Matai scored the highest mean for Vicarious Experience of 4.7 which was higher than a class average of 3.8. This may indicate that Matai could be a student whose self-efficacy is boosted through Vicarious Experience. Keasi and Maikolo also scored a high average of 4 while Fatai scored the lowest with 3. The Range of responses were from zero to five (0 – 5) indicating a wider range of responses. With a class Mean of 3.8, Vicarious Experience could be a source of self-efficacy for Matai and Keasi. As shown by their Modes, they both scored more 5s in this antecedent than everyone else. Nunu's Range was 1 with a Mode of 4 which means he would consistently give himself 4s for the aspects in the statements. Fatai's Range was zero because he responded 3s to all the Vicarious Experience statements.

5.1.2.3 Verbal Persuasion. There were seven statements relating to Verbal Persuasion. All the statements were related to teacher-student communication in the classroom. Figure 5.5 below presents student responses on this antecedent of self-efficacy.

Figure 5.5 Responses to statements on Verbal persuasion

Figure 5.5 shows most participants scored themselves 4s and 3s in this antecedent. Matai scored himself more 4s for Verbal Persuasion which could be indicating this antecedent to be a major contributor to his self-efficacy. Tole scored himself only 4s and 5s while Keasi scored herself more 5s than anyone else. For Keasi, this could be indicating that Verbal Persuasion contributes highly to her self-efficacy. Fatai continued to score himself a 3.

As with Mastery and Vicarious Experience, the frequency chart created from a tally of these responses is presented in Figure 5.6.

Figure 5.6 Grace College responses to statements on Verbal Persuasion

Figure 5.6 shows participants scored themselves more 4s for this antecedent. This indicates Verbal persuasion as a significant antecedent for self-efficacy. More specifically, there seemed to be healthy teacher-student communication either through instruction or verbal communication and encouragement to plan their investigations and by providing feedback. As in section 5.1.2.3, class frequency calculations of Mean, Median, Range and Mode were performed and presented in Table 5.5.

Table 5.5 Summary of frequency data for Verbal persuasion

Verbal Persuasion	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole	Group
Mean	4.75	3.4	3.6	4	4	4	3	4.3	3.9
Median	4	4	4	4	5	4	3	4	4
Range	5	2	3	0	3	1	0	1	1.9
Mode	5	4	4	4	5	4	3	4	4.1

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode: Score that appeared most frequently in the cluster.

Table 5.5 shows participants scored an average Mean of 3.9, and Mode of 4.1 for Verbal Persuasion. This means that even though the Mean is lower, most students scored themselves 4 and above. That is the case with Maikolo, Nunu, Keasi, Hema and Tole who all scored an average of 4 and above making Verbal Persuasion an antecedent that contributes highly to their self-efficacy. Except for Fatai, all their medians were 4 and above too. Fatai seems to be in the middle and quite unsure of how to score himself.

5.1.2.4 Physiological/Emotional. There were seven statements in the questionnaire relating to this antecedent. The statements were related to their personal interest and drive to study science. There was only one statement asking whether they have a physical impairment or not; the others were intrinsic. Figure 5.7 presents the participants' responses relating to Physiological/Emotional sources of self-efficacy.

Figure 5.7 Grace College responses to statements on Physiological/Emotional antecedent

Figure 5.7 contains mixed views with participants scoring themselves between 1 and 5 but mostly 3 and above. Keasi scored herself mostly 4s and 5s even in this antecedent. Kolo scored himself mostly 3s and Matai scored himself highly except for statement 3. Fatai probably is not sure of himself and so gave himself a 3 in all the statements. The low score statement was statement 23, meaning this class had fewer people who had physical impairments except for Maikolo who wore prescription glasses. All the ‘No responses’ were from Maikolo who did not complete his questionnaire. Therefore, the scores they gave themselves here, are from statements of intrinsic nature.

According to Figure 5.7, all participants but three (Nunu, Fatai and Tole) do not think they have a physical impairment. Even Maikolo, did not think wearing glasses affected his ability to handle laboratory equipment. Keasi and Matai responded as being always attentive in class and are motivated by achieving in their internal standards especially when they achieve a ‘Merit’ or ‘Excellence’ endorsement. However, Matai indicated, it would take him longer to catch up if he missed a class. Fatai did not think the science he learns in class is useful in his everyday life but somewhat agreed with the rest of the statements.

As with the previous sections, to obtain a clearer perspective, a frequency chart was created from a tally of these responses and presented in figure 5.8.

Figure 5.8 Grace College Responses to Statements on the Physiological/Emotional Antecedent

Figure 5.8 shows that participants rated themselves with more 3s and 4s for this antecedent. The nine disagreements probably indicate that the areas in the statements posed do not affect their perceptions with regards to this antecedent of self-efficacy. As in previous sections, the class frequency calculations of mean, median, range and mode were performed and presented in Table 5.6.

Table 5.6 Summary of Frequency Data for Physiological/Emotional antecedent

Physiological/ Emotional antecedent	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole	Group
Mean	4	2.9	2.7	3.3	3.9	3.1	2.9	2.9	3.1
Median	4	3	3	3	4	3	3	3	3.3
Range	4	3	3	2	3	3	1	3	2.6
Mode	0	4	3	4	5	4	3	3	3.7

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode: Score that appeared most frequently in the cluster.

Table 5.6 shows a class average Mean of 3.1, and Keasi still scoring more 5s than anyone else for this antecedent with a Mode of 5. Maikolo did not complete his questionnaire; however, from the statements he did do, his average was calculated to be a high 4 followed by Keasi, Nunu and Hema rating themselves as having a Physiological/Emotional influence on their self-efficacy.

5.1.2.5 Group Profile of Sources of Self-efficacy. Throughout section 5.1.2 the frequency tables have presented the average means of the Likert scores per antecedent. To establish the main sources of self-efficacy of the participants, these calculated means of the Likert values per category of antecedent were then combined and plotted to provide each participant's main sources of self-efficacy. Figure 5.9 presents a combined class profile of the antecedents as the source of self-efficacy for each participant.

Figure 5.9 Grace College Self-Efficacy Group Profile

For every participant, the highest average Likert score was considered as a primary source of self-efficacy, while the second highest peak was their secondary source. In some cases, more than one antecedent provided the same Likert average as the primary or secondary sources of self-efficacy for that participant. A low score did not necessarily imply a need; it meant that antecedent did not affect the primary source as much.

According to Figure 5.9, Keasi and Kolo's main source of self-efficacy was Mastery, while most of their classmates had Vicarious Experience and Verbal Persuasion as their sources of self-efficacy. However, even though Keasi's perception of her Mastery was higher, her averages for Vicarious Experience and Verbal Persuasion were almost equal to some of the others like Nunu, Hema, Tole and Matai. Even though Fatai's main source of self-efficacy showed to be Mastery, his average Likert score was still the lower than Keasi and Kolo who also had Mastery as their primary antecedent. Maikolo score equal Physiological/Emotional as his primary sources and Mastery as his secondary source.

The rest had Verbal Persuasion and Vicarious Experience as their primary sources of self-efficacy. Tole, Hema, Nunu, and Matai's primary source of self-efficacy was Verbal Persuasion and Vicarious Experience as the secondary source. Maikolo's greatest sources were Physiological/Emotional and Verbal Persuasion. Matai showed Verbal Persuasion as his source of self-efficacy. Table 5.7 presents a summary as Primary, Secondary, Tertiary and Least sources of self-efficacy.

Table 5.7 Participants' Sources of Self-Efficacy

Participant	Primary source	Secondary source	Tertiary source	Least
Matai	Verbal Persuasion	Vicarious Experience	Physiological/ Emotional	Mastery
Maikolo	Physiological/ Emotional and Verbal Persuasion		Mastery	Vicarious Experience
Kolo	Mastery	Verbal Persuasion	Vicarious Experience	Physiological/ Emotional
Nunu	Verbal Persuasion	Vicarious Experience	Physiological/ Emotional and Mastery	
Keasi	Mastery	Vicarious Experience	Verbal Persuasion	Physiological/ Emotional
Hema	Verbal Persuasion	Vicarious Experience	Mastery	Physiological/ Emotional
Fatai	Mastery	Verbal Persuasion, Vicarious Experience, Physiological/ Emotional		
Tole	Verbal Persuasion	Mastery/ Vicarious Experience		Physiological/ Emotional

Summary

The findings from the responses to the statements of each self-efficacy antecedent were varied. The Range was from zero to five (0-5) indicating not everyone responded in the same way most probably because everyone is different. The mean averages were Mastery = 3.5; Vicarious Experience = 3.8; Verbal Persuasion = 3.9 and Physiological/Emotional = 3.1. The original Likert scale was from 0 – 5 with a theoretical mean/median at 3 for each antecedent, however the above means show that most students placing themselves between 3 and 4.

Even though Keasi showed high Mastery, her mean scores for Vicarious Experience and Verbal Persuasion were higher than 3.5 indicating those two antecedents as major sources of self-efficacy for her. Kolo's results show a similar pattern to Keasi while others scored more highly on specific statements than overall.

Matai had Verbal Persuasion and Vicarious Experience as main sources of self-efficacy, and a high need to lift his Mastery. Maikolo's data showed Physiological/Emotional and Vicarious Experience possibly indicating his reliance on a lot of teacher support. Nunu and Hema both had Verbal Persuasion and Vicarious Experience as their sources of self-efficacy and may be indicating a need for teacher support and encouragement.

Fatai's main source as Mastery and with the other three all equal, this could mean he needs all four antecedents to lift his Mastery. Fatai was sitting in the middle marking 3s for most of the statements in the questionnaire. That means, it is not certain whether those are his true indications impacting on the validity of his results or he could be indicating a middle ground, a situation of intellectual humility portraying his own limitations despite his love of learning (Haggard, et.al, 2018).

5.2 Teacher's views about Factors Supporting Students' Learning of Science.

A semi-structured interview was conducted with Ms Smith the science teacher after I had observed five of her lessons. (See indicative questions in Appendix Y). Ms Smith, a young vibrant Pākehā teacher in her fourth year of teaching was passionate about seeing her students succeed. She was very friendly, willing to talk and offered answers to every question put to her with ease. When asked about some of the rewards and challenges she faced in a diverse classroom, she acknowledged the richness of her students' abilities and the diverse culture of her class. The responses were summarised and coded for the self-efficacy antecedent being supported. Table 5.8 provides that summary and self-efficacy antecedents from that interview with Ms. Smith.

Table 5.8 Teacher's Views about Factors Supporting Students' Learning of Science

Teacher responses to interview questions	Self-efficacy antecedent aimed at supporting
<p><i>Rewards and challenges teaching a diverse class</i></p> <p>Among the rewards were the moments when she could see the students “click”, when they felt they had achieved something and “when they worked together”. For her with the diverse personalities in the class, some of them are “quite eccentric and loud on their own and together they become very loud”. Her challenge was to maintain a balance between “having a fun environment and culture and students not getting off task”.</p>	<ul style="list-style-type: none"> • Mastery and Vicarious Experience • Verbal Persuasion • Physiological/ Emotional
<p><i>Rewards and challenges in teaching Pasifika students</i></p> <p><i>For Pasifika students in particular, she said that they were “vocal” and would let you know if they were happy with something. She found them easy going and even if she made a mistake,” they’d still turn up to class the next day”.</i></p>	<ul style="list-style-type: none"> • Verbal Persuasion and • Physiological/Emotional support offered
<p><i>When asked if she had to push them a little harder, she replied, “Not just Pasifika, all of them”</i></p> <p>For Pasifika she gave the example of Hema:</p> <p>“Not all. The quietest of them is Hema, he keeps quiet and is hard to engage but if you ask him outright, he is honest to tell you what’s on his mind. He is Pasifika, but he sits with three others who are not Pasifika and all three of them are probably the hardest to engage in the class. But if I sit down and have a chat with him about how he is doing, he is honest about struggling. He wants to pass but he doesn’t want to put in the effort for fear of failing, he needs to put in the effort and that is the constant battle with him and a few others in the class.”</p> <p>She had surveyed the class and all the Pasifika students in her class had said, they did not want to disappoint their parents and family if they don’t pass. The other concern was not to be ridiculed by their friends if they do not pass.</p>	<ul style="list-style-type: none"> • Physiological/Emotional • Verbal Persuasion

<p><i>Teacher's view about Pasifika enthusiasm about individual and group tasks</i></p> <p>Ms Smith said, book work is usually an individual task and practical work is groupwork.</p> <p>“where half of them just put their head down and they get it done and ask a lot of questions to make sure that it is perfect and then the other half almost won’t do it unless you are with them and doing it with them and so need a lot more encouragement and that goes for both Individual task and group task”. She said that they are quite enthusiastic about group work but don’t often like writing, particularly Maikolo and Fatai who tend to want to write on the white board rather than, in their books. Fatai will selectively write anything to do with numbers but will avoid writing paragraphs.</p>	<ul style="list-style-type: none"> • Vicarious Experience by allowing group work • Physiological/Emotional needs
<p><i>Teacher's view's about what Pasifika students find challenging</i></p> <p>Ms Smith identified making connections as challenging and gave the example of Keasi who will write heaps but will find connecting the concepts challenging. Others find getting started challenging. They are happy to do practical work.</p> <p>“but I guess it’s finding that balance between engaging and motivating them to push harder to get started at any level. Keasi sometimes needs to be pushed harder even though she works the hardest whereas Fatai just needs to be pushed to start. So, they are all at different levels and the challenge is in finding what best works”</p> <p>She said that often when she sat down with Fatai and spoke to him and said. “Cool so what do you need to write down?” He would write down all the bits that involved numbers but not write sentences or paragraphs, yet if she sat down and had a conversation with him, he’d tell her but would not write it down in his book but the white board. They are all quite vocal and happy to be part of the class discussion but often she did not see it get written down. The strategy she used to support Maikolo and Fatai was to let them write it on the white board, take a picture of it and send it to them so that they can have their notes with them”.</p>	<ul style="list-style-type: none"> • Mastery • Vicarious Experience • Verbal Persuasion

<p><i>Learning needs of Pasifika students</i></p> <p>Ms Smith identified literacy as one of the key learning needs of Pasifika students in her class including, writing and expanding on ideas, formulating sentences and structuring ideas. She said that Keasi, even though she writes a lot, she will sometimes repeat herself or miss out key points.</p>	<ul style="list-style-type: none"> • Mastery
<p><i>How she adapts instruction to meet the needs of Pasifika students</i></p> <p>Ms Smith said:</p> <ol style="list-style-type: none"> 1. She would include “more hands-on activities” 2. She needed to do more work on and get to know the ‘culture’ of the group. 3. The students work more effectively in a group than independently 4. She gets them to do a lot of more varied activity. She gave the example of Tole whom she said enjoyed the ‘matching activity’ when learning metals and acids. 5. When asked if she had to repeat a lot of stuff to the Pasifika students, she replied to all of them, not just the Pasifika students and she needed to work more on getting them to work more effectively together than independently. 6. She was able to assist the students that had the most need with getting started, as well as maintain the momentum with everyone else. Maikolo and Fatai were just two of the group of students she works with. When asked how she would adapt her teaching, she also voiced what the students were asking for, “more hands-on and varied activities”. 	<ul style="list-style-type: none"> • Vicarious Experience • Mastery • Verbal Persuasion • Physiological/Emotional
<p><i>Communication with whanau</i></p> <p>When asked how often she communicates with the parents or whanau, she replied,</p> <p><i>“One or two emails a term. Some reply, some don’t reply at all. They are usually when the externals are coming up as a reminder to let them know what their children are doing.”</i></p>	<ul style="list-style-type: none"> • Physiological/Emotional

<p><i>Memorable moment of some Pasifika students she has taught</i></p> <p>A couple of them have gone on to University and excelled in the courses that they are picking. Some of done well in music and Barber shop. The most outstanding memorable moment for her was when one boy came back to thank her “for pushing him last year and he made the credits he needed to get into the army.”</p>	<ul style="list-style-type: none"> • Verbal Persuasion rewarded • Physiological/Emotional support
<p><i>Career aspirations of Pasifika students</i></p> <p>When asked if Pasifika students have shared any ideas about careers in science. She replied.</p> <p>“No, not much but Keasi would like to do Chemistry and Physics. Hema would like to do a trade. The others are not quite sure at the moment”.</p>	<ul style="list-style-type: none"> • Verbal Persuasion • Physiological/Emotional

Ms Smith acknowledged the complexities and challenges of a diverse classroom but did not see them being different from each other, than a group of young learners. By encouraging them to select their own groupmates, she appeared to foster an environment for Vicarious Experiences learning from their friends. She identified literacy skills in writing and expressing their ideas as a set-back for many Pasifika students, giving the example of Keasi who she said wrote a lot but often lacked the ability to connect the ideas she was writing.

Ms Smith appeared to be very patient especially with Hema and adapted her teaching to meet the needs of Maikolo and Fatai. She saw that Hema needed a lot of Verbal Persuasion to get tasks completed. This shows Ms Smith perceived she needed to provide Verbal Persuasion and Physiological/Emotional support where needed. She worked out a strategy to deal with Fatai and Maikolo by allowing them to write on the white board. By taking pictures of their work and sending them to them revealed her empathy towards her students, however, that was not encouraging them to practise writing. Not communicating with whanau frequently and not discussing career options suggested she might have been unaware of the kind of external Vicarious Experiences they had or prior knowledge they brought with them to the classroom. She has also experienced some joy seeing her former Pasifika students excel beyond secondary school into various careers they have chosen. One such memorable moment was when a student whom she had given a lot of Verbal Persuasion came back to thank her for it because it enabled him to get into the army, something he had wanted to do for a career.

5.3 My Classroom Observations

On the first day of my visit, Ms Smith introduced me to her Year 11 Level One science class. She introduced me not only as a researcher but as a science teacher inviting me to participate in their activities and interact with the students. That fitted with being a participant observer (Fowler-Amato, 2017).

Ms Smith's classroom was a typical science classroom with sinks and taps to one side of the room and laboratory benches with power sockets around the rest of the room. It was warm with optimum lighting, well ventilated and tables were arranged in a seating plan to maximise the space of the room. The desks were set-up in a way where students were all able

to see what the teacher was doing on the board. During those five days, it was routine for Ms Smith and me to collect the laptops from the resource room and bring them to the classroom before the students got there. The room was big enough to accommodate all 22 students.

During my visit, this class had already begun the topic of metals and their uses. They had started research work in preparation for an Internal Achievement Standard to assess the properties of metals and how they are used. It aligns with the following Achievement Objectives of the *New Zealand Curriculum* (2007a). The relevant strand, achievement objectives, and levels are presented below.

Material World Level 6

Chemistry and Society

- *Identify patterns and trends in the properties of a range of groups of substances, for example, acids and bases, metals, metal compounds, and hydrocarbons.*
- *Link the properties of different groups of substances to the way they are used in society or occur in nature.*
- *Investigate how chemical knowledge is used in a technological application of chemistry.* Level 6.

This achievement standard was towards 4 credits towards the National Certificate in Educational Achievement (NCEA) Level One. The class worked on this achievement standard throughout my classroom observation period. Below is the title of that standard.

Title: Investigate the Implications of the Properties of Metals for their Use in Society.

- 1 *Implications* include the consequences of particular properties for the ways that metals are extracted from their ores, treated to prevent corrosion, or used for specific purposes.
- 2 *Properties* include:
 - Physical properties may include - melting point, colour, lustre, hardness, ductility and malleability, electrical and thermal conductivity, density.
 - Chemical properties may include - reaction with oxygen, water, and acids (HCl, H₂SO₄) (Te Kete Ipurangi, 2021b).

(Appendix B1 provides the details of that achievement standard).

With the teacher's assistance, students were required to carry out research on a type of metal they would use for the various parts of the boat and on the contents of an emergency kit of a sea going boat (*Waka Haoura*).

The activity was in two steps; the first involved reading up about the metal and making notes. The second part of the research involved practical testing of the physical and chemical properties of each of the listed metals (See Appendix B1 for the list of metals). Students were to test for: lustre, density, malleability, and electrical conductivity as well as chemical reactions including oxidation and reaction with water and acid. The data recorded, together with their readings from their internet research were kept in a folder to be used to write the standard later. I was informed that on the day of their assessment, they would use the notes collected during those preparation lessons to write the assessment.

Since they had already started working on this research activity before my visit, the students were already informed of what they were expected to do. Each morning after the greetings, Ms Smith checked with each of them where they were at and reminded them that they needed to keep moving around the different workstations she had set-up for the chemical tests and other properties of the metals. Students could repeat their chemical tests if the result they got from a test did not agree with what they had read and felt they needed to repeat the test.

On three of the days I was there, the students worked with their friends but, on the other two days, Ms Smith selected who each was going to work with in that lesson. Ms Smith would stop the class about 20 minutes into the lesson and go over some theory to help them confirm their results and record them. However, there was very little probing of students' prior knowledge of boats or what causes rust or sinking of boats to link it with what they were researching. As mentioned above, I was a participant observer, but I did record my participants' actions and other characteristics during that time using a classroom observation schedule.

The observation schedule used was adapted from Moeed (2010) and O'Loughlin (1992) to collect the data (Appendix Z). This classroom observation schedule was used to record the interaction between teacher and students during each lesson. All the observed lessons were audio-recorded which I used as back-up for checking. The observed lessons were

transcribed for analysis and used to check for accuracy of the notes. Appendix U provides a sample transcript of one observed lesson. Transcripts for all five observed lessons were read and reread to gain an overall perspective. Classroom observations were summarized as participants' observed characteristics during the lesson and teacher actions and support offered. This process was repeated for all the five lessons observed and is summarised in Table 5.9 below.

Table 5.9 Grace College Participant Profile Summarised from Classroom Observations.

Name/ gender	Observed characteristics of participants	Teacher Actions	Self-efficacy antecedent supported
Matai (M)	Matai was quiet but will raise hands to ask questions when in doubt. Matai asked his friends when in doubt or would watch friends before attempting a task.	Ms Smith did move around the room to give Matai and everyone else an opportunity to ask questions.	Verbal Persuasion
Maikolo (M)	Maikolo was slow getting started and needed to have a friend with him when attempting any task. He did not particularly like writing in a notebook or on paper, however if given the opportunity to write on a white board did it with ease. Maikolo showed signs of needing constant encouragement from both teacher and friends. Maikolo wore prescription glasses but did not mark on his questionnaire form that he had a physiological need.	Teacher allowed him and Fatai to work together writing on the white board. Ms Smith sat with them guiding and encouraging them, took pictures of their work and sent it to them as their notes.	Physiological/ Emotional, Verbal Persuasion
Kolo (M)	Kolo was quiet but astute. When attempting the online quiz which the teacher recommended, he scored 98%. I observed him as an independent thinker. He did not move to the workstations quickly, he sat and thought through the activities before moving to the workstations set up by the teacher. When he spoke with the teacher it was more for confirmation of his idea than a query.	Ms Smith would call on him to make him speak. Once she answered his queries, he would move to a workstation.	Verbal Persuasion
Nunu (M)	Nunu was extremely quiet and preferred working on his own. He allowed others to sit with him and helped them when they asked him for assistance. He did participate in group activities but would not take the lead. He stood back and watched as much as he could most of the time.	Like Kolo, Ms Smith would come checking on him to make him leave his seat.	Verbal Persuasion

Keasi (F)	Keasi appeared to be quite sharp, quick to read instructions and confidently moved on the word 'go'. Her handling of apparatus was with confidence and she did not hesitate to ask when she was stuck. She appeared to enjoy practical classes and confidently took the lead in the practical investigation.	Ms Smith would only throw a glance at Keasi but would let her get a head start and keep on working until she had completed her rounds with the rest of the students. She came to Keasi towards the end of the class. However, when Keasi put a question to her before Ms Smith came to her, she would answer Keasi.	Mastery and Verbal Persuasion, Vicarious Experience
Hema (M)	Hema was another slow starter who will take time to think and internalise the activity before getting started. During a conversation he explained that he needs to visualise the result mentally before he gets started otherwise, he ends up wasting time.	Ms Smith would have to call on him to make a move, but when she did, he did move.	Verbal Persuasion
Fatai (M)	Fatai was an extremely slow starter, hyperactive. Left the room frequently before returning to begin the task set. Hardly wrote in his book but openly expressed his idea on numerous times. Happy to write his ideas on the white board. Constantly moved around the room checking on his friends before returning to his own desk to attempt the work. Most times sat with Maikolo. Both wrote on the white board and teacher took a photograph of what they wrote and sent it to them.	Ms Smith would sit with him and Maikolo and go over the work. She would allow them to write on the white board and take pictures of their work and send to them.	Physiological/ Emotional Verbal Persuasion, Mastery
Tole (M)	Tole showed he could read and follow instructions and would get started quite quickly. He frequently asked for help when he was stuck and carried on once his doubts were cleared. Sometimes he was easily distracted by his friends and needed reminding to get back to where he was. Ready and willing to help the teacher with other tasks such as carrying transporting laptops from the storeroom to class and back.	Ms Smith did not have to call on him to make him move to a workstation, he did anyway, and she took time and care to follow through and check where they were at including Tole.	Verbal Persuasion, Mastery

Table 5.9 only provides a snapshot of Ms Smith's class of 22 during the year and the following was concluded from classroom observations. The student sample observed portrayed different strengths and needs of the four antecedents of self-efficacy however, all four antecedents were evident among the students. In my Classroom Observations I saw Ms Smith always willing to assist any student at whatever stage of the work they were at. She was very much in control of her class, despite the boisterous nature of the group under her care.

Keasi and Tole would get off the mark on the word 'go'. Ms Smith would let them get started with their group mates but stopped them at 10-minute intervals to check where everyone was. Keasi would keep going until she was really stuck or until she had finished to go check her answers with the teacher. Tole would get started immediately but constantly called on the teacher to check his work all the way through till he finished. The confidence to get started right away could indicate Mastery, and the teacher letting them get started could also indicate her confidence in their Mastery but offering support to them through the lesson indicates they need the Verbal Persuasion from her and for the others to develop Vicarious Experience by watching their friends.

For Maikolo who wore prescription glasses, there was a Physiological need (Table 5.8), the teacher provided special attention to him and Fatai, who seemed to need Verbal Persuasion and Vicarious Experiences. When the teacher was demonstrating, Fatai would pay attention (attentive to Vicarious Experience) but constantly left the room, when his friends were doing their own work. His teacher was aware that he might need extra help so would sit and assist him to get on with the work. She had found a strategy of taking pictures of his work on the board and sent it him and his friend Maikolo. It appeared both Maikolo and Fatai needed Physiological/Emotional support and were getting it.

Matai constantly followed his friends around from group to group observing what they were doing before he attempted a task, showing his need for Vicarious Experience. Nunu and Hema did not move but sat quietly thinking until the teacher came around to them indicating a need for Verbal Persuasion. Kolo, would also sit for a while before he moved but would ask the teacher to confirm his thoughts before he started. Checking with the teacher before he attempted a task could indicate a need for Verbal Persuasion. Tole got off the mark quickly as Keasi but would stop constantly to check with Ms Smith if he was on the right track indicating

a need for Verbal Persuasion, unlike Keasi who checked her work with the teacher after she had finished (indicating Mastery).

Evident in this group of Pasifika students were needs for all four sources of self-efficacy, though differently expressed by individuals.

5.4 Triangulation of the Student Data, Teacher Data and Classroom Observations

The findings from the three data sources (Student Data, Teacher Data and Classroom Observations) indicated Vicarious Experience and Verbal Persuasion as important antecedents of self-efficacy for this group of students.

Firstly, the Pasifika students' friendship appeared to be a strong source of encouragement and support; when they missed a class, they gleaned information off each other; in class through Vicarious Experiences watching each other and learning from other students like themselves. Apart from observing each other do a practical activity, they would ask each other for help when needed. For example, Tole said that friendship was very important to him and all students agreed with him, saying they can reach out to one another for help if they miss a class or seek general help during class to complete a task.

Secondly, effective communication with the teacher fostered a positive environment for Verbal Persuasion. Verbal Persuasion is promoted through teacher instruction and provision of feedback (Siegle & McCoach, 2007) and the value of friendship provides that connectedness through which students can seek clarification and encouragement when unclear about something without hesitation.

Verbal Persuasion could be indicating a need for more content/theory and actual verbal encouragement. Hema was one student who sat through half of the lesson before being 'pushed' by the teacher to get started and the teacher confirmed this during the interview. During the focus group interview Hema said he did not like learning the theory in science but would sit at his desk for some time before getting started. When I asked him why, he said he had to picture in his mind what he was going to do before getting started, otherwise he might end up doing the wrong thing. It seemed he needed to internalize the task and mentally connect to what was in front of him, confirming his need for Mastery. With the

teacher urging him to get started he clearly needed Verbal Persuasion to get started. Students' friendships helped them to learn from each other showing both Vicarious Experience and Verbal Persuasion from each other and from their teacher. It appears they needed Verbal Persuasion to get started, to continue with the task and to complete it.

Thirdly, the fear of failing and disappointing their family was a Physiological/Emotional antecedent driving their self-efficacies. During the focus group interview students said that achieving their credits was very important because they did not want to disappoint their family. This idea also came through in the student questionnaires where all the students selected 3 or above on the Likert scale to statements 27 and 29, relating to being encouraged to learn when they achieve in an internal assessment or get a 'Merit' or 'Excellence' endorsement. This appears to be an indication of a Physiological/Emotional need.

5.5 NCEA Level One Science Assessment, 2019 Data

This section presents the results of the Achievement Standards offered to the participants that they all attempted from the NCEA Directory of Standards (DAS) described in Chapter 4.5.2.6. At Level one, students are introduced to the National Certificate of Educational Achievement (NCEA) for which there are guidelines that describe what they need to know and be able to do to meet the standard and achieve and gain a 'Merit' or 'Excellence' grade (Ministry of Education, 2018; NZQA, 2021a; Te Kete Ipurangi, 2021b). The teacher offers the activities and supports the students to prepare for the assessment to meet the requirements of the standard to gain the credits offered accordingly.

Table 5.10 presents the NCEA Level One science achievements of the participants alongside two of the major sources of self-efficacy, (Verbal Persuasion and Physiological/Emotional) shown in Figure 5.9. Both the internal and external standards are labelled appropriately.

Table 5.10 NCEA Level One Science Achievements (Grace College)

Name of student	NCEA Level 1 UNIT STANDARDS ATTEMPTED					Total credits achieved	Source of Self-efficacy
	Sci1.11 AS90950 Investigate biological ideas relating to interactions between humans and micro-organisms <i>External</i>	Chem1.1 AS90930 Carry out a practical chemistry investigation, with direction <i>Internal</i>	Phy1.1 AS90935 Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction <i>Internal</i>	Sci 1.7 AS90946 Metals – Investigate the implications of the properties of metals for their use in society <i>Internal</i>	Sci 1.9 AS90948 Agricultural and Horticultural Science Demonstrate knowledge of basic plant propagation techniques <i>External</i>	20 Required	Primary and Secondary sources of self-efficacy are from Figure 5.9. The highest peak corresponding to Primary source while the second highest peak corresponding to secondary source of self-efficacy
Matai	A	A	NA	A	A	16/20	Verbal Persuasion as primary and Vicarious Experience as secondary
Maikolo	A	A	NA	A	A	16/20	Equal Likert values for Physiological/ Emotional and Verbal Persuasion as primary source with Mastery as secondary
Kolo	M	M	A	E	A	20/20	Mastery as primary and Verbal Persuasion as secondary
Nunu	NA	Standard not attempted	NA	M	A	8/16	Verbal Persuasion as primary and Vicarious Experience as secondary
Keasi	A	M	A	A	E	20/20	Mastery as primary and Vicarious Experience as secondary

Hema	A	A	A	A	A	20/20	Verbal Persuasion as primary and Vicarious Experience as secondary
Fatai	A	A	NA	A	NA	12/20	Mastery as primary. The other three antecedents had equal Likert values
Tole	A	A	M	E	A	20/20	Verbal Persuasion and Mastery and Vicarious Experience had equal Likert values for secondary source

Assessment Grade Guide: There are four possible grades for NCEA **Achievement Standards**

- Achieved (A) for a satisfactory performance
- Merit (M) for very good performance
- Excellence (E) for outstanding performance

According to Table 5.10, four students achieved all the 20 credits attempted with Verbal Persuasion or Mastery as the primary or secondary source of self-efficacy. For Kolo, it was Mastery and Verbal Persuasion, Hema Verbal Persuasion and Vicarious Experience; and Tole (Verbal Persuasion and equal Mastery and Vicarious Experience) equally. Keasi had Mastery as her primary source and Vicarious Experience as her secondary source. Even though Fatai's primary source of self-efficacy, was Mastery, his other self-efficacy needs were equal. Fatai only achieved 12 of the 20 credits attempted. The students who had at least one 'Not Achieved' were students with high Verbal Persuasion as a Primary or secondary source of self-efficacy (Figure 5.9).

5.6 Commentary on Self-efficacy and Achievement

For all the students who achieved all 20 credits for science, Vicarious Experience and Verbal Persuasion appeared to support Mastery as an important source of self-efficacy for succeeding in science for Grace college. The Comparison of self-efficacy antecedents with NCEA Level One science achievement results showed, out of the four students who achieved all 20 of their science credits, 'Mastery' stood out as the primary source of self-efficacy for Kolo and Keasi, while Verbal Persuasion stood out for Tole and Hema. Hema the thinker who would sit until the teacher urged him to get moving achieved all his 20 credits through some strong Verbal Persuasion by the teacher.

The students who did not get all 20 science credits identified Verbal Persuasion as a primary or secondary source of self-efficacy. Nunu who was one of the quiet ones in class did not achieve all his 20 credits for science but did score a 'Merit' on the internal standard that I observed perhaps through a lot of Verbal Persuasion as well. However, Fatai, appeared as though he was operating on Mastery of what he could glean and knew. He probably did not know how to get help or harness the Vicarious Experience off his friends.

As a class even though not all of them achieved all 20 credits for science, their group average in three of the standards (two Internal and one External) was better than the collective Pasifika average at Grace College. Table 5.11 was created to understand the overall achievement of the participants. Both 'Merit' and 'Excellence' endorsements have been combined as 'Achieved' for an overall perspective.

Table 5.11 Comparison of NCEA Achievement Standards (Grace College)

Standards	Participants who Achieved (%)	Total Year 11 Pasifika who Achieved (%)	Total Year 11s who Achieved (%)	National Average (%)
<i>Sci1.11 AS90950</i> Investigate biological ideas relating to interactions between humans and micro-organisms	87.5	63	67	79.7
<i>Chem1.1 AS90930</i> Carry out a practical chemistry investigation, with direction	100	89	87	90.1
<i>Phy1.1 AS90935</i> Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction	50	68	81	94.7
<i>Sci 1.7 AS90946</i> Metals – Investigate the implications of the properties of metals for their use in society	100	100	90.7	84.8
<i>Sci 1.9 AS90948</i> Agricultural and Horticultural Science Demonstrate knowledge of basic plant propagation techniques	87.5	NA	NA	75.5

Comparing the percentage achievement of Ms Smiths class with the rest of Pasifika at Grace College and the National Average, this class did exceptionally well in all their elected standards except for Physics 1.1. This may reflect Ms Smith's teaching and physics may not be her strength. Apart from group results and National averages, the Pasifika and school averages were not available for Sci 1.9; however, the group average of 87.5 percent was still higher than the National average of 75.5%. The selection of standards shows that two are related to chemistry, two biology and one for physics. Only half of the students gained achieved or better grade in the Physics standard.

A related implication of the selection of these standards is that only the assessed topics are taught to support students to Achieve the credits. For example, in chemistry they are only doing metals and their compounds and learning to do a fair test. This means, they are not going through basic chemistry, redox or organic chemistry. Similarly, in biology, and physics as they are not doing the external standards for genetics and electricity. This means their learning of the curriculum is limited.

5.7 Chapter Summary

The participants voiced their desire for more Vicarious Experiences through more practical activities and modelling in science in both the focus group interview and through the questionnaire. They valued friendships and the ability to connect with their teacher through effective communication which helped build their Vicarious Experience. There was ample Verbal Persuasion from the teacher to help build their self-efficacy. Participants rated Verbal Persuasion higher than their Vicarious Experience and Mastery. Keasi and Kolo rated their Mastery higher than the rest of the class. Even though Fatai rated his Mastery higher than the other three antecedents, it was just over the average Likert score of 3.0. Keasi and Kolo's rated Mastery as 4.7 and 4.2, respectively. Keasi not only scored herself highly in Mastery, she appears to be an all-rounder with high Mastery as her primary source of self-efficacy.

Their teacher confirmed that they are not shy and will honestly ask for clarification and seek help. Even though there is not much communication between home and school the teacher was prepared to adjust and refine her teaching strategies to respond to the diverse abilities of the students. Classroom observation confirmed the teacher went to each group

and helped with the practical investigation. She coached Keasi from a distance and reminded Hema he needed to move with the rest of the class. She made time for Maikolo and Fatai offering both Verbal persuasion and Physiological/Emotional support by allowing them to write on the white board. She used a strategy that helped them to have study notes helping them prepare for the assessment. As a result, everyone (100%) in Ms. Smith's class achieved that standard (Sci 1.7 AS90946) including two 'Excellence' endorsements and one 'Merit' endorsement. All Pasifika students (100%) at that school also 'achieved' on that internal standard, better than Grace College average of 90.7% and National average of 84.8%.

Keasi and Kolo who rated themselves highly on Mastery and Verbal Persuasion achieved all 20 credits. So did Tole and Hema who rated their Verbal Persuasion highly. However, Fatai achieved 12 credits even though he rated his Mastery slightly higher than the other three antecedents. Fatai's overall Likert score of his Mastery was just above 3 which was still lower than Keasi and Kolo's. Fatai probably sees himself as average. Matai's primary and secondary sources of self-efficacy were Verbal Persuasion and Vicarious Experience, he had rated his Mastery a low 2.5, but he still achieved probably because his need for Vicarious Experience and Verbal persuasion were met. Maikolo did not achieve all 20 credits but only 16 out of 20 credits. Maikolo rated himself very high 5s for Verbal Persuasion and Physiological/Emotional antecedents and, had that support but fell short by achieving 16 out of 20 credits.

From the above evidence, the antecedents of self-efficacy do influence how the students perceive themselves considering the work presented and their efforts towards completing the set tasks for the credits. However, among those who rated their Mastery and Verbal Persuasion highly were those who verbally voiced their need for Vicarious Experience. Classroom Observations revealed that the teacher recognized the need for Physiological/Emotional support and offered it. NCEA results revealed this group of Pasifika students achieved better than their peers in the same school and the National average except for Physics 1.1.

CHAPTER SIX

LUVA: Presentation of Findings

Mercy College

Overview

Mercy College is an urban middle decile co-educational school for Years 9-13 with a school population of more than 1000 students. The students come from diverse cultural and socio-economic backgrounds, about 18% are Pasifika students. Mercy College has over 100 staff. The school has a mission to provide an environment to enable holistic development of its students as life-long learners and to prepare them to thrive in diverse local and international communities. In a teaching week cycle, there were four science lessons.

At Mercy College, two teachers and all their students consented to have me present in their class to make observations. There were 24 students in Mr. Williams' class however, only five of the seven Pasifika students consented to participate in this research. Mr Williams is a New Zealand-trained teacher with a Bachelor of Science degree who had been teaching science for more than 27 years, 17 of which have been at Mercy College. Mr. Williams was teaching four science classes in Years 9-13 and 17 Pasifika students in total. In this class, all the science assessments were internally assessed.

In Mr. Garcia's class, all 32 students consented to be observed, however only two of the three Pasifika students consented to participate in the whole study. Mr. Garcia is also a New Zealand-trained teacher also with a Bachelor of Science degree who had been teaching for seven years, three of those at Mercy College. He taught years 10, 11 and 12 and 10 Pasifika students in total. In Mr. Garcia's class students were assessed by both internal and external assessments. In a teaching week, there were four one-hour periods of science. One lesson each week was shared where Mr Garcia taught Mr Williams' class due to a timetable arrangement. The content of this chapter is in the same order as the previous school - Grace College.

6.1 Student Data

Student Data from Mercy College were collected and analysed in the same format as Grace College. However, consenting participants were from two classes; one was streamed

and did internal science standards only and the other class did both internal and external standards. Students' perceptions relating to the sources of their self-efficacy were collected in two ways; firstly, from a Focus Group Interview and secondly a Student Questionnaire.

Table 6.1 presents the participants and the Pacific Island or origin of one or both of their parents.

Table 6.1 List of Student participants from Mercy College

No.	Participant	Gender	Island of Origin of parent/s
1	Manu	M	Tokelau
2	Tita	M	Samoa
3	Ofa	M	Cook Islands
4	Ana	M	Samoa
5	Seini	F	Samoa
6	Savea	M	Samoa

6.1.1 Focus Group Interview

A semi-structured student focus group interview was conducted following five observed lessons in both classes. Due to low participant numbers from both classes and convenience of time, students from both classes were interviewed in one focus group allowing them to be with friends and not shy when answering questions. Only Manu from Mr. Garcia's class participated in the focus group interview and completed the student questionnaire with five participants from Mr. Williams' class. The six students were shy but happy to participate and talk. Like Grace College, some of the prompts were sourced from classroom observations that will be described in section 6.3. A common interview schedule was used for all three schools (Appendix T). Participant responses to the interview questions were collated and summarised (Appendix U). Codes were allocated to each response to the questions and the emergent self-efficacy antecedents identified as for Grace College (Appendix V). Table 6.2 presents that summarised and coded data.

Table 6.2 Table of Student Responses, Codes Allocated and Emergent Antecedents for the Focus Group Interview

Student responses to Focus Group Interview questions	Codes allocated per student response	Self-efficacy antecedent identified
<p><i>What Mercy College students like most about science</i></p> <p>Two of the five students interviewed said it is fun while one said, learning new things and one said it is easy to learn</p>	<ul style="list-style-type: none"> • Developing procedural knowledge 	<p>“Fun and learning new things” taken as Vicarious Experience and “easy to learn” taken as Mastery</p>
<p><i>Students’ views about usefulness of science in their everyday life</i></p> <p>The girls said ‘No’, they did not view science useful in everyday life. The boys’ response was the opposite, saying they found science useful sometimes but not all the time. When prompted by asking how they boiled their water to make a cup of tea (whether they used an electric kettle or gas stove); or telling the time to get to school early, Seini replied after a sigh, “Aah! yes, science is useful”.</p> <p>Manu added giving the example of the gas stove as energy transfer converting from chemical energy to heat energy.</p>	<ul style="list-style-type: none"> • Need for Vicarious Experience • Conceptual knowledge (Manu’s explanation of energy transfer) 	<p>‘No’ indicating need for Vicarious Experience</p> <p>Manu’s explanation of energy transfer indicating Mastery</p>
<p><i>What science ideas the students said they could explain to others</i></p> <p>Manu said he could explain heat conduction while the girls all said No, they could not explain anything. Savea said he could explain a practical activity that they did, to his friends and even suggested how they could adapt that practical.</p>	<ul style="list-style-type: none"> • Knowledge of science concepts and practical investigations 	<p>Mastery for Manu and Savea while the girls may need Mastery</p>
<p><i>What did the students do if they could not observe a teacher demonstration?</i></p> <p>Students were quick to answer, that they would change their position or move closer to be able to see. Manu said he would ask his teacher to repeat the demonstration. Tita said, she</p>	<ul style="list-style-type: none"> • Usefulness of modelling; seeing it being done 	<p>Vicarious Experience</p>

might ask a friend who was able to observe and sometimes ask the teacher to repeat the demonstration.		
<p><i>Students' views about group work</i></p> <p>Most of the students said they preferred working in groups, while Savea preferred to work on his own.</p>	<ul style="list-style-type: none"> • Preference for working with others. 	Vicarious Experience for most
<p><i>Students' views about friendship</i></p> <p>It was a mixture of reactions; the girls preferred working with friends unlike the boys. Out of the two boys interviewed, Savea preferred working on his own and Manu preferred to sit away from friends in his class.</p>	<ul style="list-style-type: none"> • Making connections through friendships and relationships with peers 	Girls leaning more towards Vicarious Experience
<p><i>Did the students need reminders from the teacher?</i></p> <p>There was a unanimous No. When prompted why, Seini said because she wanted to pass. Manu said he finds it useful when he gets started right away so he does not fall behind.</p>	<ul style="list-style-type: none"> • 'No' coded as Mastery. • Responses to 'Why' coded as Physiological/Emotional 	Mastery and Physiological/Emotional
<p><i>Students' reported enthusiasm for the lesson</i></p> <p>When asked if they always felt energetic and enthusiastic in class, there was a mixture of Yes, No and sometimes. When prompted why, they said they must do it so they can pass and get the credits. When prompted what would make them more enthusiastic, one said she goes on her phone, one said it depends on the work set; if she enjoys the work, she'd be more energetic and one said, if he got the encouragement, he would be more energetic.</p>	<ul style="list-style-type: none"> • Yes, indicated Mastery and others need more Vicarious Experience, Verbal Persuasion and Physiological/Emotional support 	Mastery, Vicarious Experience, Verbal Persuasion and Physiological/Emotional
<p><i>What students did to catch up when they missed a class</i></p> <p>They responded they would ask their friends for help, if not they would ask the teacher. When asked why it was important to catch up, they responded so they are not far behind on notes.</p>	<ul style="list-style-type: none"> • Ask the teacher; manage themselves 	Verbal Persuasion

<p><i>Do students seek feedback?</i></p> <p>When asked they all answered yes and mentioned the latest was 'today'. Manu had feedback from his teacher about the mock exams. Seini said, the feedback which happened a couple of days ago enabled her to improve on her assessment activity.</p>	<ul style="list-style-type: none"> • Yes, response indicated need for Verbal persuasion and Mastery 	<p>Verbal Persuasion, Mastery</p>
<p><i>What motivated the students to learn science?</i></p> <p>Students said they were motivated to learn to pass and get credits. Also, encouragement from parents and family members.</p>	<ul style="list-style-type: none"> • Grades and credits and family encouragement. • Fear of failing 	<p>Vicarious Experience, Verbal Persuasion, Physiological/Emotional</p>
<p><i>What was a practical investigation they had done recently?</i></p> <p>Students from Mr. Williams' class remembered the index-finger experiment while Manu remembered doing the helicopter experiment. When asked how they carried out their plan, they said the teacher gave it to them. When asked what they found out, Mr. William's class responded that, the longer the index finger, the faster the person could run.</p>	<ul style="list-style-type: none"> • Instructions were given by the teacher. 	<p>Vicarious Experience, Mastery</p>
<p><i>When asked if they carried out multiple trials and why</i></p> <p>They all said yes and when asked why, they answered: "To get a fair test".</p>	<ul style="list-style-type: none"> • Awareness of fair testing 	<p>Mastery</p>
<p><i>When asked if there were any changes they would recommend,</i></p> <p>Savea answered he would change the shoes they ran in as school shoes are not good for running in and would recommend that change. The others agreed with Savea.</p>	<ul style="list-style-type: none"> • Awareness that incorrect equipment can alter the result of a test 	<p>Mastery from Savea</p>
<p><i>Students' views about how the teacher could help them better</i></p> <p>The students said they would like their teacher to explain more and give them more practical work and practise.</p>	<ul style="list-style-type: none"> • Need more science to be modelled 	<p>Need for Vicarious Experience</p>

<p><i>Was there anything the students did not like about science</i></p> <p>Seini said she did not like the theory bit but liked the practical work. All the others said they liked science.</p> <p>Tita: "I like science, I don't have anything that I don't like about science".</p>	<ul style="list-style-type: none"> • Happy to stay with science for future learning 	<p>Seini needed Vicarious Experience more than others</p>
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Summary

All six participants were shy at first but became more animated as the interview progressed. At first the girls did not see how science was useful in their everyday lives, but once prompted, they recalled and cited examples of how science was useful in their lives. This may indicate minimal awareness and familiarization with the utility of science. Perhaps connecting the Vicarious Experiences encountered outside of the classroom and drawing their attention to the connectedness of these experiences with science would have been helpful.

Friendships were valued by all students, especially the girls. They said they liked working with each other and were happy to ask their friends for help if they missed a class. Working with each other and learning from each other is indicative of reliance on Vicarious Experience. The boys preferred to work on their own which could indicate Mastery, or maybe they are too shy to ask for help from friends.

The need for Verbal Persuasion and Vicarious Experience was evident. Most students wanted to do more practical work and those who wanted to get started right away with assigned tasks may have indicated Mastery. Some needed encouragement to get started; they most likely needed Verbal Persuasion. Even though the method to carry out their practical was given to them, they said they still needed the teacher to explain in some detail. Credits and grades were motivational as was encouragement and Verbal Persuasion from family.

6.1.2 Sources of Self-Efficacy

The participants' sources of self-efficacy were derived from their responses in the Student Questionnaire. The 30 statements in the questionnaire were adapted from Tzung-Jin Lin and Chin-Chung Tsai (2012) to suit the year level and context of Pasifika students in New Zealand (Appendix W). The questionnaire was designed for each tick to reflect a participant's degree of agreement to a statement as it applied to themselves. That 'degree of agreement' corresponded to a Likert score that was aggregated and plotted against the statements for every antecedent explored. A Likert score higher than 3 was considered high and lower than 3 was considered low for that antecedent. A low score on one of the antecedents does not

indicate a need, rather, the participant's primary source of self-efficacy might be different to how the participant rated themselves with that antecedent.

The statements were firstly separated into the four categories of antecedents of self-efficacy (Mastery, Vicarious Experience, Verbal Persuasion and Physiological/Emotional) before being graphed (Appendix X). A low score may not necessarily mean being needy of that antecedent, it could mean this student's primary and secondary sources of self-efficacy may be other antecedents.

6.1.2.1 Mastery. The 10 Mastery statements for Mercy College were treated in the same way as Grace College. Figure 6.1 presents a cluster of participant responses to the ten statements offered for Mastery.

Figure 6.1 Responses to statements on the Mastery

Figure 6.1 shows that most students rated themselves 4 and below on all Mastery questions. However, to further understand the degree of agreement to these statements by the participants, the frequencies of the Likert scores were plotted as shown in Figure 6.2 below.

Figure 6.2 Frequency of Responses to Mastery statements

Figure 6.2 shows that most participants rated themselves 3s and 4s. As seen in Figure 6.1 there were only a few 5s and the disagreements were from Tita and Seini. To understand individual mean Likert scores and the frequencies of each score selected, Table 6.3 was created to provide a summary of the frequency data displaying the mean, median, range, and the mode.

Table 6.3 Summary of the Frequency Data for Mastery

Mastery	Manu	Tita	Ana	Seini	Ofa	Savea	Class
Mean	3.7	2.5	3.1	3.5	3.6	3.9	3.4
Median	4	2	3	3.5	4	4	3.4
Range	1	4	1	3	1	2	2
Mode	4	2	3	4	4	4	3.5

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score;

Mode = Most selected score

Further to Figure 6.2, showing most participants scoring themselves 3s and 4s; Table 6.3 shows that Manu, Seini, Ofa and Savea all selected a mean Likert score higher than the group average of 3.4. That is supported by the mode of most participants being 4s, which means, they scored themselves more 4s while Tita and Ana scored more 2s and 3s, respectively. The mean scores would be used to determine each participant's source of self-efficacy later in section 6.1.2.5.

6.1.2.2 Vicarious Experience. The six statements in the Student Questionnaire relating to Vicarious Experience were analysed the same manner as Mastery. Figure 6.3 presents the responses of the participants under this category.

Figure 6.3 Responses to statements on the Vicarious Experience antecedent

According to Figure 6.3, most participants scored themselves between 3 and 4 for the statements. Manu made two disagreements and Tita one 'strongly disagree'. Ofa rated herself with all 4s for Vicarious Experience. As with Mastery (section 6.1.2.1), the frequencies of the Likert scores of the group were then plotted to determine which score was selected the most by the group for Vicarious Experience as shown in Figure 6.4 and below.

Figure 6.4 Frequency of Responses to Vicarious Experience statements

Figure 6.4 shows most participants scored themselves more 4s followed by 3s for this antecedent. There was one strong disagreement as seen in Figure 6.3, from Tita who indicated she did not like to do more practical work.

As with the Mastery antecedent (section 6.1.2.1), Table 6.4 was created to display a summary of each participant's mean frequency data.

Table 6.4 Summary of Frequency Data for Vicarious Experience

Vicarious experience	Manu	Tita	Ana	Seini	Ofa	Savea	Class
Mean	2.83	3.5	3.33	3.5	4	3.67	3.47
Median	3	4	3	3.5	4	4	3.58
Range	2	3	1	3	0	1	1.67
Mode	3	4	3	3	4	4	3.5

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score;

Mode = Most selected score

Table 6.4 shows that four participants scored means greater than the group mean of 3.47. In terms of how many participants scored more 4s than 3s, it was equal. Consistent responses were found in Ofa, Ana and Savea with Ranges of 0 and 1, respectively.

6.1.2.3 Verbal Persuasion. There were seven statements in the Student Questionnaire relating to Verbal Persuasion. The frequency of responses as degree of agreement is presented in Figure 6.5.

Figure 6.5 Responses to statements on Verbal Persuasion

Figure 6.5 shows most participants scored themselves 4 or 3 regarding verbal communication with their teacher. However, there were several 5s and two disagreements from Seini. A low score for Verbal Persuasion may indicate either high Mastery or high Vicarious Experience, learning from their friends. However, Verbal Persuasion seems to be an important antecedent for Seini, Ofa and Savea. To obtain a clearer perspective of how the participants scored themselves as a class, Figure 6.6 was constructed and is presented below.

Figure 6.6 Frequency of responses to Verbal Persuasion statements

According to Figure 6.6, Verbal Persuasion seems to be a major antecedent for these participants. Even though some were scoring themselves a borderline 3, there were many more 4s than 3s. These frequencies were summarised and tabulated in Table 6.5.

Table 6.5 Summary of Frequencies for Verbal Persuasion

Verbal persuasion	Manu	Tita	Ana	Seini	Ofa	Savea	Class
Mean	2.71	3.86	3.29	3.86	4.14	4	3.64
Median	3	4	3	4	4	4	3.67
Range	4	2	1	3	1	2	2.17
Mode	3	4	3	5	4	4	3.83

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode = Most selected score

Table 6.5 shows that while Ana's mean was a high 4.14, Manu's mean was a low 2.71 resulting in a group mean of 3.64 for Verbal Persuasion. The rest of the group showed consistent modes of 4 and while Seini's mode was 5 indicating Verbal Persuasion as an important antecedent. Ofa's high mean of 4.14 with a range of 1 shows Verbal Persuasion to be an important antecedent for her. Manu's low mean probably indicates high Mastery, and he may not need Verbal Persuasion to study or stay in science.

6.1.2.4 Physiological/*Emotional*. There were seven statements relating to the Physiological/*Emotional* antecedent in the Student Questionnaire. Figure 6.7 presents the participants' Likert scores per statement for this antecedent.

Figure 6.7 Responses to statements on Physiological/Emotional antecedent

According to Figure 6.7, most participants scored themselves 4s and 3s. The strongest agreement in this category came from statement 29 where five out of six students scored a Likert value above 3 indicating when they get a 'Merit' or 'Excellence' endorsement it gives them confidence and motivates them to persist with science.

One day Savea came to class with glasses on. By scoring a 4 for statement 23, he could be indicating he has a physical impairment he is not willing to disclose. All the other students did not have any physical impairment except for Ofa who on the day of the focus group interview had a bandaged leg from a sporting injury. With so many indicating 3s, they could be sitting on the fence or perhaps the issue was more about an Emotional antecedent than a Physiological one.

Seini said in the Focus Group Interview that she does not see science useful in her everyday life strongly disagreeing with statements 2, 3 and 23. By strongly agreeing with statement 29, she could be indicating all she wants is an 'Achieved' grade in the Internal assessment but is highly encouraged with a 'Merit' or 'Excellence' endorsement. That was confirmed during the interview when she said what keeps her in science may was the credits to pass Level One and perhaps gain a higher grade.

Savea's high Likert scores in these statements indicate this antecedent could be a major source of self-efficacy for him. Even though Manu did not strongly agree or disagree to any statement in this category, he scored high Likert values in four out of the seven statements. This probably means that this antecedent could be a source of self-efficacy for Manu. During the Focus Group Interview all students said they wanted to pass Level 1, so they could be emotionally driven to not disappoint their parents.

Figure 6.8 Frequency of responses to Physiological/Emotional statements

Figure 6.8 confirmed that most participants scored themselves slightly more 3s than 4s for the statements pertaining to Physiological/Emotional antecedent. For the students who scored 4s, it seemed this antecedent was important for their self-efficacy. For the ones that scored 3s, it could still be a helpful antecedent however, a score of 3 could also indicate a tentative choice. The frequency data from Figure 6.8 were summarized and presented as Table 6.6 below.

Table 6.6 Summary of Frequencies for Physiological/Emotional antecedent

Physiological/Emotional antecedent	Manu	Tita	Ana	Seini	Ofa	Savea	Group
Mean	3.43	3.43	3.29	2.43	3.57	4.14	3.38
Median	4	3	3	2	3	4	3.17
Range	2	1	1	4	2	2	2
Mode	4	3	3	1	3	4	3

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode = Most selected score

Table 6.6 shows most participants scored means greater than the group mean except for Ana and Seini who scored individual means below the group mean. Most participants in the group scored a 3 for these statements. Savea mostly scored 4s (Mode =4) for the

Physiological/Emotional antecedent and his two 5s gave him a mean of 4.14. Manu also scored mostly 4s (Mode =4). By scoring highly for this antecedent, it shows that this antecedent is important as a source of self-efficacy. The participants that scored mostly 3s are borderline for this antecedent. With Seini scoring mostly 1s may mean this antecedent does not influence her self-efficacy.

6.1.2.5 Group Profile of Sources of self-efficacy. The mean Likert scores per antecedent for each participant were used to plot and determine the antecedents acting as the primary and secondary sources of self-efficacy. Figure 6.9 below shows that chart.

Figure 6.9 Overall sources of self-efficacy for Mercy College

Figure 6.9 shows each participant's sources of self-efficacy ranked accordingly. The tallest peak of the histogram is indicative of the participant's primary source of self-efficacy while the second tallest as the secondary source of self-efficacy. Apart from Ofa and Savea, Mercy College participants did not rate themselves above 4 for any of the statements in each of the categories of antecedents. This could mean they were either unsure or were generally conservative in their choice on the Likert scale. Some antecedents were equal in various places. Figure 6.9 is summarised in Table 6.7.

Table 6.7 Participants' Sources of self-efficacy

Participant	Primary source	Secondary source	Tertiary source	Least
Manu	Mastery	Physiological/ Emotional	Vicarious Experience	Verbal Persuasion
Tita	Verbal Persuasion	Vicarious Experience	Physiological/ Emotional	Mastery
Ana	Vicarious Experience, Verbal Persuasion, Physiological/ Emotional			Mastery
Seini	Verbal Persuasion	Mastery & Vicarious Experience		Physiological/ Emotional
Ofa	Verbal Persuasion	Vicarious Experience	Mastery & Physiological/ Emotional	
Savea	Physiological/ Emotional	Verbal Persuasion	Mastery	Vicarious Experience

Verbal Persuasion proved to be the Primary source of self-efficacy for four of the six participants. There was only one Mastery (Manu) and one Physiological/Emotional antecedent (Savea) as primary source of self-efficacy. As for the secondary sources of self-efficacy, it was a mixture of Vicarious Experience and Physiological/Emotional antecedents.

6.2 Teacher's view about factors supporting students' learning in science

At Grace College a semi-structured teacher interview was conducted with the teacher Ms Smith. In Mercy College both consenting teachers were interviewed using the same semi-structured interview questions. The first interview was with Mr. Williams and the second with Mr. Garcia. Although a table was used in Chapter five to present the interview data for Grace College, I have used text for Mercy College as the volume of data is greater than for Grace College. Section 6.2.1 presents the interview data with Mr. Williams and will be followed with Mr. Garcia's interview in section 6.2.2.

6.2.1 Teacher Interview #1 with Mr Williams.

Mr Williams is a Pākehā teacher with more than 30 years of teaching experience working with many underachieving Māori and Pasifika students. Mr Williams said he had worked with Māori and Pasifika students for several years. This experience was reflected in his confidence about the teaching strategies he used to support his students to gain the requisite credits to pass NCEA Level One. In the interview Mr. Williams named a few Pasifika students in his class who consented to be observed but did not participate in the focus group interview and student questionnaire. He referred to two of these students as Toutai and Motu (pseudonyms). The summary of my interview with Mr. Williams is as follows.

6.2.1.1 Rewards and challenges of teaching science in a diverse classroom. Among the rewards he enjoyed most was seeing students learn about the real world around them. He liked making memories for them in the classroom, doing practical work they will remember for a long time. He said he used it to dispel myths and clarify misconceptions. He said, there were not many challenges but occasionally a few students would be disengaged but he was able to manage this. He admitted that it was frustrating, but the real challenge would be if most students were disengaged and not interested in learning.

6.2.1.2 Rewards and challenges in teaching Pasifika students in particular. Mr. Williams did not see Pasifika students as any different to other students in his class. He was aware of the cultural difference, but he respected that and tried to use that to develop relationships with the students. He did not see Pasifika as any better or any worse but said many lacked in confidence. So, he felt his job was to build up their confidence to believe that

they can achieve. He saw students' lack of confidence as his biggest challenge. He said, the lack of confidence existed at different levels:

...for example, Ana needs this confidence to achieve at a higher level. Seini and Ofa, have a little bit more confidence and have achieved two excellences. I've been pleased that they have challenged themselves and with a little bit of confidence and little bit of help from me they have pushed themselves to that higher level...I could have stopped at merit but like I could see the potential in them to extend themselves.

Researcher: Is it just getting started or persisting? (Prompt)
Mr. Williams: Both, they want to achieve but not quite sure of their abilities.
Researcher: Where does the support come from?
Mr. Williams: I think it is more within themselves and as adults our job is to try and encourage them by reminding them that they can do better than what they think they can.
Researcher: Do they support each other?
Mr. Williams: Yes, for example, Seini who struggles a bit gets support from the other girls like Ofa and Ana. However, the two boys were different; Savea is more capable than Toutai who also lacks confidence.
Researcher: Does Savea help Toutai?
Mr. Williams: No, they don't share their ideas and classroom work at all as the girls do.

Mr. Williams believed that the biggest challenge was the students not having confidence in their own ability. He said that the girls supported each other which built up their confidence, however the boys did not.

6.2.1.3 Pasifika students' enthusiasm when attempting an individual task.

According to Mr. Williams, Ana was the only real exception; however, the rest were motivated by assessment. If it was for credits, they would work towards those credits and they are generally enthusiastic and motivated by that. He said, "Ana doesn't seem to be as enthusiastic about it at all, sometimes she's quite moody when she comes in and carries a big bag and it is quite hard for her to concentrate in class". Mr. Williams believed that this was not solely a Pasifika problem because he said, "it is most of the Pākehā too, I've got Motu, he's the male version of Ana he's quite disengaged and he doesn't care whether he gets the credits or not". He added, some students were disengaged, but generally most were on track.

6.2.1.4 Teacher's views about Pasifika students' enthusiasm during practical class. Mr Williams said that Pasifika students are just like all his other students; sometimes they are enthusiastic, sometimes they are not, but are always willing to have a go. He said that sometimes the girls hold back a little but with teacher encouragement they try. Boys, he said have a bit more confidence to try new things.

When asked if numeracy competence was an issue Mr. Williams said, "In the last assessment that we did where we calculated ratios, they were all very good and we got through really quickly, so there is no real issue with numeracy". In his view, the students did quite well with mathematics related calculations like speed and distance/time calculations and mastered them. He thoughtfully added, "The biggest stumbling block is literacy".

He explained that for the Internal assessment of practical work students are required to write a plan or a method. They seemed to struggle with writing up the method. He explained that although the students have learnt about parallax or zero error, they still struggled to find the words to describe or explain what they have done or what they needed to do.

When prompted, that I had noticed Ana waiting patiently for your assistance, he replied

Oh, her writing was spectacular, after I went through the concepts with her, she was able to conceptualise it and reproduced it very well.

6.2.1.5 What are some learning needs of Pasifika students? Mr. Williams said that the major learning need is literacy. "Numeracy is okay, confidence in doing the practical work, and having correct equipment". It is not just Pasifika but a third of the class would fall under that category. He said that homework is not such a big deal and explained that he emails things to the students who are "pushing towards Merit and Excellence, so that they can read through and practise at home". He explained that Ana and Seini did that, a reason why these girls were able to write their discussions in that assessment. "They had taken the time to do that homework. I'm pretty sure the boys hadn't bothered so the doing of homework is a bit of barrier as well".

When asked which three areas he would recommend if he was to adapt instruction to meet the needs of his Pasifika students. He replied:

I have been teaching for the last 30 years. I am not going to 'throw out the baby with the bathwater'. Uhm but I am more aware of developing good relationships of giving the students the utmost care and encouraging them to do it off their back rather than forcing them to do stuff so I'm trying to teach some skills for life... I am trying to give them a thirst for knowledge and for an interest in science and trying to get them to frame the concepts within the world around them you know... I'd probably not change things too much next year, but I'm always open to new ideas and so on.

He said, every group of students have their own challenges, and he feels he has developed a system over the years with these sorts of students... students that need support to develop skills that enable them to be able to flourish in an exam type class. This is an internal assessment-based class. The criterion for being in this class was that they do not have the confidence to sit exams. He believed that these students do not have the skills or maybe they have not got the support to be able to do what is needed to cope with learning a whole lot of words and then being assessed on it at the end of the year. He explained that he had worked out a way within the NCEA/NZQA system to support these students. The strategy he used was chunking the work and scaffolding so that everyone had access to the information so that they can achieve. He added

.... with this class the students are very nice; they comply with what I have to say. I don't have to stress or 'bash heads together' or anything like that.

If he were to change things, he would probably try to build more structured group work, but at present group work happens as they are seated. He sees them working together in practical work. He reiterated further that he would rather have them form relationships where they feel comfortable in working with one another.

6.2.1.6 Outstanding achievements of Pasifika students he has taught in the past. Mr. Williams said, "All sorts". He has formed some good friendships and relationships with the students over the years. These students still come to visit him. He talked about coaching a Samoan boy in javelin. Mr. Williams said the boy was very keen, but his organisation skills were terrible, nonetheless he won the tournament. He mentioned two others in secondary school athletics, one went on to play rugby for Wellington and the other got a scholarship in physics and went on to university.

6.2.1.7 Communication with the parents or whanau. Mr. Williams said there was not a lot of communication with the parents. Parent teacher interviews are the only opportunity to see the parents but admitted he has not seen a lot of Pasifika parents come to the parent-teacher interviews.

6.2.1.8 Conversations with Pasifika students about careers in science. He said that year 11 was a bit too early, not really a big focus. He normally starts conversations earlier on in the year of Year 12 or 13 and tries to follow that through to find out what they are going to do and have that conversation, find out what their goals are and come up with a plan of what sorts of assessments they are going to be looking at if they are going to go down that pathway.

When asked if Pasifika students needed to be pushed to achieve, he replied, “Yes, otherwise those girls will not try.” He said he has had to push the girls to work harder and the boys to aim for ‘Merit’ instead of settling for just ‘Achieved’. He added

I had to push some of them like Savea to fully realise that he had it within him to get ‘merit’ instead of settling for achieved.

He believes in encouraging these students to aim higher because he is mindful of the fact that Māori and Pasifika students do fall behind in achieving high endorsements in NCEA assessments. He emphasised, “I have tried to push all the students to achieve a merit”.

Commentary

Being an experienced teacher, Mr. Williams seemed both concerned and confident in his strategies working with Pasifika students. He identified two concerns; firstly, Pasifika students’ lack of confidence in their ability to learn science and secondly literacy to communicate their science ideas in writing.

What Mr. Williams is referring to as ‘lack of confidence’ could be indicative of low Mastery and a need to have high Vicarious Experience resulting in waiting to see it being modelled or someone else to do something before trying it themselves.

The second concern raised by Mr. Williams was literacy (oral and written) being an obstacle to ‘trying’. He talked about his concern about students being able to read the instruction or express their ideas on paper.

Thirdly, Mr. Williams acknowledged that some of his students had formed very strong bonds of friendship and that was confirmed from the student's data in the Focus Group Interviews where they said, they are able to ask each other for help. A couple of students preferred working on their own rather than be distracted by friends.

6.2.2 Teacher Interview two with Mr. Garcia

Mr Garcia is a young Pākehā teacher with seven years of teaching experience. He showed a lot of confidence in his lesson delivery and he strived to capture the attention of all students while he was going through the lesson. Being a physics class, and the topic being mechanics, he stressed that they pay attention as he does the calculations with them. He identified his need to become more aware of the Pasifika culture so that he can best guide them to see the value in science.

6.2.2.1 Rewards and challenges in teaching Pasifika students in particular. Mr. Garcia said it was rewarding to see students get engaged and seeing them wanting to continue doing science in senior school. He said, "It is a sort of affirmation that I'm leading them down the right path and that they are interested in what I am teaching". He has found the Pasifika students he has worked with generally really want to excel so they push themselves to make their families proud and that is important for them. He says, "it is really good to see that they have got a personal drive to pursue science".

He found trying to engage students that generally do not have an interest in science challenging, so he tries to connect them in areas that they do not see as valuable. Mr. Garcia said:

I find that quite challenging, so there are a few students for example, in my Year 11 class who do not see the value in science do not want to pursue it, and so that is hard for me personally. I try to find a way to support them on their journey and it is a challenge.

Mr. Garcia admitted that it was a challenge to try to connect with them on a personal level as he does not have a very strong knowledge of their Pasifika background. This is something that he felt he needs to continue to work on.

6.2.2.2 Teacher's views about Pasifika students' enthusiasm. Mr Garcia said he found Pasifika students generally took a bit longer to grasp things, so he felt they needed a bit of

support to unpack things. The teacher believes that when students are not able to access the information, they can get bored, consequently it takes longer for them to make meaning of the information provided. Mr. Garcia added “they prefer more hands-on activities than written tasks”.

Specifically, talking about his Year 11 class this year, he said they were quite different, “there are a couple of Pasifika students who are very hard working and very driven, one of them gets on to work straight away, and another one takes a bit of time to digest what is occurring and then another is very slow to start on his work, so there is a very big range in that area”.

I feel like they really thrive in that area of practical work so are willing to get involved in things. That means that there are no behavioural issues, they get a good understanding of it and therefore they can tap into that level of knowledge. The challenge with Year 11 science is trying to find the time to do that because there is a lot of content to get through, so it is a ‘bit of hit and miss sometimes.

6.2.2.3 What are some learning needs of Pasifika students? Mr Garcia said they need time to latch on to things. Maybe they have a higher need in terms of support for literacy, both written, reading and writing. He does not think there is an issue with their numerical understanding, but he thought literacy was an area that needed support.

When asked about adapting instruction to meet the needs of Pasifika students he replied:

In terms of literacy, a potential area to adapt would be to put in more scaffolding work. Giving them some tasks that are not as challenging so they can build on what they know. I think it is in the chemistry area that they need a bit more scaffolding, so breaking things down, doing things in sections as opposed to doing everything all at once.

6.2.2.4 Outstanding achievements of Pasifika students he has taught. Mr. Garcia said that a few students who had “really latched on to things” continued to senior school (Years 12 & 13); some of them had progressed to university so even though he had been a little part of their journey, for him that was a big achievement. He said that it was pleasing to see some students were put forward for achievement awards at the end of the year, for attitude and effort where intelligent work was required. He was pleased when the Pasifika

students that have achieved excellence awards were excellent overall in the course, “so that is a huge achievement”.

6.2.2.5 Communication with the parents or whanau. Mr. Garcia explained that they only have parent-teacher interviews with subject teachers once a year. Most of the communication is through the *kahui-ako* (form) teachers. He said that he emails home quite regularly, “probably two times a term just to update about assessments on where we are at and where we are going”.

6.2.2.6 Conversations with Pasifika students about careers in science. The teacher said that although the students had not talked careers specifically, “a few of them have spoken about going on to university, some have spoken about Otago university, so know they are looking into medicine”. A few students have talked about Auckland or Canterbury, so “I take from that probably engineering. So, they are setting their sights high”.

Commentary

Mr Garcia was an experienced teacher who did not see his students differently other than a class of learners whom he tries his best to support. He identified that, sometimes he finds Pasifika students less able to quickly understand and follow instructions, and often need a bit more support to do so. He suggests more scaffolding as a strategy to assist these learners. Mr. Garcia’s face-to-face communication with parents was minimal and email communication was assessment related. He did notice that some of these students were considering going to university.

6.3 My Classroom Observations

Five lessons each were observed in two Year 11 science classes. As in Chapter five, the Observation Schedule was adapted from Moeed (2010) and O'Loughlin (1992) and used to collect the data (Appendix W). All the observed lessons were audio-recorded which I used as back-up for checking for accuracy. Appendix Y provides a sample transcript of one Classroom Observation sessions. Mercy College observations were analysed in the same way as the other two schools. The transcripts for all five observed lessons were read and reread to gain an overall perspective. The notes were divided into two main categories; student observed

behaviour during the lesson and teacher support offered during the lesson (Table 6.6). This process was repeated for all the five lessons observed and is summarised here.

6.3.1 Mr. Williams' class

There were seven Pasifika students in Mr. Williams' class; Ofa, Tita, Seini, Ana and Alisi, Savea and Toutai. Alisi and Toutai were happy to be observed only but chose not to participate in the focus group interview and the student questionnaire. Mr. Williams' class had a teacher's aide present every day.

At the time of my visit, the class had just completed an Internal Achievement standard Biology 1.1 90925 *Task to carry out a practical investigation in a biological context, with direction*. The activity involved the calculation of their finger length ratio by measuring the length of their index finger and ring finger. Then they were to divide the length of the index finger by the length of their ring finger. Their activity was, '*To determine whether there is a pattern between index finger ratio and athletic sports ability of students at Mercy College*'.

Since the practical Investigation was already completed before I arrived, my observations were of students' processing and interpreting their data, drawing conclusions, and writing their report based on their findings. In each class, Mr. Williams would hand out their worksheets and attend to each student guiding and assisting them on what was required for each section. Basically, they were writing up the practical report in the scientific method format. Since the format was already given and the methodology completed, what they had to do was process their results by drawing a graph and write a discussion and conclusion.

I also observed a practical demonstration which was a revision of heat transfer. Mr. Williams used a ring made with different metals with a circular gap in the middle to hold up a marble. As he heated each metal section with a Bunsen burner, the metal expanded widening the gap and letting the marble drop through the hole. For each metal, the time it took to expand and let the marble drop through the hole was different, the shorter the time, the higher the heat conductivity. The students were all very attentive however, Mr. Williams had to urge them to take the ring from him and have a try themselves. They were all reluctant, but Savea was the first to have a go, followed by the others. The girls only watched and did not try.

Some of them sat and watched and waited for their friends to start or complete the task before asking for their help to get started indicating lack of confidence to start and waiting for a display of Vicarious Experience. Or, it could have been a portrayal of very little connection with the science outside of the classroom and in need of more Vicarious Experiences, so they choose to work with friends or watch the teacher perform a task before attempting it. Table 6.8 presents a summary of the observations I made of the seven Pasifika students.

Table 6.8 Mercy College Student profile summarised from Classroom Observations.

Student (Gender)	Observations Characteristics of Participants	Teacher Action	Self-efficacy antecedent supported
Alisi	Alisi (who chose to be observed only), was present in only two lessons, arrived late in another two and was absent in lesson five. The times she was in class, she would ask her friends for help to catch up on missing work and the teacher would allow the girls to converse to try and help Alisi who seemed distant most of the time, but I would see her smile with her friends once they were seated.	Teacher would firstly check where she was before chatting with her friends allowing them to help her with the work. He moved around the room and checked on them quite frequently.	Verbal Persuasion, Physiological/Emotional
Ana (F)	Often sat with Tita and Seini and was quiet like Tita but would take a bit of time to get started. Would wait until Tita finished, then she would ask for help or patiently wait for the teacher to come around to her to see if she needed help. Easily distracted and using her phone. Like Alisi, often checked with her friends where they were at and sought help from them.	Like Alisi, teacher allowed the Pasifika girls to work together as they sat with each other and would come around and check on their progress.	Verbal Persuasion
Ofa (F)	Although the other Pasifika girls often sat together, Ofa was different; she often sat away from the other Pasifika girls. She would often sit with an Asian or Pākeha girl. Very attentive and would work diligently. She had just had a foot injury so worked hard to catch up. Raised her hand for assistance and never hesitated to ask for help from the teacher. She waited patiently for the teacher to come around.	Teacher walked around the room, checking on everyone and would stop by Ofa to give her a little more encouragement because she just sustained a sports injury.	Verbal Persuasion and Physiological/Emotional support
Seini (F)	A lively girl but half the time played with her phone while her friends are making a head start. Took some time to get started. A few times observed her waiting for the teacher to come around	Teacher ignored her phone habit but would check to see she was getting help from her friends.	Verbal Persuasion Physiological/Emotional

	before she raised a query/question with him. Never raised her hand for attention but would wait for the teacher to come around.		
Tita (F)	Quietest in the group of 4 girls. Always happy and had a confident face on. She was the first to attempt any task and usually the first to finish. Then she would spend the rest of the class helping her friends.	When the teacher visited her desk, he would often encourage her to try extending from where she had got up to.	Verbal Persuasion Physiological/Emotional
Savea (M)	Seemed independent. Likes working on his own, but if in a group situation is very serious and wants to do exactly as the teacher directed. Played with Toutai a bit but would not help him. Savea enjoyed the heat conduction experiment where the metal ball dropped through the hole when the metal expanded due to heat transfer.	Teacher checked on Savea and informed him that what he had done would only earn him 'Achieved' but if he could discuss his result a bit more, that might be able to get over the achieved mark.	Verbal Persuasion, Physiological/Emotional
Toutai (M)	Pays attention for the first part of the class and then begins fidgeting. Sometimes talks and plays with Savea. Seems happy when he talks and plays with Savea but when there is no one to talk to, he becomes a little agitated and the volume of his voice goes up.	Mr Williams would go and check with Toutai. When he was having difficulty plotting his graph Mr. Williams took extra time with him.	Verbal Persuasion Vicarious Experience Physiological/Emotional

Commentary

Mr. Williams knew his students very well and was confident that the strategies he was using would greatly help his students to achieve the required achievement standard. He offered the same support to all his students, not just the Pasifika. For those students who he knew would try improving their grade endorsement from 'achieved' to 'merit', he allowed them to revise and resubmit. The girls valued their friendship with one another, and Mr. Williams allowed that bond to grow and use it to his advantage, allowing them to work together and help each other. Tita showed kindness to her friends, she would finish first before helping her friends.

Savea appeared very hard working and on his own most of the time while Toutai seemed happier working with a friend. His irritation when Savea moved away suggested he most likely needed a friend to work with. One day, during a graphing exercise, I noticed Savea move away from him. He got quite upset and started chatting with his neighbour instead of doing his work. I went over and sat beside Toutai and asked if he needed some help. He replied yes so, I sat down with him in that lesson. He did not hesitate when I approached to work with him. He shared with me that he had difficulty reading the tiny squares, so I offered to help him out. I suggested, for every coordinate, I would move up the page from the x-axis and if he came across the y-axis, where they met, he placed his mark. He agreed so we got working. It was during that one encounter I found out he had vision problems. I asked permission to share this with his teacher and his parents; he consented so I informed his teacher who said he would notify his parents to get his eyes checked.

The self-efficacy antecedents that stood out were Verbal Persuasion and Vicarious Experience. Students watched attentively but waited until they received the Verbal Persuasion to have a try. As for the scientific report writing, as they were working the teacher would still check on their progress and further encourage them to keep working or redirect them providing Verbal Persuasion.

6.3.2 Mr. Garcia's class

There were three Pasifika students in this class; two consented to the full study, but only Manu participated in the focus group interview and completed the student

questionnaire while Koni opted out. Mr. Garcia is an experienced teacher who had been teaching for more than seven years. This class was working on the topic of mechanics in physics during my visit. The class was mostly theory based, with the calculation of force, mass, and acceleration, so Mr. Garcia emphasised that the students should pay close attention to his board work. He gave out homework worksheets with practise problems. He corrected the homework in class before proceeding with the topic. On my last day at the school, Mr. Garcia carried out a practical titled ‘the helicopter experiment’ in which students controlled the height and allowed for a paper helicopter to fall freely to the ground to measure the time it took to land using a stopwatch. The speed was then calculated. Table 6.9 presents the profiles of consenting students.

Table 6.9 Mercy College Student profile summarised from classroom observations.

Student (Gender)	Observations characteristics of participants	Teacher actions	Self-efficacy antecedent supported
Manu (M)	Manu was a very quiet student. He always sat in one of the front seats which Mr. Garcia said was his usual seat. Every day he worked quietly and attentively, never chatted or played with anyone beside him. The only time I saw him say something in class or smile was when they did the parachute experiment.	Mr. Garcia told me that during class Manu was an extremely quiet boy who preferred to sit in front. Mr. Garcia would check on him constantly during class when he was doing his rounds checking on individual students.	Verbal Persuasion
Koni (M)	Koni was a sports ‘personality’ in the school so would sit with his sporting mates. He sometimes moved and sat in a different part of the room but would always be sitting with another sporty student. He often chatted and fiddled with things on his desk.	Koni was always quite chatty with his sports mates so Mr. Garcia called on him several times to get on with the work.	Verbal Persuasion

In Mr. Garcia’s class students were offered both internal and external achievement standards for assessment. I saw Mr. Garcia spend time over the theoretical ‘mechanics’ calculations (force, mass and acceleration). He prepared worksheets with practice and homework problems. He then took extra time on those calculations and explained why.

During the helicopter experiment, Mr. Garcia took time to check on each pair of students to make sure they were all doing it correctly. He prompted students to draw upon their prior knowledge about air friction and other related concepts in the topic they were studying. Mr. Garcia asked for prior knowledge with regards to high heel shoes sinking in sand under a lot of pressure when doing forces but could have probed more about wind resistance or about the helicopter.

6.4 Triangulation of the Student Data, Teacher Interview, and Classroom Observations

The findings from the three data sources (Student Data, Teacher Data and Classroom Observations) show Verbal Persuasion and Physiological/Emotional antecedents as common sources of self-efficacy for the students at Mercy College.

Firstly, friendship appeared to differ between the girls and the boys. The girls valued their friendship as a source of Vicarious Experience, learning from each other. Classroom observations revealed that sometimes the girls waited for others to try first before attempting it themselves. The boys indicated in their questionnaire that they felt they could carry out the set tasks by themselves only needing their teacher to check on them from time to time. Classroom observations revealed Savea would rather work on his own than with a friend. Manu sat on his own away from the rest of the class but would work with anyone assigned by the teacher.

Secondly, there was good communication between both teachers and participants. Mr Williams offered a lot of encouragement to his students generally as well as providing individually targeted strategies for the students to achieve. Mr Garcia through his stern classroom discipline ensured all students were following his instructions and worked examples and practical demonstrations for them to grasp and master the theory. Classroom observations showed both teachers providing Verbal Persuasion and Vicarious Experience generally. Mr. Williams even provided Physiological/Emotional support to Ofa after learning of her sports injury by allowing her time to complete her assessment.

Mr Williams offered support to his students by breaking down the practical investigation activity into sections which they had to complete satisfactorily before moving

on to the next part. In Mr. Garcia's class, results of the practice examination were returned to the participants and corrections made and other similar exercises. In all the practice exercises, he made sure that the students followed along while he went over the exercises.

Thirdly, the fear of failing was evident in what the participants shared during the Focus Group Interview. All of them were hoping to achieve the credits to pass and not disappoint their parents. The fear of failing could be positively indicating the Physiological/Emotional antecedent. For example, according to Figure 6.9, for high Mastery students like Manu and Savea, the Physiological/Emotional antecedent was either the primary or secondary source of self-efficacy. Seini's primary source of self-efficacy was Verbal Persuasion. She had said during the Focus Group Interview that she did not find science useful in her everyday life but was there to achieve the credits to pass NCEA Level One. Ana's mean scores were almost equal for Verbal Persuasion, Vicarious Experience and Physiological/Emotional as her source of self-efficacy. She probably could not rate herself any higher than 3-borderline.

Generally, the participants of Mercy College did not score themselves Likert values of 5s on many occasions, which may indicate:

- i) They are not confident in how to rate themselves
- ii) They are modest about themselves
- iii) They need some of those antecedents to develop their self-efficacy to make a better judgement of themselves.

6.5 NCEA Level One Science Achievement Data for 2019

This section presents the achievement results of NCEA standards offered to the participants of Mercy College. The standards they attempted were from the NCEA Directory of Standards (DAS) described in Chapter 4.5.2.6. At Level One, students are introduced to the National Certificate of Educational Achievement (NCEA) for which there are guidelines that describe what they need to know and be able to do to meet the standard and achieve and gain a 'Merit' or 'Excellence' grade (Ministry of Education, 2018; NZQA, 2021a; Te Kete Ipurangi, 2021b). The teacher offers the activities and supports the students to prepare for the assessment to meet the requirements of the standard to gain the credits offered.

Table 6.9 presents the NCEA Level One Science Achievement data of the participants in Mr. Williams' class and Table 6.10 presents Manu's results from Mr. Garcia's class. Their major sources of self-efficacy from Figure 6.10 are included.

Table 6.10 NCEA Level One Achievements for Mr. Williams' Class (Mercy College)

Name of student	NCEA Level 1 science ACHIEVEMENT STANDARDS ATTEMPTED					Total credits achieved	Source of Self-efficacy
	Sci 1.15 AS90954 v.3 Demonstrate understanding of the effects of astronomical cycles on planet Earth <i>Internal (Practical, Planet Earth and Beyond)</i>	Sci 1.4 AS90943 v.3 Demonstrate understanding of the effects of astronomical cycles on planet Earth <i>Internal (Research)</i>	Bio1.1 AS90925 v.3 Carry out a practical investigation in a biological context, with direction <i>Internal (Practical, Living world)</i>	Chem1.1 AS90930 v.3 Carry out a practical chemistry investigation, with direction <i>Internal (Practical, Material world)</i>	Phy1.1 AS90935 v.3 Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction <i>Internal (Practical, Physical World)</i>		Primary and secondary sources of self-efficacy. Source: Table 6.7.
Tita	A	M	E	A	E	20/20	Verbal Persuasion and Vicarious Experience
Ana	A	NA	NA	A	A	12/20	Equal Vicarious Experience, Verbal Persuasion and Physiological /Emotional
Seini	A	A	A	M	M	20/20	Verbal Persuasion and equal Mastery and Vicarious Experience

Ofa	A	NA	M	M	E	16/20	Verbal Persuasion and Vicarious Experience
Savea	M	A	M	M	M	20/20	Physiological/Emotional and Verbal Persuasion

- **Assessment Grade guide:** There are four grades for the NCEA **achievement standards:** (A.M.E.N)
- Achieved (A) for a satisfactory performance
- Merit (M) for very good performance
- Excellence (E) for outstanding performance
- Not achieved (N) if students do not meet the criteria for the standard (MOE, 2020)

Table 6.11 Mercy College NCEA Level One Achievements for Mr. Garcia's Class

Name of student	NCEA Level 1 ACHIEVEMENT STANDARDS ATTEMPTED					Total credits achieved	Source of Self-efficacy
	Sci1.1 AS90940 v.3 Demonstrate understanding of aspects of mechanics <i>*External</i>	Sci1.11 AS90950 v.3 Investigate biological ideas relating to interactions between humans and micro-organisms <i>*External</i>	Sci 1.5AS90944 V.4 Demonstrate understanding of aspects of acids and bases <i>*External</i>	Chem1.1 AS90930 v.3 Carry out a practical chemistry investigation, with direction <i>Internal</i> <i>(Practical, Material World)</i>	Phy1.1 AS90935 v.3 Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction <i>Internal</i> <i>(Practical, Physical World)</i>		Primary and secondary sources of self-efficacy. Source: Figure 6.5.
Manu	A	M	A	E	M	20/20	Mastery and Physiological Emotional

Assessment Grade guide

There are four grades for the NCEA **achievement standards**: (A. M. E. N)

- Achieved (A) for a satisfactory performance
- Merit (M) for very good performance
- Excellence (E) for outstanding performance
- Not achieved (N) if students do not meet the criteria for the standard (MOE, 2020)

Table 6.10 shows Savea, Tita and Seini as the participants who achieved all the 20 science credits attempted and all were internally assessed. Ofa achieved 16 credits and Ana achieved only 12. Both Ofa and Ana showed Verbal Persuasion and Vicarious Experience as their primary and secondary sources of self-efficacy just like Seini and Tita. Savea showed Physiological/Emotional as his primary source and Verbal Persuasion as his secondary source of self-efficacy.

Table 6.11 presents Manu's NCEA results from Mr. Garcia's class. Manu achieved all his 20 science credits from both internal and external standards. Manu's primary and secondary sources of self-efficacy were Mastery and Physiological/Emotional antecedents, respectively.

6.6 Commentary on self-efficacy and achievement

Out of the participants who achieved all 20 science credits, two participants scored mean Likert values of 4 on Physiological/Emotional antecedent as a primary source of self-efficacy. One participant had Verbal Persuasion and one had Vicarious Experience as their primary source of self-efficacy. Figure 6.5 shows that almost all the participants except Manu, had a mean score higher than 3 for at least three of the antecedents as the sources of self-efficacy. However, Tita who scored herself lower than 3 for Mastery, achieved three 'Excellence' and one 'Merit' endorsements and achieved all her 20 credits. Tita seemed to be a hard-working student who probably did not see the potential in herself by scoring herself low on her Mastery but scored herself highly on Verbal Persuasion (Figure 6.5).

Manu needed his Physiological/Emotional antecedent to support his Mastery, while Savea's primary source of self-efficacy is Physiological/Emotional driving his Mastery. Seini achieved two 'Merit' endorsements and did achieve all 20 credits with Verbal Persuasion as her primary source of self-efficacy and equal Vicarious Experience and Mastery as her secondary. Ofa did not achieve one standard, but she did obtain one 'Excellence' and two 'Merit' endorsements for 16 out of 20 credits.

Generally, all these Achievement Standards were internal assessments except for Sci1.11 AS90950 v.3 and Sci 1.5AS90944 V.4 which were externals that were attempted and

achieved only by Manu from Mr. Garcia's class. I observed in Mr. Garcia's class (Manu's class), that the students were taught more content than Mr. Williams' class. It seemed Mr. Garcia was preparing his students to enable them to attempt the externals by providing them with a lot of examples (worked problems) and Verbal Persuasion. In Mr Williams' class, they were also provided Verbal Persuasion to attempt a task and Vicarious Experiences through practical demonstrations and time to better their Internal assessment task to enable them to achieve. The students in Mr. Williams' class were only being assessed to carry out a fair testing type of assessment in four different contexts by doing four different practical activities. Achieving in these activities provides confidence to carry out such an activity but with a lot of teacher and peer support.

The question though is what about the assessment of other learning in science that they have done? OR is this all the learning that they do in the year? This is evident in the Table of Achievement when compared with the National Average for each standard below Table 6.12.

Table 6.12 Comparison of NCEA Achievement Standards for Mr. Williams' class (Mercy College)

Achievement Standards	Participants who Achieved (%)	Total Pasifika who achieved (%)	Total Year 11s who Achieved (%)	National Average (%)
Sci 1.15 AS90954 v.3 Demonstrate understanding of the effects of astronomical cycles on planet Earth - <i>Internal Assessment (Practical, Planet Earth and Beyond)</i>	100	Not Available	Not Available	77.9
Sci 1.4 AS90943 v.3 Demonstrate understanding of the effects of astronomical cycles on planet Earth – <i>Internal Assessment (Research)</i>	60	Not Available	Not Available	80.1
Bio1.1 AS90925 v.3 Carry out a practical investigation in a biological context, with direction <i>Internal Assessment (Practical, Living world)</i>	80	Not Available	Not Available	86.5
Chem1.1 AS90930 v.3 Carry out a practical chemistry investigation, with direction - <i>Internal Assessment (Practical, Material world)</i>	100	Not Available	Not Available	90.1
Phy1.1 AS90935 v.3 Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction - <i>Internal (Practical, Physical World)</i>	100	Not Available	Not Available	94.7

Table 6.12 shows the percentage of the Pasifika participants in the group who achieved compared with the national average on three standards (Sci 1.15 AS90954 v.3, Chem1.1 AS90930 v.3, Phy1.1 AS90935 v.3). In one standard (Bio1.1 AS90925 v.3) they almost reached the national average at 80%. Those standards were all practical activities where they may have had a lot of teacher and peer support providing the Verbal Persuasion and Vicarious Experience. However, they did not do so well compared with standard Sci 1.4 AS90943 v.3 Research where it required a bit more Mastery to be able to find the correct information and write well. Literacy is one of the learning needs identified by both teachers.

However, for Manu from Mr. Garcia's class the result was quite contrary. Manu achieved all his 20 credits. His results are presented in Table 6.13 below. The data for Pasifika of Mercy College was not available to draw any comparison with the rest of Pasifika and the Mercy College statistic.

Table 6.13 Comparison of NCEA Achievement Standards for Manu in Mr. Garcia's class (Mercy College)

Achievement Standards	Participants who Achieved (%)	Total Pasifika who achieved (%)	Total Yr11s who Achieved (%)	National Average (%)
Chem1.1 AS90930 v.3 Carry out a practical chemistry investigation, with direction - <i>Internal (Practical, Material World)</i>	100	Not available	Not available	90.1
Phy1.1 AS90935 v.3 Carry out a practical physics investigation that leads to a linear mathematical relationship, with direction <i>Internal (Practical, Physical World)</i>	100	Not available	Not available	94.7
** Sci1.11 AS90950 v.3 Investigate biological ideas relating to interactions between humans and micro-organisms <i>*External</i>	100	Not Available	Not Available	79.7
** Sci 1.5 AS90944 V.4 Demonstrate understanding of aspects of acids and bases <i>*External</i>	100	Not Available	Not Available	77.0
** Sci1.1 AS90940 v.3 Demonstrate understanding of aspects of mechanics <i>*External</i>	100	Not Available	Not Available	73.1

** Key: Three externals only attempted and achieved by Manu from Mr. Garcia's class.

6.7 Chapter Summary

The participants voiced their desire for more explanation of science ideas and Vicarious Experiences. Student Questionnaire results revealed that Verbal Persuasion and Physiological/Emotional antecedents were the two major sources of self-efficacy for these participants.

Teachers believed that Pasifika students lacked the 'confidence to try' which was confirmed by most students who selected a degree of agreement of 4 and under, indicating a possible lack of 'belief' in themselves. Both teachers said literacy was a concern and said that the Pasifika students preferred more hands-on activities than written tasks. Teachers believed their strategies were working and the students confirmed that they are getting a lot of feedback and said they communicated well with their teachers.

Four out of the six participants scored average means of 4 for Verbal Persuasion. Verbal Persuasion and Physiological/Emotional antecedents make up the main primary and secondary sources of self-efficacy among participants of Mercy College. Classroom observation revealed a tremendous amount of Verbal Persuasion being given in both classes. One teacher provided guidance to complete an internal assessment task over a week while one teacher provided a lot of worked examples for students to practise on for an external assessment. Being experienced teachers, both found a technique to capture the students' attention from the beginning of the class till the end.

Through substantial Verbal Persuasion, students like Tita who scored herself low for mastery achieved all her 20 credits. Only one student who achieved all 20 science credits rated high Mastery. Others selected Verbal Persuasion and Physiological/Emotional antecedents as the primary and secondary sources of self-efficacy. Having achieved all 20 credits Seini had met her desire to achieve the science credits. It is possible that as they were all doing internal standards, she may have had a lot of teacher input and Verbal Persuasion to achieve.

For students like Seini the fact that she was not being challenged to sit the externals might increase their lack of confidence which is likely to be impacting on their self-efficacy. For instance, it is evident from Figure 6.9 that Tita and Seini both scored low for Mastery, but both had Verbal Persuasion as their primary source of self-efficacy. Their achievement of their

20 credits might have been mostly due to Verbal Persuasion and Vicarious Experience with little evidence of Mastery. Both Seini and Tita scored low on the Physiological/Emotional antecedent. Unlike Savea and Manu who seemed highly driven by Mastery and Physiological/Emotional antecedents to do well and achieve, these girls were highly dependent on Verbal Persuasion and Vicarious Experience. This may well have led them to be dependent on their teacher and friends to pass and not to try themselves. This may impact on their chances of pursuing a career in science as Seini said she did not believe that science was useful in her everyday life, she was there to get the credits and not to Master the subject. A related concern is whether the limited amount of content learnt by the students in Mr Williams' class would make it harder for them to progress to senior level. Manu would have the externals giving him the choice of taking biology, chemistry or physics but would bring limited knowledge.

The evidence suggests that the antecedents which the participants identified as their primary and secondary sources of self-efficacy might have impacted on their NCEA achievement. The two participants who scored a mean of 4 for Mastery both achieved their 20 credits. They also perceived that they required Verbal Persuasion and Vicarious Experiences, suggesting that these antecedents support their Mastery. Of those that desired Vicarious Experiences, some achieved all 20 credits, perhaps because their need for Verbal Persuasion was satisfied by the teacher and Vicarious experiences were gained from learning off their friends.

CHAPTER SEVEN

LUVA : Presentation of Findings

Leep High School

Overview

Leep High School is an urban high decile unisex boys' school for Years 9 -13 students. The School Roll comprised more than 700 students with more than 50 teaching staff. The School's vision is

to educate and nurture their young men in a Christian Faith based environment to empower them to realise the potential God placed in them when He created them.

The class I observed was that of Ms Finau a Pasifika teacher with 25 years of teaching experience. Ms Finau consented to be observed in class but could not be reached for an interview. Some of the Pasifika students from two other classes consented and participated in the Student Questionnaire and Focus Group Interview however, only Ms Finau's class (Class A) was observed.

7.1 Student Data

Student Data from Leep High school were collected in the same way as Grace College and Mercy College. Student Data was collected using a Focus Group Interview and Student Questionnaire. Eight Pasifika students from three different classes consented to participate in the study. Five were from one class (Class A), while three were from two other classes (Class B and Class C). Table 7.1 introduces the student participants with the Pacific Island of origin of one or both parents.

Table 7.1 List of Student Participants from Leep High School.

No.	Participant	Gender	Island of Origin of parent/s
1	Tevita	M	Samoa
2	Sione	M	Samoa
3	Fale	M	Samoa
4	Ma'ake	M	Samoa
5	Lolo	M	Samoa/Cook Islands
6	Matiu	M	Tonga/Samoa/Tokelau
7	Pita	M	Samoa/Cook Islands
8	Samiu	M	Samoa

Section 7.1.1 presents participants' views of factors that support their classroom learning as they shared during the Focus Group Interview.

7.1.1 Focus Group interview. A Focus group interview was conducted with eight participants. All students who participated in the focus group interview completed the student questionnaire. Data collection and processing was carried out in the same manner as Grace College and Mercy College with the same interview schedule (Appendix T), however some of the prompts were sourced from classroom observations. Participant responses to the interview questions were collated and summarised (Appendix U) before codes were allocated to the responses and identified as the emergent self-efficacy antecedents from these responses Appendix V). Table 7.2 presents the processed data.

Table 7.2 Table of Student Responses, Codes allocated and Emergent antecedents from the Focus Group Interview

Student responses to focus group interview questions	Codes allocated per student response	Self-efficacy antecedent identified
<p><i>What Leep High school students like most about science</i></p> <p>Leep students found science to be interesting, they find out new things that impact their everyday lives. They said it helps them to be aware of many useful things like taking care of their bodies and how to keep healthy. Two students said the curiosity and thirst to learn more has brought them out of their shyness. One student felt he was good at mathematics and said science goes hand in hand with mathematics and that science challenges his brain, while another student enjoyed learning about nature and how we live with the world around us.</p>	<ul style="list-style-type: none"> • Future utility 	<p>Mastery, Vicarious Experience</p>
<p><i>Students' views about usefulness of science in their everyday life</i></p> <p>Most of the students said that the science they learn in class about how the body works helps them to recognise and understand how to keep healthy, how to help someone else during sports injuries, and the importance of exercise and preparation for games.</p> <p>When I prompted about boiling the kettle or turning the stove on or getting to school on time, they all chorused "Yes", before Fale elaborated "Because it gives us a better understanding of how things work with electricity and electronic appliances too."</p>	<ul style="list-style-type: none"> • Future utility of science; understanding of application to everyday life 	<p>Mastery, Vicarious Experience</p>
<p><i>What science ideas the students said they could explain to others</i></p> <p>Matiu replied he could help his friend explain how to keep a PE (Physical Education) journal while Fale said he could explain some mechanics</p>	<ul style="list-style-type: none"> • Knowledge of science concepts and practical investigations 	<p>Mastery</p>

<p>concepts like, mass, force, and acceleration to his friends. Sione said he could explain turning electricity off to save power, and body systems.</p>		
<p><i>What did the students do if they could not observe a teacher demonstration?</i></p> <p>They replied that they move to the front, ask the teacher to repeat the demonstration or ask a friend.</p>	<ul style="list-style-type: none"> • Usefulness of modelling; seeing it being done 	Vicarious Experience
<p><i>Students views about group work</i></p> <p>All students said they preferred working in groups, but sometimes preferred to work on their own. They noted that sometimes, some individuals let the group do all the work for them and then they take the credit for it whereas others tend to split evenly to do the work. Most times they chose their group mates themselves, but other times the teacher chose for them.</p>	<ul style="list-style-type: none"> • Preference for a balance, sometimes with others, other times working on their own 	Vicarious Experiences.
<p><i>Students views about friendship</i></p> <p>They responded, “very important”. It was observed that during the class the students liked being with and doing things with their friends.</p>	<ul style="list-style-type: none"> • Friendships; relationships with peers 	Vicarious Experiences.
<p><i>Did the students need reminders from the teacher?</i></p> <p>When asked if they needed reminders from the teacher to get on with the practical, there was a split response. Most said no while two said sometimes. Matiu confessed that he gets distracted easily by his surroundings.</p>	<ul style="list-style-type: none"> • Reminders: help get them moving. 	“No” coded as Mastery and “Sometimes” as Verbal Persuasion.
<p><i>Students reported enthusiasm for the lesson</i></p> <p>When asked if they always felt energetic and enthusiastic in class Tevita answered “Yes,” while Sione answered “sometimes” and others said they did not. When asked why, Sione replied; “sometimes it gets boring, when the teacher talks too much”. He said, he switches off when the teacher talks</p>	<ul style="list-style-type: none"> • Enthusiasm dependent on situation 	<p>“Yes”, indicated Mastery,</p> <p>“Sometimes” needed Vicarious Experience or Physiological/ Emotional</p>

too much and waits until she stops talking before, he switches back on again.		
<p><i>What students did to catch up when they missed a class</i></p> <p>They responded they would ask their friends for help or ask the teacher.</p> <p>Fale informed me that the school runs a homework class, in the library every Tuesday afternoons providing a space and time for students to catch up with anything that they have missed. Fale gets help from his parents when he cannot get help from his friends.</p> <p>Sione and Lolo said they would ask help from friends and teacher because their teacher posted answers and feedback regularly.</p> <p>When asked why it was important to catch up, they responded so they are not far behind on notes that are important. Fale said; “Otherwise we would go into a cycle of trying to catch up and fall further and further behind”.</p>	<ul style="list-style-type: none"> • Manage themselves through communication with teacher and their friends 	Physiological/Emotional
<p><i>Do students seek feedback?</i></p> <p>Those students who needed help said they asked for feedback; others who could manage themselves said, “Sometimes”. Among the “sometimes” group one student said he would go to the “<i>smart people in my class, so they know a lot more than myself so if I get something wrong, they will help me</i>”.</p>	<ul style="list-style-type: none"> • Yes, response indicated need for Verbal Persuasion and Mastery 	Verbal Persuasion, Mastery
<p><i>What motivated the students to learn science?</i></p>	<ul style="list-style-type: none"> • Grades and credits and family encouragement. • Fear of failing 	Verbal Persuasion, Physiological/Emotional

Students said they were motivated to learn to pass and get credits to pass Level 1 and make their parents and family proud. Encouragement received was from both teacher and family members.		
<p><i>What was a practical investigation they had done recently?</i></p> <p>Some students remembered doing practical when studying about energy and heat transfer (making of the 'umu'), some said study of metals, another added, it was given to us and yet another could not remember.</p> <p>When asked if they planned it or were the instructions given by the teacher; Samiu replied the theory was given by the teacher, but they planned the 'umu' themselves with the help of parents.</p> <p>When asked if they would like more practical work with a Pasifika theme like the 'umu' they made, Tevita, Ma'ake and Samiu said, yes. However, Fale and Sione said it really didn't matter, just more practical work would be more helpful. The others agreed with Fale and Samiu for more practical work</p>	<ul style="list-style-type: none"> • Heat transfer -connecting science ideas means Mastery • Pasifika theme - Physiological/Emotional • Wanting more practical work means- Need for Vicarious Experience 	<p>Mastery and Vicarious Experience</p> <p>Physiological/Emotional and Vicarious Experience</p>
<p><i>When asked if they carried out multiple trials and why</i></p> <p>They all said yes and when asked why, they answered: "To get a fair test" that is almost close to the true value.</p>	<ul style="list-style-type: none"> • Awareness of multiple trials and fair testing 	Mastery of fair testing
<p><i>When asked if there were any changes, they would recommend</i></p> <p>They replied No.</p>	<ul style="list-style-type: none"> • Safer to follow instructions 	Physiological/Emotional

<p><i>Students views about how the teacher could help them better</i></p> <p>The students wanted the teacher to explain more, and in detail, provide guidance through the experiments, and get them started. Sione said he wanted “more practical work” and they all agreed. Matiu said.</p> <p><i>“explain a bit more because sometimes it’s confusing when he explains some stuff”; Samiu said; “My teacher (referring to Ms Finau) explains it and then she’ll break it down to make it easier so everyone can understand the way she teaches and how she teaches”</i></p> <p>Then Fale interjected.</p> <p><i>“Yeah, he’s saying that because he has a good teacher, we don’t all have that kind of a teacher who is caring. I would like to see teachers show a little bit more care to their students”.</i></p>	<ul style="list-style-type: none"> • Need for more science to be modelled • Need for more support from the teacher • Need of Verbal Persuasion from the teacher 	<p>Need for Vicarious Experience and Verbal Persuasion</p>
<p><i>Was there anything the students did not like about science</i></p> <p>All agreed they liked science. Fale, Sione, Tevita, Lolo, Samiu, Pita all said they like science.</p> <p>Matiu said; “Lots of stuff to study but it’s okay, I like it”.</p>	<ul style="list-style-type: none"> • Happy to stay with science for future learning 	<p>Physiological/Emotional</p>

Summary

Most participants from Leep High School interviewed acknowledged the value of science in their lives. They were aware that science knowledge contributed to keeping their bodies healthy, healing and avoiding sports injuries. They said it helped them to understand the world around them; their use of electronic appliances and gadgets all have to do with science. They acknowledged the value of practical work and said they would like more of it. They viewed teacher feedback as important and valued their friendships because they could get help from each other if they fall behind; both aspects are sources of Verbal Persuasion and Vicarious Experiences.

The Physiological/Emotional antecedent was also evident as students set themselves a goal of attaining the credits to pass NCEA Level One. Obtaining the credits together with the 'fear of failing' kept them on track because they did not want to disappoint their parents. Fale and Lolo said they were given a lot of Verbal Persuasion and encouragement at home.

They all liked science, did not mind if they did more practical work with Pasifika themes or not, but said more practice would be ideal indicating a desire and need for more Vicarious Experiences. For example, Fale and Sione said that a Pasifika themed practical activity like the 'umu' did not really matter, but more practical work generally would be ideal. These boys seemed Physiologically/Emotionally affected by not having enough Vicarious Experiences in the classroom. There was disagreement about 'teacher support'. Some said they are being supported very well, while others felt they were being overlooked in class, while yet some students yearned for a more 'caring' approach by the teacher. Again, the need to satisfy that Physiological/Emotional antecedent came through when Fale said the 'caring' was absent from his teacher.

7.1.2 Sources of Self-efficacy

The sources of self-efficacy of participants from Leep High school were explored using the same process as the other two schools, utilizing a student questionnaire adapted from Lin (2012) to suit the context of Pasifika students in New Zealand (Appendix T).

The analysis of the student questionnaire was carried out in the same manner as the previous two schools. Chapter 4.5.2.4 described how the questionnaire was designed for each

tick to reflect a participant's degree of agreement to a statement as it applied to themselves. That 'degree of agreement' corresponded to a Likert score that was aggregated and plotted against the statements for every antecedent explored. A Likert score of 5 was allocated to strongly agree, 4 to mostly agree, 3 to somewhat agree, 2 for disagree and 1 for strongly disagree. A score 0 was allocated for a No response. (See Table 4.4).

A Likert score higher than 3 was considered high and a Likert score lower than 3 was considered low as how the participant rated themselves with that antecedent. A low score for an antecedent may not necessarily indicate a need, it could mean this student's primary and secondary sources of self-efficacy may be other antecedents.

7.1.2.1. Mastery. The 10 Mastery statements in the student questionnaire were treated in the same way as the previous two schools. Figure 7.1 presents a cluster of their responses to those statements exploring the Mastery antecedent.

Figure 7.1 Leep High School Responses to statements on Master

Figure 7.1 shows most participants rated themselves 3 and above. The two statements in which most of the participants rated themselves highly were statements 1 and 15. However, there were many disagreements, with Sione and Pita strongly disagreeing with statement 6a and 8a, respectively. Tevita and Fale mostly scored 5s while Sione and Lolo scored himself mostly 3s around the borderline mark. To distinguish which of the Likert scores received the most votes, a frequency chart was created as presented in Figure 7.2 below.

Figure 7.2 Frequency of Responses for Mastery

Figure 7.2 shows that most participants scored themselves more 4s than 3s for Mastery. Almost 15 scored 5s. Next was to determine the individual frequency data, for Mastery and that is presented in Table 7.3 below.

Table 7.3 Summary of the Frequency Data for Mastery

Mastery	Tevita	Sione	Fale	Ma'ake	Lolo	Matiu	Pita	Samiu	Group
Mean	3.6	2.6	4.2	3.2	3.3	3.7	3.9	3.7	3.53
Median	3	3	4	3	3	4	4	4	3.5
Range	3	3	3	2	2	3	4	3	2.88
Mode	5	3	4	3	3	4	4	4	3.75

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode = Most selected score

Table 7.2 shows that even though the class mean for Mastery was 3.53, most of the participants scored above that value. It also shows that with a mode of 5, Tevita responded with more 5s than anyone. Fale, Matiu, Pita and Samiu responded with more 4s, and the rest responded with more 3s. Sione scored the lowest mean score for Mastery and with a mode of 3 placing himself borderline. Generally, all participants scored themselves either as midway or high for Mastery. Even though the theoretical median was 3, participants like Fale, Matiu, Pita and Samiu did score personal medians of 4 indicating a high degree of agreement to the Mastery statements.

The mode revealed the most selected Likert score and the range to provide the consistency of the responses by each participant. Each participant's mean scores were used to determine the sources of self-efficacy in section 7.1.2.5.

7.1.2.2 Vicarious Experience. There were six statements in relation to Vicarious Experience. Figure 7.3 presents a cluster of participant responses to statements relating to Vicarious Experience.

Figure 7.3 Leep High School class Analysis of Vicarious Experience

Generally, it appeared most participants scored themselves 4 and above for this antecedent. There were only two disagreements from Ma’ake and Tevita in relation to statements 16 and 17 respectively. As with Mastery (section 7.1.2.1), to obtain a clearer distinction of the distribution of Likert scores, a frequency chart was created as presented in Figure 7.4 below.

Figure 7.4 Frequency of Responses to Vicarious Experience statements

Figure 7.4 shows that most participants scored themselves 4s, and an almost equal number of 3s and 5s for Vicarious Experience. More 4s and 5s indicate a high degree of agreement to the Vicarious Experience statements. Students rated themselves as being encouraged by persons demonstrating something or situations where science is modelled. There were however more than 10 3s. Table 7.4 below shows a summary of the frequency data presented in Figure 7.4.

Table 7.4 Summary of the Frequency Data for Vicarious Experience

Vicarious Experience	Tevita	Sione	Fale	Ma'ake	Lolo	Matiu	Pita	Samiu	Group
Mean	3.3	4.3	4.7	3.7	3.5	4.2	4	3.7	3.93
Median	3	4.5	5	4	3.5	4.5	4	3.5	4
Range	3	2	1	2	1	2	0	2	1.63
Mode	3	5	5	4	3	5	4	3	4

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score; Mode = Most selected score

Table 7.4 shows more participants scoring 4s and 5s with a median score of 4. With more participants scoring themselves 4s and 5s for this antecedent, this suggests Vicarious Experience as an important antecedent for participants at Leep High school. Half of the participants scored personal means above the class mean of 3.93 and the other half scored below the class mean for Vicarious Experience. Class means would be used to determine the sources of self-efficacy in section 7.1.2.5.

7.1.2.3 Verbal Persuasion. There were seven statements in the Student Questionnaire relating to Verbal Persuasion. Figure 7.5 presents the cluster of responses to these statements.

Figure 7.5 Leep High School Responses to statements on Verbal Persuasion

Figure 7.5 shows that most students scored themselves in the high 4s and 5s. The one strong disagreement from Tevita in statement 20, may indicate high Mastery, as he may not need teacher encouragement to complete set tasks. To get a clearer picture of this profile, frequency chart Figure 7.6 was created to show the distribution of the Likert scores.

Figure 7.6 Leep High School Frequency of Responses for Verbal Persuasion

Figure 7.6 shows most participants scored themselves 5s, followed by 4s and 3s for Verbal Persuasion. It could indicate a desire for more Verbal Persuasion or that they perform better in an environment where there's a lot of Verbal Persuasion. As mentioned above, the one strong disagreement possibly indicates high Mastery and may not need the Verbal Persuasion in the area in question. Table 7.5 presents a summary of the frequencies per participant and as a class comparison.

Table 7.5 Summary of the Frequency Data for Verbal Persuasion

Verbal Persuasion	Tevita	Sione	Fale	Ma'ake	Lolo	Matiu	Pita	Samiu	Group
Mean	4.3	4.1	4.4	4	3.1	4.3	3.9	2.9	3.9
Median	5	4	5	4	3	4	4	3	4
Range	4	2	3	3	2	2	2	2	2.5
Mode	5	5	5	5	3	5	4	3	4.4

Key: Mean = Average score; Median = middle most score; Range = Difference between highest and lowest score;

Mode = Most selected score

Table 7.5 shows that most of the class also scored 5s (Mode = 5) which was above the class average of 4.4. Verbal Persuasion also proved to be an important antecedent for Leep High school participants. Most individual means of the participants were above the class average for Verbal Persuasion. Class means would be used to determine the sources of self-efficacy in section 7.1.2.5. The next section presents the data on Physiological/Emotional antecedent.

7.1.2.4 Physiological/Emotional. There were seven statements in the student questionnaire which explored this antecedent. Figure 7.7 presents the participant's Likert scores as they scored themselves.

Figure 7.7 Leep High School Responses to statements on Physiological/Emotional Antecedent

According to Figure 7.7 most participants scored themselves above 3s especially between 4 and 5. Statement 23 received a low ranking most probably because they all appeared to be healthy during the interview. Again, disagreements may indicate high Mastery and strong disagreements may mean the participants do not have a physical impairment. The frequency of responses as degree of agreement is presented in Figure 7.8.

Figure 7.8 Leep High School Frequency of Responses for Physiological/Emotional Antecedent

Figure 7.8 shows most participants scored themselves highly for the Physiological/Emotional antecedent. During the Focus Group Interview, Fale said that he would like to see their teachers with a little more caring attitude towards them. Others agreed with Fale. Sione said, too much talking from the teacher bores him and he switches off easily when that happens. It seemed they rated Physiological/Emotional as important too by rating it highly as they did on Verbal Persuasion. Table 7.6 provides the summary of the frequency data.

Table 7.6 Summary of the Frequency Data for the Physiological/Emotional antecedent

Physiological Emotional	Tevita	Sione	Fale	Ma'ake	Lolo	Matiu	Pita	Samui	Group
Mean	3.1	4.4	4.6	3.9	3.4	3.7	3.3	3.3	3.71
Median	3	5	5	4	4	4	4	3	4
Range	4	2	2	3	3	4	3	4	3.13
Mode	3	5	5	5	4	5	4	3	4.25

Key: Mean = Average score; Median = Middle most score; Range = Difference between highest and lowest score;

Mode = Most selected score

Table 7.6 shows an average mode of 4.25 (most selected), indicating the importance of the Physiological/Emotional antecedent to this group of participants. Half of the participants scored mean scores above the class average (3.71) while the others scored less than the class average. However, class means would be used to determine the sources of self-efficacy in section 7.1.2.5.

7.1.2.5 Group Profile of Sources of Self-efficacy. The mean Likert scores per antecedent for each participant were used to plot and determine the antecedents acting as the primary and secondary sources of self-efficacy. This was carried out to answer SRQ2. Figure 7.9 presents the Overall sources of self-efficacy for participants of Leep High School.

Figure 7.9 Leep High School Overall Self-Efficacy Profile

According to Figure 7.9, six out of eight students scored highly on Verbal Persuasion. Only Samiu had Mastery and Vicarious Experience as his major source of self-efficacy. Pita, Fale and Lolo had Vicarious experience. Sione had Physiological/Emotional as his source of self-efficacy. Even though Fale scored above (4) in all antecedents, Vicarious Experience showed as his major source of self-efficacy. Fale could be a very outstanding student scoring Likert values of above (4) for all antecedents. Table 7.7 presents the individual self-efficacy antecedent rankings of the participants from their primary source to the least.

Table 7.7 Participants' sources of self-efficacy

Participant	Primary source	Secondary source	Tertiary source	Least
Tevita	Verbal Persuasion	Mastery	Vicarious Experience	Physiological/Emotional
Sione	Physiological/Emotional	Vicarious Experience	Verbal Persuasion	Mastery
Fale	Vicarious Experience	Physiological/Emotional	Verbal Persuasion	Mastery
Ma'ake	Verbal Persuasion	Physiological/Emotional	Vicarious Experience	Mastery
Lolo	Vicarious Experience	Physiological/Emotional	Mastery	Verbal Persuasion
Matiu	Verbal Persuasion	Vicarious Experience	Mastery	Physiological/Emotional
Pita	Vicarious Experience	Mastery	Verbal Persuasion	Physiological/Emotional
Samiu	Mastery and Vicarious Experience		Physiological/Emotional	Verbal Persuasion

7.2 Teacher's Perception of Pasifika students' self-efficacy

Ms Finau couldn't be reached for an interview therefore, there is no data for Teacher's views.

7.3 My Classroom Observation

The Classroom Observations were made at the end of term for Leep High School. All the class times observed were used for revision and completion of any outstanding assessments. The science teacher allowed her students to complete any outstanding work in any subject other than science during that time. No actual science lesson was observed being taught. Table 7.8 summarises the participant profiles and summaries of student behaviour and teacher support provided where applicable during the classroom observations.

Table 7.8 Participant Profiles from Classroom Observations

Participant/gender	Classroom Observations	Teacher Actions	Self-efficacy antecedent supported
Tevita (M)	<p>Tevita could get busy from the start. Other students he went to for help were mostly the Pasifika boys and his teacher.</p> <p>Tevita had the most credits from internal assessment and was awaiting the externals in some subjects.</p>	<p>After prayer, teacher sat at the front desk with her laptop and allowed students to go and see her regarding their credit deficits in all the lessons.</p> <p>Teacher read out the credit's students had achieved so far.</p>	Verbal Persuasion and Physiological/Emotional
Pita (M)	<p>Needed a couple more credits to make up his 80 credits overall for Year 11.</p> <p>He also went to his Pasifika friends mostly for help besides his teacher.</p>	<p>After prayer, teacher sat at the front.</p> <p>She allowed him time to complete his PE assessment to bring his credits up</p>	Verbal Persuasion And Physiological/Emotional
Matiu (M)	<p>Worked quietly to begin with but kept going to Tevita for help and his teacher would then call him over and enquired further. She would provide him the assistance he needed. Most of the time was encouragement as</p> <p>he still needed to make up the credits he was missing.</p>	<p>Teacher sat in the front with her laptop but would call Matiu to the front to enquire about what he really needed</p>	Verbal Persuasion and Physiological/Emotional
Ma'ake (M)	<p>He was quiet but his friends Samiu and Tevita would help him out. Ms Finau also called him up to her desk to help.</p>	<p>Sat at the front desk and only talked to the students.</p> <p>Teacher called him up to her desk on numerous occasions, then called on Tevita and Pita to help him out.</p>	Verbal Persuasion and Physiological/Emotional

Samiu (M)	Another very quiet student. Sometimes he would sit and stare into space and his teacher would call on him to check if he was okay.	<p>Sat at the front desk with her Laptop to monitor students' credits</p> <p>The teacher provided the feedback, guidance and encouragement he sought.</p>	Verbal Persuasion and Physiological/Emotional
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Table 7.6 provides what went on in Ms Finau's class towards the end of term. It was also towards the end of the year and most of the students seemed pressed for time to catch up on missing credits. In all the lessons observed, Ms Finau sat at the front of the classroom with her laptop open to monitor each of her students' credits and allowed them to complete that assessment. In all the lessons Ms Finau provided feedback and encouraged her students to keep working to complete their outstanding assessment activities to gain the required credits.

7.4 Triangulation of Student Data and Classroom Observations

The findings from the two data sources (student questionnaire and classroom observations) show students considered Verbal Persuasion and Physiological/Emotional support as important sources of self-efficacy. They rated themselves highly with 5s for both Verbal Persuasion and Physiological/Emotional antecedents and 4s for Vicarious Experience and Mastery. During the focus group interview when asked how the teacher could help them better, Samiu, Matiu and Fale shared mixed views. Samiu was happy his teacher provided him with a lot of support while Matiu wanted some clearer explanations. In my observation of Ms Finau's class, Samiu was among those students who approached the teacher individually for help and they were offered the assistance. Fale said he would have liked some 'caring' aspect from his teacher. Fale, who scored the highest Likert means for all the antecedents, Mastery, Vicarious Experience, Verbal Persuasion showed in this response that some Physiological/Emotional aspect of his self-efficacy were not being met. That also showed in his Likert average (4.6) as the highest mean for the Physiological/Emotional antecedent. In contrast, Samiu scored the lowest mean score (2.9) for Verbal Persuasion and one of the lowest means (3.3) for the Physiological/Emotional antecedent, perhaps indicating he might be already supported adequately enough for him in those two areas.

Friendship was also expressed as important to the participants of Leep High School. Classroom observations revealed Samiu, Tevita and their friends asking each other for help without hesitation. Even their teacher, Ms Finau encouraged them to help one another and, on several occasions, called on Tevita to help Samiu because he had achieved the most credits on Internal assessment while awaiting some externals in other subjects.

Secondly, communication between Ms Finau and the participants was that of respect. Even the other class members responded to Ms Finau in the same way as the Pasifika students. She offered a lot of encouragement to her students generally as a class as well as individually. That was evident in her time schedule to allow all her remaining science lessons for her students to catch up with any incomplete assessment tasks even in other subject areas.

Thirdly, as with the other two schools, the fear of failing was evident among this group of participants. They said during the focus group interview that they did not want to disappoint their parents. As with the previous two schools, the 'fear of failing' is indicative of the Physiological/Emotional antecedent. For example, Fale, even though he scored himself highly in all four antecedents, he still said during the focus group interview that he did not want to disappoint his parents by not making the credits. That indicated an affinity towards the Physiological/Emotional antecedent.

Generally, the participants of Leep High school mostly scored themselves Likert values of 4s for Mastery and Vicarious Experience and 5s for Verbal Persuasion and Physiological/Emotional antecedents. This may indicate that:

- (i) Some were not confident to rate themselves 5s for Mastery and Vicarious Experience
- (ii) They could have been modest in many of those statements.

7.5 National Certificate of Educational Achievement - NCEA Level One Science Achievement, 2019 Data

The participants of the study were from three different classes taught by three different teachers. The teacher from one class consented to be observed, hence the Classroom Observation Data in section 7.3. Other consenting participants joined the group during the focus group interview and completed the Student Questionnaire. Since the participants were from three different classes, not all of them completed the same standards. Participants from one class (Class A) were offered all internal standards and their results are presented in Table 7.7, while Table 7.8 presents the results of the other three students from the other two classes who were offered five achievement standards including externally assessed standards. Both the Internal and external standards are labelled appropriately.

Table 7.9 Leep High School NCEA Level One Achievements (Class A)

Name of student	NCEA Level 1 ACHIEVEMENT STANDARDS ATTEMPTED				Number of credits attempted	Total credits achieved	Source of Self-efficacy
	Sci1.10 - Investigate life processes and environmental factors that affect them *Internal	<i>Science 1.4 - Investigate implications of heat for everyday life</i> *Internal	Science 1.7 - Investigate the implications of the properties of metals for their use in society *Internal	<i>Bio 1.2 - Report on a biological issue</i> *Internal			Primary and secondary sources of self-efficacy
Tevita	M	M	A	M	16	16	Verbal Persuasion and Mastery
Ma'ake	A	A	A	A	16	16	Verbal Persuasion and Physiological/ Emotional
Matiu	M	A	A	A	16	16	Verbal Persuasion and Vicarious Experience
Pita	A	M	A	A	16	16	Vicarious Experience and equal Verbal Persuasion and Mastery
Samiu	A	A	A	A	16	16	Equal Mastery and Vicarious experience

Assessment Grade guide: There are four grades for the NCEA **Achievement Standards**:

- Achieved (A) for a satisfactory performance
- Merit (M) for very good performance
- Excellence (E) for outstanding performance
- Not achieved (N) if students do not meet the criteria of the standard (MOE, 2020)

Table 7.10 Leep High School NCEA Level One Achievements (Classes B & C)

Name of student	NCEA Level 1 ACHIEVEMENT STANDARDS ATTEMPTED						Number of credits attempted	Total credits achieved	Source of Self-efficacy
	Science 1.1 - Demonstrate understanding of aspects of mechanics *External	Science 1.11 - Investigate biological ideas relating to interactions between humans and micro-organisms *Internal	Science 1.5 - Demonstrate understanding of aspects of acids and bases *External	Science 1.8 - Investigate selected chemical reactions *Internal	Science 1.9 - Demonstrate understanding of biological ideas relating to genetic variation *External	Physics 2.5 - Demonstrate understanding of atomic and nuclear physics *Internal			
Sione	NA	NA	A	E	NA		20	8	Physiological/ Emotional and Vicarious Experience
Lolo	NA	NA	A	M	NA		20	8	Vicarious Experience and Physiological/ Emotional
Fale	A	NA		A	NA	A	20	12	Physiological/ Emotional and Vicarious Experience

Assessment Grade guide

There are four grades for the NCEA **Achievement Standards**:

- Achieved (A) for a satisfactory performance
- Merit (M) for very good performance
- Excellence (E) for outstanding performance
- Not achieved (N) if students do not meet the criteria of the standard (MOE, 2020).

Table 7.9 shows that all participants in Class A achieved all their science credits from four standards. In Table 7.10, none of the participants who attempted five standards, achieved all. Only Fale attempted Physics 2.5 and achieved. Fale attempted two external assessments while Sione and Lolo attempted three external assessments, and all achieved in only one each.

From a learning perspective, Table 7.9 shows that the students in Class A were only offered 4 standards which means even less content was covered in this class. Having done the standard on life processes and researching a biological issue, it is an open question whether the students did learn anything about micro-organisms. As they did not do the externals, they would not have covered electricity or genetics. Seeing that they did not do a standard on mechanics their knowledge of physics would be very limited. They have not covered any geology or astronomy and would not have learnt organic chemistry.

Table 7.11 shows the NCEA results for Pasifika students from the other classes. Having been offered six standards, these three students would have learnt more science content. However, none of them achieved the genetics external or achieve in the internal standard for micro-organisms. Overall, these three students achieved fewer credits and it is highly unlikely that they would have a total of 80 credits to pass NCEA Level One.

7.6 Commentary on Self-efficacy and Achievement

Table 7.7 shows that all the participants from Class A achieved all the 16 credits attempted with Verbal Persuasion as a primary or secondary source of self-efficacy. Apart from Samiu who scored equal Mastery and Vicarious Experience as his primary source and Physiological/Emotional as a second source (Figure 7.9), all the other students in that class scored close to 4 and above for Verbal Persuasion. Verbal Persuasion was the main contributing antecedent to their self-efficacy.

Class A achieved well above their Pasifika colleagues and other Leep High School students (Table 7.9). It is also evident that they performed well above the National standards for those standards they achieved. One factor could be, with teachers like Ms Finau allowing them time to complete any outstanding assessment tasks for missing credits, suggests that

this class may have received a lot of Verbal Persuasion and Physiological/Emotional support from their teacher to perform outstandingly.

Table 7.11 Summary of NCEA Achievement Results Compared with the New Zealand National Average (Class A)

Standards	Percentage % of participants from the group who Achieved	Percentage % of Pasifika who achieved from Leep High School	Percentage % of students from Leep High School who Achieved	Achieved – National Average %
Sci1.10 - Investigate life processes and environmental factors that affect them <i>*Internal</i>	100	100	90.9	83.7
<i>Science 1.4 - Investigate implications of heat for everyday life</i> <i>*Internal</i>	100	82	90.5	80.1
Science 1.7 - Investigate the implications of the properties of metals for their use in society <i>*Internal</i>	100	82	100	84.8
<i>Bio 1.2 - Report on a biological issue</i> <i>*Internal</i>	100	91	86.4	81.3

National Average: Percentage of students in New Zealand who achieved that standard

It seems when the teacher provided Verbal Persuasion and Vicarious Experience, the students Physiological/Emotional need was taken care of, and students did well. Also noted during the focus group interview was that the participants who desired some ‘caring’ were in Class B and Class C. Verbal Persuasion was evident in my classroom observation of Ms Finau’s class. She encouraged them to help each other to complete any incomplete work to achieve the outstanding credits.

For the second group of participants, who attempted five achievement standards, their main sources of self-efficacy were identified as Physiological/Emotional and Vicarious Experience (Figure 7.9). All three participants failed to achieve all the 20 credits. However, they did all achieve in three of the standards as shown in Table 7.12.

Table 7.12 Comparison of NCEA Achievement at Leep High School with National Standards.

Standards	Percentage % of participants from the group who Achieved	Percentage % of Pasifika who achieved from Leep High School	Percentage % of students from Leep High School who Achieved	Achieved – National Average %
Science 1.1 - Demonstrate understanding of aspects of mechanics *External	33	36.4	80.6	73.1
Science 1.11 - Investigate biological ideas relating to interactions between humans and micro-organisms *Internal	0	44	72.7	79.7
<i>Science 1.5 - Demonstrate understanding of aspects of acids and bases</i> <i>*External</i>	100	60	75	77
<i>Science 1.8</i> <i>- Investigate selected chemical reactions</i> <i>*Internal</i>	100	85.7	91.6	86.1
Science 1.9 Demonstrate understanding of biological ideas relating to genetic variation *External	0	20	82.0	75.4
<i>Physics 2.5 - Demonstrate understanding of atomic and nuclear physics</i> *Internal	100	50	40	Not available

National Average: Percentage of students in New Zealand who achieved that standard

Another factor is that since the classes were not the same, the group that attempted Externals may have received a different form of Verbal Persuasion through teaching and instruction from their teachers. However, those participants clearly indicated in their student questionnaire that their primary and secondary sources of self-efficacy were

Physiological/Emotional and Vicarious Experience. It can be seen from this group that when Verbal Persuasion is missing, Mastery was not as high but Physiological/Emotional antecedent is high. Due to the timing of this data collection, the emotional pressure students were under to complete assessment tasks for missing credits and preparing for external exams could have also contributed to some of the responses.

7.7 Chapter Summary

As with Mercy College, the participants voiced their desire for more explanation of science ideas and Vicarious Experiences during the Focus Group Interview. While half of them were satisfied with the Verbal Persuasion and Vicarious Experiences their teacher was providing, the other half expressed some dissatisfaction. Some like Sione and Lolo felt left out when explanations are given and Fale expressed the desire for a little more care leaning towards the Physiological/Emotional antecedent.

Analysis of Student Questionnaire revealed Verbal Persuasion and Vicarious Experience as the two major sources of self-efficacy for the participants in the class I observed. The other participants indicated Physiological/Emotional and Vicarious Experience as their sources of self-efficacy. When all the mean Likert scores were collated, Figure 7.9 revealed that all the participants rated themselves highly for all the antecedents by scoring means above 3 for all antecedents. Only Sione scored himself an average of 2.5 for Mastery.

Classroom Observations revealed a tremendous amount of Verbal Persuasion in class through verbal encouragement. That could be the reason why all the participants from that class achieved all the four standards attempted. Since the other half of the participants were in a different class, they could be under a different expectation with a different teacher requiring a different approach to achieving the standards attempted. That may be why they scored highly for the Physiological/Emotional antecedent.

This poses a concern about the amount of science learning taking place in Leep High school. In Class A students were only offered 16 credits while the other two classes were offered 20 credits. What message does that give the students about how the school sees

them? Although students have achieved, they have learnt less and progression to the next level or pre-requisites for future science careers will be problematic.

There is evidence that the antecedents which the participants identified as their primary and secondary sources of self-efficacy may have contributed towards their NCEA Achievement. All the participants scored highly (above 3) for all antecedents. The group that achieved all the standards attempted identified Verbal Persuasion and Vicarious Experience as their primary and secondary sources of self-efficacy. The group that did not achieve all the assessment standards attempted identified Physiological/Emotional and Vicarious Experience as the primary and secondary sources of self-efficacy. However, with the group that expressed Physiological/Emotional antecedent as their primary source of self-efficacy, none of them achieved the 20 credits they attempted.

CHAPTER EIGHT

MĀLIE – DISCUSSION OF FINDINGS

Overview

“If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning.”

Mahatma Gandhi

This chapter answers the Research Question by discussing each sub-research question as a lead-up. Concordant with Pasifika Epistemology, three garlands or leis were woven from Grace College, Mercy College and Leep High School and presented (*Luva*) as findings in Chapters five, six and seven respectively. According to the *Kakala* Research Framework, after *Luva* is the *Malie* stage. *Malie* symbolizes the appreciation of the fragrance of the elements in the lei by the wearer or recipient. These elements represent the key findings to answer the research question - the smelling and appreciation of the distinct fragrant scent of the petals in the lei. In research contexts, the discussion (*Talanoa malie* – worthy conversation) exposes the relevance and worthiness of the findings in line with literature (Johansson-Fua, 2009, 2018).

Research Question: What are the Factors that Influence Pasifika Students’ Self-Efficacy in Science and Achievement in Science?

Sub research questions

1. What are students’ views about factors that support their learning in science?
2. What are the main sources of self-efficacy in Pasifika students’ learning in science?
 - 2a. What are students’ views about their self-efficacy?
 - 2b. What are science teachers’ views about Pasifika students’ self-efficacy?
 - 2c. What teacher actions or approaches during the teaching of science support the development of Pasifika students’ self-efficacy?
3. How does self-efficacy affect the overall achievement of Pasifika students?

Each section presents the key findings that emerged from the study and indicates the data sources and attempts to answer a sub-research question listed above.

I am aware of the caution by Usher and Pajares (2008) of the complexity involved in trying to assess, explain and predict self-efficacy beliefs at broad levels and may not totally correspond with the intended outcome (Bandura, 1997; Pajares, 1997). However, as this study was exploratory, the findings presented and discussed here may be expanded and enhanced in future. Each sub-research question is discussed in the light of the extant, recent, and relevant literature.

8.1 Students' views about factors that support their learning

This section attempts to answer sub-research question #1. The factors presented are from the analysis of the focus group interview with the participants. The first three views were common across all three schools and the fourth factor came from Leep High School. Students views are presented as:

- *Desire for more hands-on activities*
- *Practical Investigations*
- *More explanation by the teacher*
- *Friendships and group work*
- *Fear of Failing*
- *Desire for more 'caring'*

(i) Desire for more hands-on activities

The important and distinctive characteristic of scientific knowledge is that it allows for enquiry to test and provide material explanations for how and why materials and entities behave the way they do (Abrahams & Millar, 2008; Millar, 2004). Millar (2004) believes that science education should be aiming at helping our students to gain an understanding to:

- apply the science knowledge to their future needs, interests, and capabilities and
- develop an understanding and gain confidence in using scientific methods (Millar, 2004).

It is a widely held view that practical work enables students to develop their understanding of science (Abrahams & Millar, 2008; Millar, 2004). However, this does not always happen in school science as intended. Abrahams and Millar (2008) found that practical work as conducted in most classrooms is only effective at students being able to do what the teacher intended them to do (Level One of effectiveness of learning from practical work according to their model) and not effective at Level Two where students are expected to learn what the teachers intended them to learn (Abrahams & Millar, 2008). They suggested that if teachers had fewer learning intentions for a practical task and shared it with the students, practical work could be effective at Level Two. Moeed and Anderson's (2018) research in New Zealand found that when the teachers shared the intended learning with students and had fewer learning intentions from a learning task, practical work was effective at level 2 both in primary and secondary schools.

Abrahams (2009) found that while practical work may generate short-term engagement, it does not generate long-term motivation or interest in science. He suggests that those teaching sciences need to develop a more realistic understanding of how practical work affects the feelings and emotions of students (affective domain) when studying science. Abrahams (2009) also found that students responded to practical lessons more to avoid written work rather than learning from it and teachers believed that practical work was motivational.

However, Hodson (2014) argues that practical work is not the answer to all learning in school science and that different methods need to be used according to the different goals for science learning whether it is conceptual understanding, doing science or learning about the nature of science. He draws the distinction as explicit and implicit approaches of teaching Nature of Science (NOS). He explains that in the explicit approach, emphasis is placed on teaching science content. In the implicit approach, is the notion to teach science content using hands-on activities. The concern here is that, failure to teach science content adequately may lead to students failing to reach the conceptual understanding which teachers might be seeking. Hodson (2014) contends that a more explicit approach should be adopted to learning NOS as "learning science is too much important to be left to chance" (p.2535).

Similarly, Osborne (2015) argues that learning from practical work is misunderstood in school science as doing science is only one method for learning science along with reading

science, talking science, writing science, and using representations. He emphasises that practical work is just a part of testing science ideas and should not be the only way to teach and learn science.

This study found that in all the three schools, students expressed the desire for more practical work even though they seemed to have mastered 'fair testing' type of practical investigation and the importance of it. Some expressed that they liked science because it was fun, and they learn new things which aligns with previous research findings (Abrahams, 2009). Other participants said they just needed to stand and get out of their seats so wanted more practical work. This behaviour could point towards what Abrahams (2009) describes as, avoiding doing other work.

It is most probable that the implicit approach to teaching NOS as described by Hodson (2014) above may be at work. Practical investigations are not being used to test and confirm science ideas but rather, students are expected to master science ideas from carrying out practical investigations without a deeper understanding of content. That is leaving students asking for more explanations and more practical work. It is highly likely that they have mastered and enjoy doing 'fair testing' type of experiments with a recipe from the teacher, but are not able to plan and carry out a practical investigation on their own as they disclosed in the focus group interview. They have learnt to do and write what is only required of them for an assessment.

(ii) Practical Investigations

This study also explored what participants communicated about practical investigations. When asked to recommend some changes to a practical investigation they had carried out recently, participants from Grace College and Leep High School said they would not make any changes. They would keep teacher instructions as it was comfortable to follow a recipe provided by the teacher. Most of Mercy College participants also said they would not make any changes except for Savea who wanted to change the type of shoes used for running. Savea had thought about the practical investigation and realised that in a running activity, you need running shoes. He said, school shoes were not appropriate for running and would affect the results. This shows that Savea understood the effect of a change of a variable on

the outcome of the investigation. Although all students carried out a fair testing type of investigation, this was the only example given that demonstrates controlling variable. To gain credits students need to demonstrate that they can control variables however, this appears to be limited to rote-learning the answer and presenting it in the assessment.

Moeed (2015) reports that, while teachers said that science investigations were motivating and engaging, students prefer it to doing written work. Moeed (2016) added; that year 11 science students were motivated if the practical investigation carried an element of novelty, variety, and relevance in students' everyday life. If that was not motivational, it would be something perceived as more beneficial, such as obtaining credits. This study has found Year 11 students being motivated by accruing credits towards NCEA qualification.

This research has found that some students are being left behind and denied Vicarious Experience when the teacher 'misses' them during practical demonstrations. At Leep High school, a concern was raised by students that some teachers were 'selective' over which students they show the experiment/demonstration to. Students in this study resorted to asking their friends what they saw and learning off their friends and thus miss out on that teacher-student engagement, the Vicarious Experience and Verbal Persuasion from the teacher during discourse. When asked what they would do to get a better view of what the teacher was demonstrating, the common answer was; "move and get a better view" or ask the teacher to repeat or ask their friends in class.

(iii) More explanation by the teacher

At Grace College two students wanted to understand the science idea to enable them to work out what the practical task was intending to illustrate. They wanted the teacher to explain the theory more. Keasi, and Tole wanted more explanation of content while Hema said he did not like the theory part but if it was explained more, he could understand it better. Hema was the student who would sit and internalise the instruction before moving. Hema needed to understand what he was doing before he executed it. Understanding the science idea would have helped Hema to work out what the practical intended to illustrate. Not understanding content may lead to negative emotions making students feel powerless and frustrated. To the teacher, it may seem as though they showed a lack of effort leading to

low achievement (Ghasemi, 2021). Here it seems, more explanation of content would help others like Hema. However, Keasi who had high Mastery and got started straight away, still needed to understand what she was doing. During classroom observation, I saw that she would ask the teacher to come and check her set-up before proceeding.

At Mercy College, Manu, Savea, Tita and Seini all wanted content to be explained more. Seini, like Hema from Grace College did not like learning the theory but said she wanted more explanations. It is possible that they had learnt dependency on the teacher providing them with all the information as they did for practical investigations. Recently, Ghasemi (2021) found that teachers and their practices are prominent factors in promoting or alleviating *Learned Helplessness* symptoms and behaviour in students learning English as a second language. Learned helplessness is further discussed in section 8.3.7.

A teacher has the capacity to positively or negatively reinforce the self-efficacy of the students through effective teaching process (Britner & Pajares, 2006). Bonne and Laws (2016) agree that self-efficacy can be reinforced through the teaching learning process. Although a teacher may demonstrate a practical and assume the students get on with it, they still need to understand what they are testing and why. In that sense, Cherry (2016) supports Bandura (1997) that building self-efficacy is not just giving positive appraisals and advocates for Verbal Persuasion as it is powerful and encourages a measurement of success in terms of self-improvement rather than just watching others and having Vicarious Experiences. Pajares (2002) describes Verbal Persuasion as developing self-efficacy beliefs from 'social messages' from others to cultivate their own beliefs in themselves. Ackerman (2021) asserts that people's words can have a positive impact on self-efficacy. She gave the example that if a child is told and reminded that they can face any challenges, it will add to their own belief that they can succeed.

At Leep High School, one class was happy with their teacher, while students from the other two classes were not. Like participants from Grace College and Mercy College, they wanted their teacher to spend more time explaining content well so that they could understand what they were testing. Overall, it appears that students wanted to understand the science ideas associated with the investigation and are asking for more explanation.

(iv) Friendships and group work

Students from all three schools said that friendships were important to them and that they enjoyed working in groups. Sometimes they selected their own group mates, other times their teacher assigned them a friend to work with which they all enjoyed. Studies by Marder (2009) showed friendships as having no significant correlation to self-efficacy. However, the value of friendships may be in the Vicarious Experiences of watching and seeing a task being successfully performed by a friend which raises their Physiological/Emotional state of mind and become more ready to attempt it for themselves (Usher & Pajares, 2008).

Özlem and Melike (2015) found that 'group work' had a positive effect on the self-efficacy of a group of social work students. They argue that group work is an important intervention method for social interactions which allows students to build on skills in strengthening and understanding people differences. During group work, they help each other, despite their differences. These researchers assert that the advantages are vast ranging from; mutual assistance, empathy, feedback, building and instilling hope, socialization, looking for what is normal and seeking approval and social support from friends.

Therefore, group work not only allows for Vicarious Experiences through watching friends perform a task successfully, it also arouses the Physiological/Emotional state of readiness of mind to attempt that task. During group work, participants were given verbal feedback by the teacher as Verbal Persuasion to complete the task or practical investigation.

(v) Fear of Failing

When asked what motivated them and kept them in science, all the participants of the three schools said they needed to achieve the credits because they did not want to disappoint their parents and family. It seems the achievement credits are no longer incentives but rewards, serving more like an extrinsic motivator. When I asked the students what they wanted to be in future, most of them across all three schools did not know what they wanted for a career in future. For them passing Level One was more important than a career which was many years away. Elliot and Thrash (2004) report that the fear of failing in most cases is adverse in nature rather than helpful. Fear of failing lies within the affective and selection processes (Bandura, 1993) of perceived self-efficacy (discussed in Chapter 3.3.1); and it typically

influences people to adopt specific avoidance-based goals. In other words, they set goals that are specific to what is required of them to achieve that specific outcome and avoid trying a task they consider too hard (Elliot & Thrash, 2004). Jang-Jones and McGregor (2019) noted a fear of failing factor with the PISA results. Out of the 22 participants studied, 14, (64%) indicated Verbal Persuasion as the source of their self-efficacy. It could be that fear of failing causing them to rely on Verbal Persuasion to lift their self-efficacy.

(vi) Desire for More ‘Caring’

Caring lies within the Physiological/Emotional realm of self-efficacy antecedents. Lewis et.al (2012) emphasise the importance of establishing dialogue through caring to facilitate a common understanding between teacher and pupil as seen among Hispanic children. They found the self-efficacy of children with caring teachers was higher than those with teachers that were not so caring. Hunter (2013) states that when students feel that their experiences and perspectives are valued, this leads to a sense of belonging paving the way for improved achievement levels (Chapter 3.2.3). This research found that the students who voiced the need for ‘care’ from the teachers did not achieve the 20 credits they were aiming for (Table 7.8).

8.2 Main Sources of Self-Efficacy in Pasifika Students’ Science Learning

The main tool used to determine the sources of self-efficacy was the Student Questionnaire. The analysis process has been described in Chapter 4.5.3.4. to answer SRQ2 and SRQ2a in each of the three schools (Chapters 5.1.2.5, 6.1.2.5 and 7.1.2.5) each have presented the findings of the sources of self-efficacy in the three schools studied. Even though Mastery is the desired antecedent, Verbal Persuasion and Physiological/Emotional antecedents showed to be important antecedents among the participants.

8.2.1 What are students’ views about their self-efficacy?

Chapter 4.5.3.4 described how the participants’ views about their perceived self-efficacy was determined. Students were provided with statements and they indicated to what extent they agreed with them. The resultant Likert values were averaged for all four

antecedents and plotted using Microsoft excel (Figure 5.9, Figure 6.9, and Figure 7.9). The highest peak on the histogram for each student was his or her primary source of self-efficacy. The second highest peak corresponded to the secondary source, the third highest, to the third source and the lowest peak to the least source of self-efficacy. The results showed that for some participants there was more than one dominant antecedent. Those were categorised as equal primary with the other antecedents that showed up beside it.

Of all the views explored, Verbal Persuasion stood out as the most selected antecedent of self-efficacy among the participants. Out of the 22 participants, 12 (54%) selected Verbal Persuasion as the primary source of their self-efficacy. Five selected Mastery, four selected Vicarious Experience and three selected Physiological/Emotional antecedents. This suggests that Pasifika students' self-efficacy is in many cases influenced by the Verbal Persuasion antecedent. It was observed that students' enthusiasm was low, and they were not confident about working on their own. They needed their teacher's persuasive comments to engage in the learning activities. Requiring Verbal Persuasion may mean two things.

- (i) Students need to understand the content well before they can confidently do that practical. They needed to comprehend the science idea, that underpinned their investigation.
- (ii) They have learnt to wait for the teacher to provide them the information to rote-learn what was required for assessment of practical investigation.

It was observed that in many cases the requirement of the assessment was given to the students as the aim to investigate. They had not done any exploration to come up with the question they were looking to find the answer to. It almost appears they did not know why they were doing what they were doing.

8.2.2 What are science teachers' views about Pasifika students' self-efficacy?

The science teachers' views about Pasifika students' self-efficacy were explored through teacher interviews. All three teachers had similar views about students' enthusiasm.

At Grace College, Ms Smith said that students were quite enthusiastic working in groups but not individual tasks like bookwork. This suggests that students needed to see someone else perform a task before they attempted it, indicating a low self-efficacy, and needing Vicarious Experience. So, she allowed them to select their own group mates but

sometimes chose whom they should work with and she said she found it worked well with them.

At Mercy College, Mr. Williams said, he observed Pasifika students generally had a lack of “confidence to try”, which may be the reason for low self-efficacy. So, he “held their hands” and guided them through step by step, otherwise, they would not even try. Mr. Williams offered both Vicarious Experience and a lot of Verbal Persuasion encouraging them to try. Mr. Garcia found Pasifika students generally took a bit longer to grasp things, so he felt they needed a bit of support to unpack the science concepts for understanding. That indicates the need for Verbal Persuasion to help them understand the concepts.

Analysis of teachers’ overall perceptions suggests that all the teachers framed self-efficacy as students’ needs. All three teachers said their students had high literacy needs. All three teachers suggested that Pasifika students struggled to connect their ideas and express them in their writing (Section 5.2, Section 6.2.1, and Section 6.2.2). When asked what they would change if they were to teach science to this class again, they all had different ideas.

Ms Smith said she would offer a variety of learning activities for the likes of Tole who liked puzzles to help them with word-building (Table 5.2.). She said she noticed Keasi wrote a lot of things but would often miss connecting the main ideas (Table 5.2). Keasi needed help to connect ideas. Ms Smith also talked about Tole, who liked a variety of activities; Malakai and Fatai who preferred to write on the white board than in their books; and Hema, who would sit in his chair and only moved when Ms Smith urged him to get started. This to me indicated Ms Smith was aware of her students’ individual needs and was prepared to try out new strategies to help them.

At Mercy College, Mr. Williams said he would not change anything; he believed his approach to help students achieve was working quite well. The school approach to separate the students in this way was to ensure greater numbers of achievements at Level One. Those who they felt would not achieve their Level One were placed in a class where only internal assessments were offered. Mr. Williams felt that chunking the work and giving the students in small amounts might help them achieve those credits. Both Mr. Williams and Ms Smith scheduled several teaching periods to carry out the tasks for the achievement standard. Mr. Garcia felt more scaffolding by offering them simple exercises to begin with might help them

build on what they already know as proposed by Mahuika, Berryman, and Bishop (2011). Ms Finau did not do any revision work in science with them but allowed them five whole periods to do catch-up work on their own.

According to Millar (2004) one of the aims of science education is to help students to understand scientific knowledge and its appropriation and application for their needs and interests in their own capacities. This research has found that the students were lacking deep understanding of content as they expressed during the focus group interview (Table 5.1, Table 6.1, and Table 7.2). The differences between a 'Deep approach' and 'Surface approach' has been described by Entwistle (2005a) in Chapter 3.5. Sometimes students choose to attempt to understand the material for future utility and sometimes they learn just enough to pass the course with limited effort or very little engagement. Each of these intentions brings into play their own processes of learning that may "lead to different learning outcomes and levels of understanding" (Entwistle, 2005a, p. 1).

Students in all three schools said they would like their teacher to explain more (Table 5.2, Table 6.2, and Table 7.2). My two probable interpretations are:

- (i) The students did not understand the theory behind those practical tasks and were asking for more explanation. It appears they did not know why they were doing this practical investigation. They were probably just trying to complete the practical work for assessment purposes only and found it hard to connect the underlying science ideas. This aligns with a 'surface performance' described by Entwistle (2005a) as a 'surface learning approach' (Chapter 3.5.1). In this approach, the intention is to learn the procedures necessary to fulfil the assessment requirements and not on the underlying science ideas. In contrast in a 'deep approach', there is vigorous interaction to understand content, relating ideas to previous knowledge and experiences. This approach leads to Mastery and is linked to an academic interest in science (Ashwin, 2019; Entwistle, 2005a; Palmer, 2005).

In a cultural modelling perspective, Brown and Ryoo (2008) proposed a 'content first' approach to teaching science, where everyday language is used to introduce the primary ideas of the content first to familiarise students with the

concepts before the scientific phenomena, including formulae are taught. This model was used in literacy studies and mathematics (Lee, 2006) to help students from minority cultures to value their own cultural practices and apply them to classroom learning practices. However if this model is to be used in teaching science, there would need to be a redesign of the science curriculum (Brown & Ryoo, 2008).

- (ii) The second explanation could be that they could be used to being spoon-fed so they are asking the teacher to give them the information they need to write instead of searching for information themselves or indeed thinking for themselves.

Even though this study did not measure teacher self-efficacy, teacher perceptions of their students did play a major role in how they presented the assessment material and tasks. Teacher self-efficacy has a positive impact on the students' academic achievement (Khurram & Naureen, 2017). Numerous studies have shown that teacher perception has a positive correlation with student's academic achievement. Tschannen-Moran and Johnson (2011) found teacher self-efficacy also influences how teachers perceive the cognitive ability of their students (Chapter 3.7.3). Tschannen-Moran and Johnson (2011) found that the greatest challenge was when teaching students with a wide range of reading abilities. However, a teacher with high self-efficacy will tend to be highly motivated to find challenging activities for his or her students. Teachers with low self-efficacy tend to have low expectations of their students and do not attempt to find challenging activities for them (Tschannen-Moran & Hoy, 2007). Studies by De Boer et al. (2018) also found that if teacher expectations are raised, it would also be possible to increase student achievement with appropriate interventions.

8.2.3 What Teacher actions or approaches during the teaching of science supported the development of Pasifika students' self-efficacy?

As reported in Chapters Five, Six and Seven, the four teachers took four different but similar approaches to support the development of Pasifika students' self-efficacy. Similarly, they all wanted their students to achieve Level 1. They designed their lessons according to their own plans and the type of class they were teaching. The class selection and allocation of

students was done by each department head and school administration, something which teacher and students had no control over. They all saw Pasifika students as being like any group of young learners, no different to students of other ethnic groups. What was observed between the four teachers and their students was mutual respect and open communication.

The differences, however, were in their approaches. Jerant, To, and Franks (2015) state that to tailor personal and Vicarious Experiences to enhance self-efficacy is very complex to develop and implement.

At Grace College, Ms Smith said, she liked the ‘honesty’ of the Pasifika students. She found them not afraid to tell her their likes and dislikes which she respected. She assisted and attended to every student who asked for her help, in return they offered their help freely to clean up or put away laptops they had used in the storeroom. I saw her paying close attention to the students who needed help the most. One such student was Hema, whose primary source of self-efficacy was Verbal Persuasion, and he achieved all his 20 credits for science. Maikolo’s Likert scores for Physiological/Emotional was equal to the Verbal Persuasion antecedent (Figure 5.9). Ms Smith’s approach was to allow Fatai and Maikolo use the white board to write their notes on instead of writing in their books. She then took pictures of the writing and sent to them. That strategy paid off when both Fatai and Maikolo achieved that standard, Sci 1.7 AS90946 (Table 5.5).

At Mercy College, Mr Williams was concerned that Pasifika students did not have the ‘confidence to try’ so he broke down his practical investigation write-up into sections. He allowed them class time to write each section of the practical report and assisted them through to achieve. He moved around the room, to every student in class and paid attention to those who had a question for him. All but Ana achieved that standard, one with an Excellence endorsement and two with Merit endorsements (Table 6.8). However, this level of help has been criticised by Hume and Coll (2009) who suggest that it is training the students to perform in the assessment rather than helping them to learn how to investigate.

Mr. Garcia felt he needed to guide his students step by step through the Force, mass, and acceleration calculations (mechanics) so that they Master how to read the questions and understand what it is asking for. During the ‘helicopter practical’ he used questions to gauge students’ understanding. It was a big class of 32 but Mr. Garcia went to every table, to check

with students including Manu that they were on the right track. This may have resulted in Manu whose source of self-efficacy was Mastery, achieving all his 20 credits (Table 6.9).

I was not able to interview Ms Finau at Leep High School, but I did observe her classes. She was a teacher full of encouragement for her students. Her students spoke highly of her during the Focus Group Interview. Since it was towards the end of third term that I did the observations, she had finished teaching the term. So, the class was allowed class time to catch up with any outstanding achievement standards that they had not completed which suggests that she wanted the students to have the best possible outcome in achieving the credits in all other subjects so they would have the requisite 80 credits at NCEA level one. All the participants from Ms Finau's class achieved all their 16 science credits as presented in Table 7.7.

8.3 Relationship of Self-Efficacy and NCEA Achievement of Pasifika Students in Science

This section aims to answer sub-research question three, discussing the four antecedents of self-efficacy and in relation to participants achievement of the NCEA achievement standards.

Chapters 5.1, 6.1 and 7.1 have reported my 22 participants' perceived sources of self-efficacy. Most had one antecedent as a primary or secondary source of self-efficacy but there were some that had two or three antecedents as equal primary or secondary sources suggesting a possible an interplay of these antecedents. According to Bembenuddy et al. (2016), for the reciprocal effect of self-efficacy to occur, in a classroom environment, one has to take action to affect the environment (Figure 3.5). For example, a student might ask the teacher to repeat a demonstration seeking clarification and make the teacher pause or slow down. In doing so, the students gain the Vicarious Experience of seeing it being done, as well as building on their Mastery. Hence one may have a secondary source of self-efficacy that may be equal to their primary source, each antecedent operating to reinforce the reciprocity of their overall self-efficacy (Bembenuddy et al. (2016). Several participants had equal first or secondary sources of self-efficacy, Fatai, for example had three antecedents as his secondary source of self-efficacy. This research also found a trend on how these antecedents may have influenced participants' NCEA achievement. Table 8.1 below summarizes that finding.

Table 8.1 Percentage of Students who Achieved Against Source of Self-Efficacy

Antecedent as Primary or secondary source of self-efficacy	Number of participants who perceived the antecedent	Number of participants who Achieved	Percentage
Mastery	8	7	87.5
Vicarious Experience	16	8	50
Verbal Persuasion	16	10	62.6
Physiological/Emotional	8	3	37.5

*Note: Percentages calculated from totals indicated for primary and secondary sources due to the overlap of equal voting of antecedents by some participants.

According to Table 8.1, Mastery was found to be the most powerful of the four antecedents influencing achievement. 87.5% of the participants who indicated Mastery as a primary or secondary source of self-efficacy achieved all the credits, they attempted. Of those who indicated Verbal Persuasion as their antecedent 62.6% achieved all the credits they attempted, 50% of those who indicated Vicarious experience achieved all the credits they attempted and 37.5% of those who indicated Physiological/Emotional achieved all their credits. However, over half the participants indicated Vicarious Experience and Verbal Persuasion as an antecedent but these do not appear to have translated as strongly into achievement as the Mastery antecedent. Figure 8.1 below summarizes the self-efficacy-achievement pathway discovered in this research.

Figure 8.1 Self-Efficacy-Achievement pathway

The data showed that students with high Mastery achieved all their credits. Over half of those that indicated Verbal Persuasion and Vicarious experience also achieved. Verbal persuasion and Vicarious Experience were the two most common antecedents of self-efficacy among Pasifika students studied. However, out of all those that did not achieve all their credits were ones that had physiological/emotional antecedent as their primary or secondary source of self-efficacy, even though they had a high overall perceived self-efficacy. This research showed a positive relationship between self-efficacy and science achievement in the Pasifika students studied.

8.3.1 Mastery, Self-Efficacy and Achievement

Mastery is said to be the most powerful of all sources of self-efficacy and the most effective way of developing a strong sense of self-efficacy is through mastery experiences where these experiences enable a person to overcome their fears and perfect their skills (Bandura, 1997; Tschannen-Moran & Hoy, 2007). That strengthens their perceived self-efficacy and “can reduce their vulnerability to dysfunction” (Bandura, 1986, p. 259).

Evidence from this study shows that students who scored themselves a Likert score of 3.5 and above for Mastery as a Primary or secondary source of self-efficacy achieved all the credits they attempted. In Grace College, Keasi and Kolo whose primary source of self-efficacy for science was Mastery, both achieved all the 20 credits they attempted. Tole’s secondary source of self-efficacy was Mastery, he achieved all his 20 credits too (refer to Table 5.1). However, for Fatai even though his primary source of self-efficacy was Mastery, his average Likert score was under 3.5, around the borderline mark of 3.0 (refer to Figure 5.9). His scoring lower for the antecedents other than Mastery may indicate an overall needy student. When Fatai filled out his student questionnaire, he marked 3s for most of the statements which may be why his overall average was at borderline. There may have been other Physiological factors involved where he was not willing to disclose; maybe attention span on a sheet of paper in black and white; difficulty reading; not understanding the question; or he was not too sure of himself and how to rate himself and kept himself at borderline. Kreitchmann, Abad, Ponsoda, Nieto, and Morillo (2019) propose that Likert scale responses may well have biases such as “social desirability” and “acquiescent responding” (p. 2309). As the researcher, I consider he might have had difficulty reading and writing because I observed in class that he took very long to write in his book.

At Mercy College, Manu, whose primary source of self-efficacy was Mastery, achieved all his 20 credits. Savea who scored highly on all four antecedents, had an average of 3.9 for Mastery. He achieved all his 20 credits despite his primary source of self-efficacy being Physiological/Emotional and Mastery as third source of self-efficacy. There was only one participant from Leep High School who indicated Mastery equal with Vicarious Experience as his primary source of self-efficacy. Two others indicated Mastery as secondary sources; they all achieved their 16 credits attempted.

Bieg, Reindl, and Dresel (2017) suggest that there could be an intrinsic aspect driving Mastery which may have been the case for the participants who had Mastery as their primary source of self-efficacy. However, there could also be external rewards such as obtaining credits to achieve Level One. It could also be a case of learning to master the activity rather than learning science for future utility, for example mastering how to plan and carry out a 'fair testing' type of science investigation in order to achieve the standard (Hume & Coll, 2009). Studies by Hume and Coll (2009) found students could become reliant on their teacher to provide assessment specifications and what evidence was required for them to achieve. Teachers' attention turned towards assisting students on how to meet those criteria for their achievement:

...teachers are implementing a narrow interpretation of formative assessment in classrooms using techniques that focus on assessment procedures and practices to assure students comply with criteria and achieve awards for external qualifications. This variation on 'teaching to the test' has led to the coining of the phrase 'assessment as learning' to indicate the instrumentalism that results from such restricted practice (Hume & Coll, 2009, p. 269).

For example, Seini was happy to sit and wait for her friend Tita to finish her work so that she could copy from her or wait for Mr. Williams to come around so that she could ask him exactly what she needed to put down on the paper to achieve the standard. Seini's primary source of self-efficacy was Verbal Persuasion and she achieved all her credits (Table 6.10), most probably through being reliant on her friends and her teacher for the Verbal Persuasion. Therefore, it can be argued that the antecedent 'Mastery' is only present in a few students and achievement among students who indicate Mastery as an antecedent is high. However, also present in the schools is mastery of learnt, practised reporting of the assessed

investigation (Hume & Coll, 2009). My observations at Mercy College (Chapter 6.8) supports this possibility.

8.3.2 Vicarious Experience, Self-Efficacy and Achievement

Vicarious experiences are where one builds one's own self-confidences and self-efficacies by observing others similar to oneself accomplishing a task (Usher & Pajares, 2008). Out of the three schools studied, Vicarious Experience showed as the primary source of self-efficacy for 50 percent of the participants of Leep High School. Two of them achieved all the 16 credits attempted from Internally assessed standards and two did not achieve all the 20 credits they attempted from a class where externals were offered. During the focus group interview, Leep High School participants talked about their desire for more practical work. It seemed like they were hungry for more practical work but divided on how they interacted with their teachers. One group said their teacher was supportive and provided them with lots of practical work and encouragement. However, the other group said their teacher was only supportive selective towards a certain group of students when it came to practical demonstrations. Sione and Lolo said most times they were left to either ask the teacher to repeat the demonstration or ask their friends what they saw (Table 7.1). Literature states that young students are always looking to find role models in their lives and their teachers fit this social model in a powerful way to influencing young people's self-efficacy (Schunk, 1997). Fale and Sione said during the focus group interview that they were able to ask their friends for help if they missed out on a lesson or just needed some help. Friendship bonds enable students to compare themselves to classmates, peers and help each other out by learning together vicariously (Schunk, 1991; Usher & Pajares, 2008).

Vicarious Experience was consistently evident as a major source of self-efficacy for Grace College and Mercy College. Seven out of eight participants from Grace College; had Vicarious Experience as a secondary source of self-efficacy. Out of those seven, four achieved all their 20 credits. However, for Leep High School, 50 percent of the participants did not achieve their credits even though Vicarious Experience was a primary source of self-efficacy. This evidence emphasises the importance of providing the opportunity for students to see science being modelled, (Abrahams, 2009; Abrahams & Millar, 2008). However, an observation at Mercy College is that, even though the teacher demonstrated metal expansion

and had all the students paying close attention to what he was doing, they were reluctant to have a try holding the metal ring over the Bunsen burner. This could indicate two things:

- (i) they were too shy, lacking the confidence to try or
- (ii) (ii) they have not had this kind of practice before and were not motivated to try.

Here was an opportunity for some of their friends to try and they did not. Some of the students could have been stimulated to try if only they saw a friend try it first.

8.3.3 Verbal Persuasion, Self-Efficacy and Achievement

In this study, Verbal Persuasion was the most selected antecedent as a primary or secondary source of self-efficacy. Table 8.1 shows the greatest number of participants who achieved had Verbal Persuasion as a primary or secondary source of self-efficacy. Verbal Persuasion was either a primary or secondary source of self-efficacy for all the participants from Grace College. Hema whose primary source of self-efficacy was Verbal Persuasion achieved all his 20 credits even though his average Likert score for Mastery was under 3.5. He might have been modest and unsure about how to score his Mastery. He told me during the focus group interview that he spent time internalizing everything before he moved to do a task (Table 5.1.) This could mean spending time to confirm his cognitive Mastery and waiting for a nudge of Verbal Persuasion to make the move.

Verbal Persuasion showed to be a strong antecedent as a source of self-efficacy for the five participants from Mr. Williams' class. Three of them achieved all their 20 credits attempted and one missed out on one standard (Table 6.8). Classroom observations (Table 6.x) showed them waiting for instructions from Mr. Williams most of the time. They engaged in unrelated light talk while waiting for Mr. Williams instead of concentrating on the task. Waiting for instructions is a sign of waiting for Verbal Persuasion. Schunk (1989) states that verbal encouragement, persuasive speech and feedbacks all go towards lifting the self-efficacy of a person to strive to achieve but if one has negative experiences, they are bound to reconsider when attempting the same task in future. In this study Verbal Persuasion was an important antecedent that showed a strong link to achievement.

8.3.4 Physiological/Emotional Self-efficacy and Achievement

Schunk (1989) asserts that if someone is successful in accomplishing something, it will raise their self-efficacy and their failures will lower it. Being able to do something involves physique and telling yourself you can do something involves emotion, and therefore I will split this section in two, treating Physiological and Emotional aspects separately.

8.3.4.1 Physiological. With a purposive sample gender based physiological differences could not be controlled. In one co-educational school, there were more boys than girls, and in the other, it was the opposite. However, all the participants were aged between fifteen and sixteen therefore there was very little age bias.

Maikolo from Grace College was the only student who scored a high Likert value of 5.0 for Physiological/Emotional antecedent. Maikolo wore prescription glasses. Maikolo had equal Physiological/Emotional and Verbal Persuasion antecedents as his primary sources of self-efficacy and achieved 16 out of the 20 science credits he attempted.

At Mercy College, Savea came to class wearing prescription glass on one day. The rest of the time, he did not wear them. He probably did not want to wear the glasses every day or he probably had contact lenses of which he did not want to disclose to me. Both Maikolo and Savea indicated Physiological/Emotional as their primary source of self-efficacy.

8.3.4.2 Emotional. Telling yourself you can accomplish a task involves Physiological and Emotional arousal and in some may involve sweating, or anxiety (Schunk, 1989). On the negative side, Margolis and McCabe (2006) state that, low self-efficacy beliefs, may impede academic achievement and in the long run lead to learned helplessness and poor psychological well-being. Learned helplessness is further discussed in Section 8.3.7.

At Grace College I observed Fatai continually leaving the room as soon as Ms Smith had finished speaking (Table 5.9). He may have had other Physiological and Emotional issues like anxiety that he may have been struggling with internally. He could have been telling himself, "I can do this" but needed to leave the room to regain composure before returning and attempting the task. That could have also contributed to him refusing to write on paper rather than on the white board. Margolis and McCabe (2006) explains this behaviour as that

of a struggling learner who feels uneasy, anxious, and probably believes they might fail. When overcome by such emotions, the learner might disrupt the class or try to escape doing the task. That may explain why Fatai kept leaving the room but returned because he knew he wouldn't get the credits if he didn't complete the required task. Margolis and McCabe (2006) state that typically such 'escape behaviours' reduces anxiety but causes more escape behaviour; they advise teachers to spot struggling learners' with physiological reactions such as this.

Self-efficacy can be strengthened by learning relaxation techniques and ways to deal with the irrational thoughts that provoke these Physiological/Emotional responses. If struggling learners suffer excessive anxiety, it may lead to an overall low academic self-efficacy resulting in non-achievement (Margolis & McCabe, 2006). Another strategy to help students with low self-efficacy would be to place them with a peer whom they can identify with and learn from, known as a 'coping model' (Margolis & McCabe, 2006). Ms Smith successfully used this strategy to separate Fatai and Maikolo and have them work together. Although Fatai achieved the standard I observed them doing, he only achieved 12 out of the 20 credits he was aiming for (Table 5.5).

At Leep High School, the three boys who scored Physiological/Emotional as either primary or secondary sources of self-efficacy did not achieve the 20 credits they attempted. Sione who had Physiological/Emotional as his primary source of self-efficacy, said he 'switched off' and did not concentrate when his teacher talked too much about things unrelated to the lesson. Sione only achieved 8 out of the 20 credits he attempted. Fale who wanted more 'caring' from his teacher, scored a very high Likert average above 4.5 for Physiological/Emotional as secondary source of self-efficacy (Figure 7.9). He achieved only 11 of the 20 credits he attempted. Lolo was almost a bench sitter, and he had this antecedent as his secondary source of self-efficacy and achieved only 8 out of the 20 credits attempted. Clearly, the findings from Leep High School may have been more on the Emotional side than the Physiological side as no participant showed evidence of a physical impairment. Most scored average Likert values of above 3.5 for almost all the antecedents, indicating high self-efficacy; however, their non-Achievement of all the science credits attempted could be for reasons other than just self-efficacy.

The emotion of 'fear of failing' may also negatively impact Pasifika students' achievement if it lowers their science self-efficacy (Burns, Martin, Kennett, Pearson, & Munro-Smith, 2021). Jang-Jones and McGregor (2019) also found 'fear of failing' as a factor evident on PISA self-efficacy tests.

8.3.5 Internal Versus External Assessment and Self-Efficacy

Chapter 4.5.2.6 described the NCEA Level One requirements for students to successfully complete that Level. A requirement by the Ministry of Education is that schools find ways to adjust their programs to cater for the underachieving Māori and Pasifika priority learners (Te Kete Ipurangi, 2013). One of the strategies as found with Mercy College and Leep High School is to stream students into Internal assessment only classes and the rest of them into internal and external assessment classes.

Section 8.1 described the factors affecting students' self-efficacy. The three groups studied were all different. All the participants from Grace College were from one class which I observed and who participated in both the focus group interview and Student Questionnaire. This group mostly had Mastery and Verbal Persuasion as their primary or secondary sources of self-efficacy. They did both internal and external achievement standards. Four students did not achieve one Internal standard, while two students did not achieve one External standard each, out of the two externals attempted by this class. The overall achievement by Grace College was satisfactory except for Physics 1.1 AS90935 where four students did not achieve that Internal Standard. This class also performed better than their Pasifika cohort at Grace College.

As for Mercy College, the one high Mastery participant who attempted externals achieved all his 20 credits (Table 6.9). In the other class, three out of the five participants who did only internals, achieved all their 20 credits (Table 6.8). Their perceived primary and secondary sources of self-efficacy were mainly Verbal Persuasion and Vicarious Experience.

In the third school, the focus group was a mixture of three different classes. Only five were from the class I observed, and all achieved all the 16 credits they attempted. They perceived Verbal Persuasion and Vicarious Experience as their primary or secondary source of self-efficacy. It seems they achieved due to a lot of Verbal Persuasion and support from

their teacher Ms Finau who they said during the focus group interview was kind and very helpful. Two of the other three participants only achieved eight credits while one achieved 11 credits out of the 20, they attempted. This was the group who told me they wanted their teachers to be a little more 'caring' towards them. All three perceived Physiological/Emotional antecedent and Vicarious Experience as their primary and secondary sources of self-efficacy.

It is evident that perceived Mastery proved to be a key player in students' achievement overall. Verbal Persuasion and Vicarious Experience were the important antecedents for the participants that were assessed through Internal standards only. As was observed in two of the schools, some Internal assessments may take up to two or three weeks doing the same thing until they master a task or are given a lot of time to complete it. Time is lost in this approach and the idea of being dependent on the teacher must be considered. Students who are streamed into 'internals only' classes may be considered not capable of doing the Externals. This could possibly have an impact on their self-belief, their ability and self-efficacy. Career pathways in science could possibly be limited in the long term.

8.3.6 Distinction Between Interest, Motivation, and Self-Efficacy

Chapter 3.4 described how interest, motivation, and self-efficacy are inter-related. However (Abrahams, 2009) clarifies the distinction between motive and interest. *Motive* is an inner drive to cause an action (Bandura, 1986) while *interest* is a fascination with something (Abrahams, 2009) and self-efficacy is the energy source of that inner drive. In other words, Motivation is the inner drive that gains its energy from self-efficacy.

Chapter 3.7.1 described the factors that affect student self-efficacy. These are their perceived self-efficacy, teacher efficacy, and collective or school efficacy. The students are interested in doing science for intra-personal reasons; one of which is achieving the credits on offer. Achievement of credits becomes an intrinsic motivator or motive. Teachers on the other hand through the school are happy to provide the environment for them to achieve. So, they provide the extrinsic motivation which is also achievement of credits. Teachers also provide the tasks and time necessary to achieve those credits. Students' achievement

depends on how they go about completing the required tasks provided by the teacher or school.

Here is a scenario:

Motivation says: Yes! Let's do it to get those achievement credits.

Self-efficacy says: How are we going to be able to do it?

Self-efficacy then calls on its four commanders (sources of self-efficacy): Mastery, Vicarious Experience, Verbal Persuasion and Physiological/Emotional aspects.

Mastery says: Yes, I know how to do it, I can read instructions and figure it out.

Vicarious Experience says: Show me an example to see how it works to know what you mean before I do it. I saw it being done; I can do it too.

Verbal Persuasion says: Show me and watch me to see if I do it right, then give me full marks. Otherwise, if you only explained it more, I would have figured out how to do it.

Physiological/Emotional says: I have a problem with reading fine print, can you enlarge it for me please? I have been working very hard, but you don't care enough to see if I am on the right track, I think you don't like me.

In the end, students call on one, two or more, if not all their commanders (antecedents) to help them achieve the task at hand. This is where their individual sources of self-efficacy matter. In all of these, the question remains, what learning took place? Did the students learn science ideas, or did they learn how scientific inquiry is conducted? Or did they only learn to follow and master a process or recipe provided by the teacher to gain the credits that became more important than learning itself?

This could mean that, students might possess an interest in science and be intrinsically motivated to study science but, when faced with a situation where the teaching/learning approach only requires them to 'master' a task with procedural knowledge (Hume & Coll, 2008) to achieve the required assessment credits, it limits their opportunity to build their Mastery of the subject and their ambition to pursue a possible career in science. This research has shown that students with high perceived Mastery as an antecedent may cope and achieve the required credits (Table 8.1), while others might resort to relying on the other three

antecedents of self-efficacy to achieve the credits they are aiming for or need to stay in science. The second group could be ones that develop an intrinsic motivation to achieve through what Hume and Coll (2008) describes as ‘mastering the rules of the game’. They have learnt to obtain from their teacher through feedback the exact assessment requirements needed to obtain certain credits. Hence, they would be happy to step back and watch their friends have a try before they do (Vicarious Experience) and would need the urging and encouragement of their teacher (Verbal Persuasion) to complete certain tasks to achieve (Table 8.1).

8.3.7 Learned Helplessness

Studies by Ghasemi (2021), with English students showed ‘learned helplessness’ had an “influence on students’ achievement, motivation, and engagement with learning” (p.1). Helplessness is when a person loses control of cognitive, motivational, and emotional functions when their expectations become negative. The individual develops this learned behaviour perhaps thinking that there is no relationship between his or her behaviour and the outcome; he or she tends to minimise his or her motivational drive to take further actions.

In this study, I witnessed the girls from Mercy College sit and wait for Mr. Williams to come around to them to check what they were doing and issue further instructions. Even though they were working as a group, there were no discussions regarding the assessed task in front of them, idle chatter seemed to be taking place. They waited for Tita to finish what she was doing before she could help the others by letting them look at her work while waiting for Mr. Williams. None of the girls raised their hands to ask for help, they just sat and waited. This behaviour fits with the description given by Ghasemi (2021) of a state of learned helplessness. They were not taking any initiative themselves. Is it possible that by offering more support and reducing the challenge the teachers are creating a situation where students are not provided the opportunity to develop mastery either of learning science or of what is required to pass an internal assessment? They are creating dependence.

8.4 Justification of Conceptual framework

Bandura's triadic model of Social Cognitive Theory (SCT) gives a three-way reciprocal determinism (Figure 3.1) of self-efficacy (Bandura, 1986, 1997, 2006c; Zimmerman, 1989). Figure 3.5 presented the possible pathways in which self-efficacy is reinforced to influence academic efficacy and achievement (Bandura, 1991; Bembenutty et al., 2016; Schunk, 1984; Zimmerman, 1989). I started the research using this framework in the hope of finding how some of these factors affect the self-efficacy of Pasifika students in their learning. So, my focus was on learning as the big driver in a science classroom as presented in Figure 4.4.

Theoretically, the SCT model could exist for science students, but this research found only the reciprocity effect of self-efficacy as evident. It seemed the achievement credits were driving both the students' and teachers' self-efficacy. Evident from my classroom observations was the middle section of Figure 4.4. This model reflects similar findings by Hume and Coll (2009) and Moeed and Hall (2011) who found that student learning became secondary to assessment in the case of school science investigation. The present research adds to their work and highlights that little has changed over the past decade. Additionally, this model extends and stresses that assessment issues have had a major impact not only on learning but also the self-efficacy of the participating Pasifika students. Their engagements were purely teacher driven. Students indicated, they were motivated when they achieved in an assessment, but not only Achieved but also Merit or Excellence. That informs my claim of just the middle section of Figure 4.4 being evident.

As a result, what should have been the focus of Learning (Figure 4.4), has now become Achievement. Learning should have been the focus of classroom activities. Instead, learning has diminished, and Achievement has now taken over as the focus of classroom activities. Figure 8.2 below is a schematic modification of Figure 4.4 as the present model of Pasifika student's self-efficacy cycle, proposed by this research as what was happening. The pink arrows indicating the actual pathway of interaction and how self-efficacy appeared to be operating. The pink rectangles showing credits overtaking all three initiators of what SCT intended as behavior being affected by one's intrapersonal goals and the environmental factors. Both the intrinsic and extrinsic motivation now become all about achieving to gain credits.

Figure 8.2: Proposed schematic cross section of SCT - Self-efficacy cycle

Key: Possible pathways

All expectations: Intrinsic expectations, Teacher expectations, School expectations, and parental expectations were achievement credit-driven and had little to do with actual science learning. That took a toll on students' self-efficacy. Those whose self-efficacy needs were met achieved, while those whose self-efficacy needs were not met did not achieve the credits they aimed for.

Firstly, the majority of the participants indicated Verbal Persuasion and Vicarious Experience were their source of self-efficacy suggesting an absence of 'Personal Interest' or an 'Intrinsic motivator' (Bieg et al., 2017; Deci, 2010).

Secondly, the teachers used many class hours to assist the students to get all the aspects of the assessment task right to achieve their credits. Teachers tried to stimulate the situational interest, but it appears they used a lot of Verbal Persuasion. Consequently, most participants depended on Verbal Persuasion as their primary antecedent for self-efficacy. At the time of my observations, assessment tasks were being carried out for which students needed a lot of teacher support. Only four participants in the three schools studied showed

Mastery that was reflected in their NCEA achievement results. The extrinsic motivator was credits. Overall, the environment was created in a way to enable the students to achieve the credits rather than being presented with learning opportunities. Both students and teachers had to work together to achieve as the school expected that school credits would be compared with the National average.

The pattern that emerged was that for most participants, both the intrinsic and extrinsic motivators were credits for NCEA achievement. Students felt they had to get those credits and that seemed to be their personal interest. The fear of failing and disappointing their parents was another intrinsic motivator. It appears that the future was not in their collective sights as was evident with all participating teachers saying they had not discussed career prospects. Therefore, future learning or career options in science was absent. When interviewed, participants had not thought about careers at that point, all they cared about was to pass Level One NCEA.

In relation to the *fau* metaphor, could it be the self-efficacy (*fau*) of Pasifika students, the light porous fibre (Figure 4.0), is not woven properly? The flowers, the science content have not been selected appropriately. Learning, the flowers that make up the lei are not the best. When the fibre pieces are woven well while inserting those flowers, one gets a beautiful lei but when the weave is not properly done, flowers are not held tightly and soon start falling out. That is not a good lei. The idea is to weave beautiful leis. The *fau* forms the sturdy support and frame for the lei. Therefore, those strands of *fau* need to be woven carefully and tightly, inserting the correct flowers for the desired fragrance and an attractive lei.

8.5 Assessment Reliability, Validity, and Manageability

According to Moeed and Hall (2011), there are three guiding principles that underpin assessment: reliability, validity, and manageability. The reliability of an assessment is the “extent to which it can be said to be accurate and not influenced by the particular occasion or who does the marking or grading” (Harlen, (2005), p. 246). It is about how accurately the assessment measures each individual student’s performance and whether they are able to repeat this type of investigation in another situation. As observed, with the level of teacher support provided in some cases down to bite size chunks being taught and mastered, it is

unlikely that students would be able to perform the same task only after a short time. This is also unlikely to happen as after one internal assessment, evidence suggests that the focus becomes the preparation for the next assessment.

From the classroom observations and focus group interviews, I deduced that there might have been repeated summative type assessments being carried out in the three strands of biology, chemistry and physics for students to master a 'fair testing' type of analysis. While it is important for students to know about 'fair testing', too much of it across the three strands of science might take the place of learning something else in science. Repeated summative assessment has a detrimental effect on both teaching and the extent to which the curriculum is covered (Harlen, 2005). In the 1990s in England and Wales and with the introduction of NCEA there has been a shift to more internal assessment. As stated earlier, internal assessment of science investigation has been problematic. For example, Abrahams, Reiss, and Sharpe (2013) suggest that in the U.K, such assessment "reduces the likelihood that practical work will be taught and learnt as well as it might be" (p. 209). That brings into question the value or worth of the assessment activity.

The worth of the assessment is gauged by its validity. "Validity refers to what is assessed and how well this corresponds with the behaviour of the construct that it is intended to assess" (Harlen, 2005, p. 246). In the context of this research two types of validity described by Harlen are important: construct validity and predictive validity. Construct validity is about how well the knowledge and skills the assessment task measures what it ought to measure. Predictive validity is about how well the assessment carried out can predict future performance. In this case being able to succeed in the assessed task does not necessarily mean a student is able to plan and carry out a science investigation in future. That is because everything they did was provided and many said, they would only do what the teacher instructed and wouldn't change a thing. Therefore, this assessment is less likely to have predictive validity.

Hall (2007) describes validity as "fitness for purpose" (p. 1), presenting three types of validity.

- (i) First of these is face validity, which is related to how clearly the task is described and whether it assesses what is described. In this case the task and the criteria for

assessment and achievement criteria were clearly set out. Therefore, assessment of students in this study would have face validity.

- (ii) Second is content validity. According to Hall, it is about how well the assessment appropriately samples content and learning outcomes. As the curriculum mandates a variety of investigative approaches including identifying, classifying, pattern-seeking, and making models, for example, a single fair testing type of investigation would not have content validity.
- (iii) Finally, consequential validity. This relates to the extent to which marking, and feedback help the student to improve their performance. The students in the present study were provided more than enough feedback and were able to improve their performance, therefore it would have consequential validity (Hall, 2007).

Affordability and other practical considerations including access to resources, time, and workload for teachers are related to manageability according to Hall (2007). He argues that the manageability of standards-based assessment is problematic because it is time consuming for both the teacher and student time. Management issues with a large class of students are likely to affect validity and reliability, which was evident in this research. Students achieving in the assessment of science investigation in this study has had reliability and validity issues and the focus has shifted from learning to assessment.

8.6 Constructivist Versus Social Cognitive Theory

As discussed in Chapter 2.3, the New Zealand Science curriculum statement provides a learning context which is underpinned by a social constructivist theory of learning (Ministry of Education, 2007a; Moeed, 2010). Constructivists assert that the teacher needs to find out what the learner already knows, clarify any misconceptions, and provide learning opportunities that require the learner to make links between their prior learning and new learning. Rannikmäe, Holbrook, and Soobard (2020) draw upon Jerome Bruner's ideas which emphasise the important role of the teacher. These researchers believe that social constructivism focusses on the collaborative nature of learning in a social context. In the present research, students did collaborate but not in well-considered, teacher-organised groups. Ms Smith

asked questions to recall learning from previous lesson to guide them through to the next part of the assessment activity, however, there was little evidence of finding out what the learner already knew. This is problematic because, the teacher would either be assuming that the student has considerable science knowledge and skills due to earlier science learning or that they do not bring any knowledge to the learning context.

In the former case, it is assumed that the school teaching programme is structured in such a way that the students have a good grounding in the science ideas that underpin their science investigations and have level appropriate adequate skills to carry out science investigations and that students have prior knowledge about how science works. There was little evidence that suggested students had such prior knowledge. Equally, if students arrive with no science knowledge, skills, and understandings about the Nature of Science, they would then require opportunities to develop conceptual, procedural, and epistemic understanding. Most learning opportunities were limited to conceptual knowledge and some skills. It was not apparent that the students were using their prior knowledge to make sense of their new learning (the guiding principle of constructivism) (Driver & Leach, 1993). In summary, the classroom environment and teaching approaches used had little to demonstrate a social constructivist paradigm.

This research used Bandura's (1986) Social Cognitive Theory (SCT) model as the theoretical framework as described in Section 3.2. The SCT model theoretically describes the interactions between Behaviour, Intra-personal Factors and Environmental factors in a classroom setting. Bembenutty et al. (2016), says that a classroom context strives to build self-efficacy through interactions created between Personal factors, Environmental factors, and Behavioural factors (Figure 3.5).

Bembenutty et al. (2016) report that for reciprocal effect of self-efficacy to occur, one must take action to have an impact on the environment. For example, if a teacher is talking too fast, a student who does not understand can raise their hand and ask the teacher a question. This then impacts on the teacher to slow down or explain something again or clarify enabling the student to understand. Such interaction was observed between Ms Smith and her students at Grace College where students were not hesitant to stop her to seek clarification, a practice she welcomed and labelled as 'honesty' from the students.

At Mercy College, pedagogy was mostly teacher-led in both classes, and the teacher instructions determined the pace and students followed as instructed. There was minimal question time, students were very quiet and waited for the teacher to come around to them and attend to their individual needs, except during the practical classes. During practical students interacted and created a supportive learning environment among themselves and with their teachers.

At Leep High school, the teacher encouraged students to help each other. She knew each student well and would specify which student was going to help another student. This created a mutualistic and supportive environment.

In summary, only at Grace College did students set goals and do some self-regulating with their group mates and use strategies to find out about metals and their properties. At Mercy College most waited for instructions to complete the next section of the assessment task, and at Leep High School the teacher was more focussed on allowing students to work with each other to achieve the overall 80 NCEA credits.

8.7 Summary of Discussion

The focus of this Chapter was to answer the sub-research questions which led to the overarching Research Question: what are the factors that influence Pasifika students' self-efficacy in science and influence their achievement in New Zealand? This research shows three major factors influencing students' self-efficacy: their own perceived self-efficacy (Bandura, 1993), teacher perception (Pajares, 2002) and the school's academic department's belief in their program (Bandura, 1993).

The first factor is the students' personal intrinsic motivators driving their self-efficacy. Plunged into a classroom environment with a teacher and a group of peers a student adapts, utilizing the latent self-efficacy antecedents with the learning opportunities presented. The role that thoughts and beliefs play in a student's learning process has been a focus for many researchers. Self-efficacy is a 'key element' of Bandura's (2002b) social cognitive theory (van Dinthera, Dochy, & Segers, 2011).

- (i) Perceived self-efficacy as sources of self-efficacy

Students perceived self-efficacy translated as drawing on one, two or more of the four antecedents: Mastery, Vicarious Experience, Verbal Persuasion and Physiological/Emotional states as sources of self-efficacy.

If the student perceived high Mastery, little was going to stop this student from harnessing the learning opportunities to achieve. Students who perceived high Mastery all achieved all the credits they attempted except for Fatai. Even though Fatai indicated Mastery as his primary source of self-efficacy, Fatai also showed evidence of overall low perceived self-efficacy.

Some students showed latent Mastery but had low overall self-efficacy and utilized Vicarious Experience or Verbal Persuasion on offer by the environment (teacher or peers). Other students might have high self-efficacy but if not provided with enough Vicarious Experiences in the classroom or with the Physiological/Emotional support, might be discouraged and they would probably not perform well enough to achieve. Other environment supports which participants utilised were their friends with whom they shared their ideas and learned from.

- (ii) The second factor is teacher perception and assessment of their class needs resulting in the provision of learning opportunities in the classroom environment. Each teacher operates according to assessment schedules confirmed by their Head of Department as an overall school requirement. Teacher views of students' self-efficacy translated as needs, particularly literacy, however, only Ms Smith spoke of how she would vary students' activities and include more quiz type games to stimulate cognitive reasoning and vocabulary building. Teachers were happy to facilitate peer learning through friendship bonds by allowing students to work in groups with their friends learning vicariously. However, this approach does not support students with science literacy needs. Teachers provided Verbal Persuasion through direct feedback by providing assessment criteria.
- (iii) The third factor is the school policy on how students are grouped into classes and how the teacher perceives his or her students' learning capabilities according to NCEA guidelines. Most of the students in the internal assessment only classes selected Verbal Persuasion as their primary or secondary source of self-efficacy.

The participants who scored high overall self-efficacy but did not achieve all their science credits either had Vicarious Experience and Physiological/Emotional factors as their primary or secondary source of self-efficacy.

Some intuitive teachers will catch this type of students as happened with Hema and Fatai at Grace College. Others might go into a state of learned helplessness and wait for the teacher to hold their hands every step of the way to achieve as Mr. Williams did with Seini at Mercy College. Other teachers of subjects like physics where a lot of calculations was needed took a teacher-centered approach to ensure all their students grasped the content and calculations needed for the assessment task, as observed with Mr. Garcia at Mercy College.

Each participant's selected antecedents as sources of self-efficacy reflected on their achievement of their NCEA credits. Some of the participants were separated into classes where only internal assessment was offered while some participants did both internal and external standards. Of the students who indicated Mastery as their primary or secondary source of antecedent, 87.5% achieved all their credits; 50% who indicated Vicarious Experience achieved; 62.6% who indicated Verbal Persuasion achieved and only 37.5% who indicated Physiological/Emotional achieved all their science credits.

Therefore, Mastery proved to be the most desired antecedent for achievement while Vicarious Experience and Verbal Persuasion also translated into achievement. Apart from Mastery, there were also participants with high Verbal Persuasion and Vicarious Experience as primary or secondary sources of self-efficacy who achieved all the credits they attempted. Verbal Persuasion was attributed to teacher support in the classroom.

CHAPTER NINE

HOUNGA'IA: CONCLUSION

Implications and Recommendations

Overview

Chapter Eight answered the research question focussing on the three factors that affect a student's self-efficacy. These were:

1. *Pasifika students' personal perceived self-efficacy,*
2. *Teacher perceptions of students learning needs,*
3. *School policy and programs for meeting NCEA requirement.*

While the students had no control over their teachers' perceptions and the teaching program offered, they could perhaps manage their own self-efficacies through engagement with the set tasks, accessing help from their peers, and utilising the support offered by the teachers.

The study found that the sources of self-efficacy; Mastery, Vicarious Experience, Verbal Persuasion or Physiological/Emotional antecedents played an important role in students' achievement. The focus on achievement appeared to compromise learning for Year 11 Pasifika students in science as previous research has found for New Zealand students in general (Hume & Coll, 2009; Moeed & Anderson, 2018; Moeed & Hall, 2011).

Teaching appeared to be assessment driven and narrowly focused on learning the skills required specifically for the Achievement Standard selected. The resulting unintended consequence was that learning was limited and assessment driven too. Literacy issues were raised by the teachers but other than Ms Smith all teachers found the best way to help was by providing the right answer through small chunks of information. This did not create opportunity for students to improve their literacy, which would have been useful as they progressed to the next level.

This research studied the interactions of four New Zealand science teachers with their students in a classroom with Pasifika students. Even though Constructivism underpins the New Zealand Curriculum (Ministry of Education, 2007a), this study found few learning

opportunities provided for the students to unpack any prior knowledge and construct new meaning or connect with the science content related to the assessment activity. Classroom interactions and the findings appeared to align with the SCT model affecting self-efficacy adapted by (Bembenutty et al., 2016).

Except for one class in Mercy College, students in all three schools had some choice in deciding which Achievement Standards they would like to be assessed with for their 20 or 16 science credits towards their NCEA Level One Certificate. By being streamed and grouped into classes, students in one class at Mercy College were only able to do the internal standards offered. Even though students were streamed into 'ability' classes, not all achieved their elected credits. Most participants in the 'streamed' group had Verbal Persuasion and Vicarious Experience as major sources of self-efficacy. One teacher recognised a couple of students with low self-efficacy and was willing to work with them individually. However, another student fell into a state of 'learned helplessness' and relied heavily on peer or teacher support.

The students were wanting more hands-on activities, practical investigations, and more explanation by the teacher so that they could understand the science ideas underpinning those investigations. Friendships and group work were said to be helpful. Students expressed a fear of failing and some wanted more caring by the teacher.

Burns et al. (2021). Burns, et al. (2021) in their recently published science education research have reported two findings that are relevant to the present research:

- Self-efficacy had significant positive main effects on student- and classroom level achievement.
- Anxiety negatively moderated the association between self-efficacy and achievement at the student level (p. 101937).

The first confirms the findings of this research that science self-efficacy is a positive antecedent of Pasifika students' science achievement (Burns, et al. 2021). The present investigation found that science self-efficacy did indeed positively predict science achievement at both the student and classroom-levels. These findings have implications for both policy and practice.

9.1 Implications for Policy and Practice

The OECD considers proficiency at Level Two as the baseline at which students should begin to demonstrate the competencies that will enable them to participate actively in life situations (OECD, 2017). Over the years, there has been mounting concern to lift Pasifika students' achievement, not only at NCEA Level Two but also in Level Three. This prompted NZQA to establish an advisory group, STEM Taupulega, to provide support, advice, and guidance to help realise the target:

To achieve a 50 percent lift in NCEA Level Three Pasifika student achievement, in one or more standards in STEM related subjects by 2020. Taupulega - a Samoan /Tokelauan term which means Council of Advisors (ESR, 2021).

Figure 2.3 showed that goal been achieved with Level Three now as the highest qualification among Pasifika, but few Pasifika are gaining entrance to university. This is possibly due to the standards selected for these students in year 11 that limits their options in senior sciences. Having arrived in Biology, Physics, and Chemistry with a narrow knowledge base they would be less likely to succeed. If the narrow curriculum they may experience in Years 12 and 13 do not align with the universities entrance requirements for science related professional courses, these students miss out on equitable learning opportunities and reduced career choices.

An added influence of the narrow curriculum learnt by these students is that the few who enter tertiary study in sciences at university may not have the breadth of knowledge base of disciplinary knowledge to cope with the demands of higher education in science. This may well sound hopeless, and the study does not have these evidence to support the idea, that the Achievement Standards selected in Year 11 may well be the reason for fewer Pasifika students in science related careers. An area, that needs further research.

In all three schools the Achievement Standards offered were decisions made by the science department. In two of the three schools, participants were in 'internal assessment only' classes. This suggests low expectations of achievement for these students and that the material selected was "easy" and "chunked into small bits" to enable students to "learn" it to gain credits for the assessment. Both approaches have been criticised by Bishop (2019) as ineffective for student learning and achievement. Importantly, this learning was not to gain

an understanding of the associated science concepts or the nature of science investigation; it was merely to be successful in the said achievement standards.

Student agency to choose what they are learning is likely to lead to higher engagement and possibly learning relevant to the student choice (Cavagnetto, Hand, & Premo, 2020; Chuter, 2021). Cavagnetto et al. (2020) in their research on supporting student agency in science argue that internationally science education reforms propose an “increase in science inquiry, peer collaboration, and making student thinking visible in order to support science learning” (p. 128). They argue that dialogic opportunities arise for actually making choices when participating in science, for example: choosing the question to investigate; deciding what the most effective way is of collecting or organising data; and what evidence they might need provide the agency for them to engage in scientific practices. Cavagnetto et al. (2020) assert that “central to the concept of agency in science is the notion of authorship” (p. 128). This idea of authorship is relevant in this case of an assessment that requires a practical write-up. Were the students who were given small chunks of information to process and write up, assessed for their own work? Evidence suggests that most participants had neither authorship of their work nor agency in their learning.

Since 2009, the focus has been to lift Pasifika achievement in schools. However, this research has found in the three schools studied that, too much emphasis being placed on achievement (Figure 8.2) and not on learning (Figure 4.4). Figure 9.1 presents the probable unintended consequences of policies implemented through the researcher’s lens in this study.

Figure 9.1 The probable unintended consequence of Policy and its Implementation.

These are the probable consequences of policy decisions; the following section discusses the implications for practice.

9.2 Implications for Practice - a Backwash Effect

Maunu e kakala 'oku fī – Falling of the flowers from a lei

In the theoretical concept of self-efficacy Vaka-Vivili (2014) coined *Ko e fau ko e no'o'anga ia 'o e kakala*: in English, “The fibre (*fau*) holds the flowers together in a lei. That means, self-efficacy drives one’s motivation towards achievement. This research has discovered that when environmental conditions according to SCT are not provided in a way that encourages students to unpack prior knowledge, the situation is likened to a state where the flowers that were supposed to have been inserted during weaving and held together by the fibre of self-efficacy become loose and flowers fall off due to a backwash effect, as it is explained next.

In a model of constructive alignment, teaching goals, teaching methods and assessment method are aligned for students to reach the intended goals. Such alignment promotes active engagement in useful learning process that nurtures understanding (Leber, Renkl, Nückles, & Wäschle, 2018). Conversely, when learners adapt learning strategies to the ‘announced assessment’, it results in the unintended consequences called backwash effect (Leber et al., 2018, p. 161).

9.2.1 A backwash due to the mode of assessment

One such backwash effect found in this research was how narrow the learnt curriculum experience was with an assessment driven focus on classroom delivery. Simply put if it was not to be assessed it was not taught. The curriculum at level six requires that students learn about the nature of science as they learn science content from the Living Material, and Physical World, and Planet Earth and Beyond strands of the science curriculum. Assessment of science investigation was among the activities observed in this research involved learning to perform a fair testing type science investigation in the context of content from any of these strands. Focus Group discussions revealed students knew with confidence what a fair test was.

In activities where it involved aspects of Physics (speed) and biology (measurement of index finger) students found it difficult to graph the results and form a discussion and conclusion. The choice of standards selected led to students being trained to perform a

science investigation in all these subjects, Biology, Physics and Chemistry. This restricted choice can best provide evidence of being able to carry out a fair testing types of investigation in each of these three contextual areas. However, it limited the curriculum experienced by the students. With the amount of support the students were receiving to succeed in the assessment there was less time available to cover the very broad base of science that one would expect the students to understand at this level for scientific literacy which is a curriculum requirement (Ministry of Education, 2007b, p. 17).

At best student learning to be limited to concepts associated with the topic within which the task was set. In attempting to break the curriculum into bite sizes for the students, the unintended backwash effect is that very little of the content is retained to help the students in the long term. Therefore, to reduce this backwash effect, there needs to be a constructive alignment in what needs to be taught, how it will be taught, and how it will be assessed. This requires a focus on student learning and assessment of that learning. Students are coming with an intrinsic motivation to achieve NCEA Level One and science offers 20 or 16 of those 80 credits required by NZQA. Apart from credits, Meyer, Mclure, Weir, Walkey and McKenzie (2009) found that most Pasifika students' motivation orientation in Years 10 and 11 were related to future academic achievement. They stated that most Pasifika students taking science at Level One have a science career in mind although they may not speak of it openly yet.

When the learning opportunities reduce Vicarious Experiences, or the teacher does not provide the Verbal Persuasion, Mastery is lost giving rise to Physiological/Emotional need for self-efficacy. That means the fibres needed to hold those flowers in place have become loose (*maunu*) leaving room for the flowers (content knowledge of science) to fall off. A lei that loses its elements is un-desirable for presentation as a gift. Undesirable effects are underachievement overall. I have presented the backwash effect of the mode of assessment.

9.2.2 Literacy in Science – Are we closing the gap?

The Pasifika Education Plan 2013-2017 (the PEP) provided a strategic direction to improve educational outcomes for Pasifika students in New Zealand and literacy and numeracy were among the key target areas needing improvement. The target was to have all Pasifika school leavers with NCEA Level One to have attained 95% literacy and numeracy by 2017. According to the Pasifika Education Plan Monitoring Report (2017), the gap between

Pasifika and Non-Pasifika with NCEA Level One literacy and numeracy requirements had decreased to within two percentage points in 2016. Despite this improvement, having science teachers still identifying literacy as a need for Pasifika in 2020 is a concern. This could be more related to the language of science rather than just general reading and writing. It may have been that teachers were only repeating a Ministry of Education target for Pasifika from previous reports or that the need was to do with science literacy more than just reading and writing. If the latter was the case, then curriculum delivery should be focusing on teaching the scientific vocabulary that needs to accompany content for students to connect the ideas and improve the quality of their written science assessments.

This study found a common learning need raised by all the teachers interviewed was literacy. Even though literacy was identified as an issue for Pasifika, there was no evidence of teachers providing the necessary vocabulary and definitions needed for students to make connections with their ideas and present them on paper for assessment. Literacy in science is about students learning the language of science; that is, how students learn to read, write, and speak in scientific ways, enabling students to communicate their understandings in spoken or written form. To clarify, the focus in this case is not 'scientific literacy' which is the ability to understand the natural world, key science ideas and principles and ways of thinking (Pearson, Moje, & Greenleaf, 2010). Scientific literacy is likely to help individuals to make informed decisions about science related issues in their everyday life. Wilson and Jesson (2018) believe, though, that "developing literacy in science contributes to the development of scientific literacy" (p. 133).

In recent research by Hicks, Hyler, and Pangle (2020), attention is drawn to a lack of writing in science classrooms. These researchers assert that, students generally lack skills in basic science writing. This lack of ability to communicate in writing becomes an issue as students' progress towards the senior classes. A focus on relevant literacy and associated book work in junior science classes (Year 9 and 10) would prepare the students better in written communication. Hicks et al. (2020) further assert that students need to be taught the process of deciding what to write and how to write it. Students need to "experience the painstaking work of moving from thought to words, and from words to sentences (p. 27)". Clearly, the students in this study needed support to develop better skills as was found by Moeed and Cooney (in Press) in their research in a high school with high Pasifika numbers.

They report that when teachers taught science vocabulary, students had the words to express their developing science ideas. Once they constructed meaningful sentences, they could answer questions that required them to write paragraphs.

Science ideas are communicated in words, but there was little evidence to show how the teacher was assisting students to connect those ideas in their writing. Teachers in this study felt students needed support with literacy (writing and expressing science ideas), but their practice did not show them addressing this need. Perhaps the teachers themselves needed support to enable them to address this need. In all the classroom observations, there was no science-related literacy familiarization or recap of science key words and their definitions which may have led to better understanding, something the students said they needed. According to Hayden and Eades-Baird (2020), many science teachers do not have the skill and do not notice how literacy is integral to science learning. We expect students to make observations, explain, obtain data, use information from texts/media, argue, describe, ask questions, and communicate (Bull, 2015). Communicating what the students have done, thought about, and have evidence of only develops if they have the opportunity to learn how to do this and to practise it (Wright & Domke, 2019). In this research, students were taught what to do and what to write but there was little evidence of them learning how to communicate *their* ideas and transfer them in writing on paper. Even though the assessment was carried out over several days and broken down into bite size chunks to help them, some students were still looking for the words to write in a state of learned helplessness.

This poses room for concern because scientific literacy means a student:

- can ask questions and seek answers to curiosity about everyday experiences.
- Is able to describe, explain and predict,
- Is able to read and write and engage in social conversations (National Research Council, 2007, p. 22)

For the students who advance to Year 12 Biology, Chemistry and Physics, limited scientific literacy might pose an impediment. In Biology and Chemistry, they would need to describe processes and explain certain reactions the teacher might expect. Having the correct scientific vocabulary may earn them 'Merit' and 'Excellence'. In Physics, a sound

understanding of science literacy would help them understand phenomenon and explain or apply to formula.

In the modern age of digital technology, being scientifically literate means being able to evaluate the quality of scientific information at hand based on its source and methods used to generate the information.

Scientific literacy has different degrees and forms; it expands and deepens over a lifetime, not just during the years in school. But the attitudes and values established toward science in the early years will shape a person's development of scientific literacy as an adult (National Research Council, 2007, p. 22).

In terms of self-efficacy and achievement, it is a disappointment for a high Mastery student who may be actively involved in class and all aspects of the practical investigation to then get marked down on the final presentation just because they did not use the right words to express the science ideas. Teachers can give them feedback and ask them to re-submit but it is time lost for both teacher and students in resubmitting a report. Resubmission of reports could also have a negative impact on student's Physiological/Emotional antecedent of self-efficacy towards the next assessment activity. Perhaps if the teachers were aware of their students' self-efficacies from the beginning of the year or term through a standardized test tool, they might be able to help them lift their self-efficacy and achievement.

9.3 Limitations of this study

Firstly, the sample size in this study was small, with just three participating secondary schools. Effort had been made to approach all schools in the region that had high numbers of Pasifika students. Although these were the only schools that accepted the invitation to participate in the study, Pasifika student numbers in these schools were small.

Secondly, only five lessons were observed in each participating class per school. Observations were limited to the teaching period during those five lessons and were not representative of the whole year. This limited the amount of data collected and kept it manageable for this project, however it is acknowledged that the findings may not be

generalisable. I acknowledge that the limited time spent in the classroom for observations provides only a brief snapshot of the teaching and learning year.

Thirdly, because the focus of the study was on teaching, learning and the assessment of science investigations, these were the times suggested as most appropriate by the participating teachers to collect the data. While it may be that my observations happened to coincide with assessment periods, in all five lessons in every school, the focus of teaching was on how to achieve in the set assessment. As these were senior students, it was not possible to get access to the schools for a longer period, again because they had to prepare for assessment.

Fourthly, the research instruments were not standardised since they were designed and piloted by me in only one school before using it with the other three schools.

9.4 Future Research

In terms of this research, the data has revealed that there is a relationship between the self-efficacy antecedents as students' sources of self-efficacy and their achievement in science. This adds to the ongoing concern for professional development and need for intervention to assist teachers to better help our Pasifika cohort in secondary schools to learn science and achieve at a higher level. The following four areas of research are recommended in future.

1. A national study which has both quantitative and qualitative self- efficacy surveys would help provide an insight into the picture nationally. This would provide a much larger sample and could include some focus groups interviews to gain clarification from students about the questions raised by the surveys.
2. An intervention study would also be useful to inform teaching. For example, a modified questionnaire like the one used in this study could be administered at the start of the year and the information about students' self-efficacy antecedents could then be used by the teacher to provide appropriate support. Research involving such an approach could be helpful to the teachers of Pasifika students.

3. NCEA Level One is currently under review. The proposed changes will make Year 11 science optional. Research to inform its impact on Pasifika students' self-efficacy and achievement would be useful. NCEA was introduced in Level One in 2002. Several studies highlighted the backwash effect of the NCEA Level One assessment over 10 years ago (Hume & Coll, 2009; Moeed & Hall, 2011). It has continued to affect students' learning in this area. It would be useful to research the impact of the proposed changes early on so that the changes made are research informed.
4. While general literacy levels attained by Pasifika students is increasing (Ministry of Education, 2016a) there is a need to address the science-related literacy of students in Year 9 and 10. This could have a positive flow-on effect on student learning. Intervention studies that involve students being proactively taught the language of science would be informative.
5. With the recent research findings by Burns et al. (2021) and the findings of this thesis that Pasifika science students' self-efficacy affects their science achievement and that, the finding that participating Pasifika students' express concerns such as fear of failing. Future research needs to explore whether anxiety caused by the fear of failing affects Pasifika students' self-efficacy and achievement.

The real champions of this research are my participating Pasifika students who were not the respectful, timid Islanders portrayed in common educational stereotypes, but were honest and brave enough to share their learning experiences and allow me to compare their self-efficacies with their NCEA Level One science achievement, adding to both this research and my learning. Students expressed the need for science content to be explained and clarified to help them understand the science ideas underpinning the assessed practical work. The common themes identified by students were a fear of failing and disappointing their parents.

The factors identified by this research that affect Pasifika students' self-efficacy are the NCEA credits on offer, parental expectations, Teacher perceptions of their students and students' own perceived self-efficacy. While Mastery showed to be the most desired

antecedent for achievement, students with high Verbal Persuasion and Vicarious Experience as primary or secondary sources of self-efficacy also achieved all the credits they attempted. Verbal Persuasion was powerful and came from the teachers. These antecedents are important motivators for achievement. Generally, high self-efficacy meant high achievement although some with high overall self-efficacy did not achieve all their credits due to high Physiological and Emotional needs. Future research should not be limited to the above mentioned five areas but should have an aim to monitor students' self-efficacies as an on-going process to help detect cases of low self-efficacies. A research-informed and collaborative effort would be beneficial to all stakeholders including Pasifika students to achieve at higher levels.

An important aspect of a Pasifika students' life that may also impact on their self-efficacy is of the spiritual and religious aspect of their lived reality. This research found the Physiological and Emotional antecedent as being dominant in some of the students' individual analysis of self-efficacy. This suggests a need for further research to understand how the spiritual dimension may interact with their overall self-efficacy and whether this would impact on their achievement. This aspect is particularly important when studying Tongan students' self-efficacy. Future research can be conducted in schools where there are high numbers of Tongan students or Samoan students for singular ethnic perspectives.

9.5 Contribution to the Kakala and Kakala Research Framework

This research has contributed to the kakala and Kakala Research Framework in two ways. Firstly, the extension of the *fau* concept by Vaka-Vivili (2014) to explore the four strands of the *fau* as used in a four-strand weave to depict the four antecedents of self-efficacy proposed by Bandura (1997). This research has given significance to the *fau* used to make the fragrant garland in the Tongan cultural context. *Fau* is a weak and delicate fibre, yet when woven or braided is strong enough to hold the chosen flowers together providing a structural support for the garland. Without the fibre to hold the flowers together, there would be no lei or garland. Therefore, the *fau* becomes an important element in the construction of the lei making *fau* the metaphor for self-efficacy; an important aspect to consider and nurture for improved academic achievement. *Fau* depicts the *loto'aki* (willpower) of a person who has

set goals to achieve. Other researchers may use the *Fau* concept in a similar way to highlight how this weak, yet strong fibre may be central to their topic of interest.

Secondly, the proposed inclusion of *Hounga'ia* as deep inner appreciation before *Māfana* as a separate step in the KRF represents the reflection on the key findings and discussion of those findings in the research. It highlights the implications posed followed by recommendations for further action. *Hounga'ia* is an internal *māfana* (warmth) where the weaver appreciates their work when they see it displaced by the wearer and heartfelt appreciation by the wearer.

As a researcher, the reflection on the discussion of findings provides the basis to discuss any implications and propose future research. It is also a stage where the recipient of the garland or lei feels the appreciation in their heart and mentally prepares to show their appreciation. As the *fau* is a hidden element of the lei, *hounga'ia* is also an internal element of appreciation. The inclusion of *Hounga'ia* suggests a seven step research framework instead of six (*Teu, Toli, Tui, Luva, Mālie, Hounga'ia, Māfana*) for the purpose of a thesis by research.

9.6 Māfana - Application

Māfana encapsulates the final stage of the Kakala Research Framework (KRF) in harmony with the Pasifika epistemological significance of the completion of the purpose for which the garland was woven and presented. However, *Hounga'ia* is where the appreciation takes place internally by both the weaver and the wearer for two different reasons. *Māfana* becomes the outward display of that elation and appreciation through speech or dance.

In the research context, (Johansson-Fua, 2009) suggests *Māfana* as the direction for application, transformation or inform policy and practice based on the findings of the research. Hence, this thesis concludes with *Hounga'ia* as it's final chapter as *māfana* occurs only after the recommendations from the findings are accepted and actioned by the relevant bodies. In the context of a thesis, only after it is examined and accepted, then there will be celebration (*māfana*).

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Appendix A: Vocational education and training (VET) – Participation statistics

Learners in vocational education and training (VET) - Key Participation Statistics										
See notes for data specifications and definitions										
Sub-sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Industry training	159,505	131,870	129,430	134,010	133,220	138,840	139,780	138,040	131,905	129,320
Institutes of technology and polytechnics	99,535	76,670	74,395	71,365	69,545	70,050	68,570	64,505	63,985	62,720
Private training establishments	48,715	45,125	40,325	37,800	36,405	34,135	32,210	31,520	29,585	30,255
Wānanga	15,055	12,915	12,070	12,265	11,835	11,580	12,010	11,630	10,545	9,370
Total	309,305	258,470	248,850	247,895	243,610	247,405	245,985	239,685	230,265	226,270
Ethnic group										
European	190,100	159,585	154,180	153,350	151,690	151,290	146,890	141,285	138,905	134,735
Māori	64,025	55,630	52,855	53,390	52,670	53,225	51,950	51,935	50,555	49,030
Pacific Peoples	26,885	24,175	23,815	23,465	23,125	25,435	25,395	24,290	22,140	22,350
Other	34,935	29,415	29,400	30,935	30,500	33,070	34,140	35,785	35,355	36,740
Total	309,305	258,470	248,850	247,895	243,610	247,405	245,985	239,685	230,265	226,270

Notes:

1. Counts are of learners enrolled in Vocational Education and Training (VET) programmes only. See definitions tab for VET criteria.
2. Learners are counted in each sub-sector they enrol in, so the sum of the various sub-sectors may not add to the total.
3. Learners are counted in each qualification type/NZQA level they enrol in, so the sum of the various types/NZQF levels may not add to the total.
4. Learners are counted in each ethnic group they identify with, so the sum of the various ethnic groups may not add to the total.
5. Age is calculated as at 31 December.
6. Credits related to the credit value of the qualification enrolled in. Learners can enrol in multiple qualification so the sum of the credit values may not add to the total.
7. Region is the location of delivery for provider-based tertiary education, and the location of employment for industry training learners.
8. The region data at institutes of technology and polytechnics, wananga and private training establishments only includes learners that are studying intramurally.
9. The Region 'Total' includes both intramural and extramural learners.
10. Learners may be enrolled in programmes in more than one region, and are counted in each, so the sum of the various region values may not add to the total.
11. Totals also include those learners indicating gender diversity and with unknown values.
12. Data in this table has been revised, and so may differ from previously published figures.
13. Data in this table including totals, have been rounded to the nearest 5 to protect the privacy of individuals, so the sum of the individual counts may not add to the total (Education Counts, 2020c).

Appendix B Invitation to Participate in the research

Faculty of Education

FACULTY OF EDUCATION, TE WHANAU O AKO PAI
VICTORIA UNIVERSITY OF WELLINGTON, PO Box 600, Wellington 6140, New Zealand Phone + 64-4-463 9500 Fax +64-4-463 9649 Email education@vuw.ac.nz, Web www.victoria.ac.nz/education

Dear Principal,

RE: Invitation to participate in Educational research.

Title: Self-efficacy beliefs influencing Pasifika Students' achievement in science

My name is Margaret Vaka-Vivili, I am a doctoral student from Victoria University of Wellington and would like to invite your school's participation in my research. Current understanding is that science education is very important to a child's cognitive development for lifelong learning no matter what career path they take after leaving secondary school. In my research I am hoping to find out what aspects of self-efficacy (Mastery, Vicarious Experience, Verbal Persuasion or Physiological/Emotional factors), influences students' achievement in science.

I would like to invite the participation of one science teacher of a Level 1 science class (preferably the class with the most Pasifika students) and all Pasifika students who take Level 1 science. Here's an outline of my plan.

1. Working closely with the consenting teacher, I would like to be a participant observer of his or her science classes for a week. I will be making notes of teacher-student interactions and will be audio recording the class as my backup of the classroom interaction.
2. I would also like to interview the participating teacher at a time convenient with the teacher during that week. This interview will also be audio recorded.
3. Consenting Pasifika students to complete a student questionnaire. I intend to administer it myself and collect it at the end. Those not participating can return a blank questionnaire. For that, I will need a room big enough to administer the questionnaire.
4. From the consenting teacher's class, I would like to invite 5-7 consenting students to a focus group interview. This interview will also be audio recorded.

5. Ask the participating teacher to share internal assessment standards results of the participating students.
6. Ask the participating teacher or the school to share NCEA Level 1 science results of the participating students at the end of the academic year.

Participant information sheet, consent forms and parental consent forms are attached for your information. Each participant will be provided with an information package accompanied with the necessary consent forms for themselves and their parents.

The nature of the survey is confidential; I will ask that; they confirm their consent by placing a tick (v) in the appropriate boxes. The participants can opt out of the research if they wish to during data collection. The completed Questionnaires will be collected by myself after they have completed it.

All information collected will be used with confidentiality for the primary purpose described above. However, it may also be used for the purpose of other educational publications by the researcher or any conference presentations or otherwise as cited. All data collected will be stored in password protected offices at Victoria University and will be destroyed 3 years after the completion of the research. The research has been approved by the Faculty of Education Human Ethics Sub-committee under delegated authority from the Victoria University Human Ethics Committee (Ethics approval number 0000026833).

If you have any concerns about the way the research is conducted, please contact Dr Judith Loveridge (Judith.loverage@vuw.ac.nz), ph: 04 463 6028, Chair of the Human Ethics Committee, Victoria University of Wellington. Please feel free also to contact me at (margaret.vakavivili@vuw.ac.nz) or my Supervisors Associate Professor Azra Moeed (azra.moeed@vuw.ac.nz) & Dr Dayle Anderson (dayle.anderson@vuw.ac.nz) to discuss the research and ask any questions.

Your school can withdraw from the research at any time during the collection of data. If your change your mind and do not wish to participate, please write "Do not wish to Participate", and return the form to the researcher at the above address.

A copy of the research findings will be provided to the participating schools upon request.

I thank you sincerely for accepting my invitation to participate in the study and look forward to hearing from you.

Yours faithfully,

Signed:

Margaret Vaka-Vivili (Researcher)

Attachments:

22. Information sheet for teacher participants
23. Classroom Observation schedule
24. Semi-structured teacher interview schedule
25. Participant consent (Teacher to be observed)
26. Participant consent to be interviewed (Teacher)
27. Information sheet for all student participants
28. Student Questionnaire
29. Student Participant Consent to take survey
30. Information sheet for student participants (Focus group)
31. Indicative questions for focus group interview
32. Student consent for focus group interview
33. Information sheet for parents
34. Parental consent form
35. Principal's consent form
36. About the Researcher

Appendix C: Information for School Principals

Self-efficacy beliefs influencing students' achievement in science

INFORMATION SHEET FOR SCHOOL PRINCIPALS

Thank you for your interest in this project. Please read this information before deciding whether your school will take part. If you decide to participate, thank you. If you decide not to take part, thank you for considering my request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a **doctoral** student in *Education* at Victoria University of Wellington. This research project is work towards my **thesis**.

What is the aim of the project?

This project aims to find out more about the influence of self-efficacy on students' achievement in science. In this research, I am focussing on Pasifika students.

Self-efficacy is an inner drive that propels students' interest and motivation in attempting something or propels an interest to learn something or carry out an activity. There are four ways in which self-efficacy works; mastery, persuasion, modelling and vicarious experience.

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged, or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

Your school's participation will support this research by *giving Pasifika students an opportunity to share their views and beliefs relating to their experiences which might affect the self-efficacy which in turn have an influence on their achievement in science*. It will equally provide an opportunity for one of your

science teachers to share some of his or her experiences and perceptions of factors that might influence his or her students' self-efficacy. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

If you agree to take part, I will interview your science teacher with the most Pasifika students in his or her class. I will ask them questions about *their teaching experience teaching science to Pasifika students and their perceptions on what they think may influence their students' self-efficacy and science achievement overall*. The interviews will take *about 30 – 40 minutes* and this can be arranged with the teacher during a time suitable for the teacher. He or she will not be expected to leave class. The interview will take place *at school*. The participating teacher will be asked to provide consent before his or her involvement in the research. I will audio record the interview with the permission of the teacher and write it up later. The interviews will be confidential, meaning that I will know who participated, but the identity of the teacher will be protected.

AND:

If you agree to take part, I will survey your Pasifika students who are taking science at Level 1. I will ask them questions about *their interest in learning science and what motivates them to study science at Level one*. The surveys will take *about 30 minutes to complete*. The surveys will take place *at the school so I will need a room large enough to hold all of them*. Students will not be expected to come out of class. I would like to speak with them at the beginning of the study to discuss a suitable time (either during lunch time or after school) to complete the survey. I will provide them with lunch if done during their lunch hour or refreshment after school, if they wish to do the survey after school. Each participating student will be asked to provide consent before their involvement in the research. The surveys will be confidential, meaning that I will know who participated, but the identities of the participants will be protected.

AND

If you agree to take part, I will observe your science teacher with the most Pasifika students. I will be observing him or her as he or she is *teaching and engaging with the students*. The observations will occur *in class for every science class for 1 week*. The observations will not have an impact on your teacher's work as I will be a silent observer and making my own notes. This teacher will be asked to provide consent before their involvement in the research. I will audio record the observations with the permission of the participating teacher and will transcribe it later. The audio recording will be for back-up to my written notes. The observations will be confidential, meaning that I will know the teacher, but the identity of the teacher will be protected.

AND:

If you agree to take part, I will also interview about 5 to 7 consenting Pasifika students from the participating science teacher's class. This is a onetime focus group interview. I will ask

them questions about *their science learning and factors that influence their interest and motivation to study science. Some of the questions would be to get more information on some questions they may have seen in the survey attributing to their self-efficacy and that may influence their overall achievement in science.* The interview will take *about 30 – 40 minutes* and this can be arranged during a time suitable for the students. They will not be expected to leave class. The interview will take place *at school and time of interview can be arranged when I visit the school and speak with them. Lunch or refreshment will be provided depending on what time of the day it will be.* The participating students will be asked to provide consent before their involvement in the research. I will audio record the interview with the permission of the students and write it up later. The interview will be confidential, meaning that I will know who participated, but their identity will be protected.

AND:

If you agree to take part, I will also request if the science teachers of the participating students who took the survey to share their assessment standard results and their NCEA Level One science results when it becomes available. The participating students will be asked to provide consent for their assessment marks to be shared with me. This will remain confidential and their identity will be protected.

The instruments above were designed as part of a Qualitative research methodology to collect the appropriate data for analysis. The findings will be summarised and triangulated with the assessment results and their NCEA results to answer the research question.

What will happen to the information the participants give?

Participation in this research is confidential*. This means that the researcher named below will be aware of the identity of your school, but your school will not be revealed in any reports, presentations, or public documentation

Only my supervisors, the transcriber (who will be required to sign a confidentiality agreement) and I will *read the notes or transcript of the interview and have access to the survey data. The interview transcripts, summaries, and any recordings/survey data]* will be kept securely and destroyed on *30th July 2024.*

Be aware that the identities and contributions of participants will be kept confidential from your school.

What will the project produce?

* Confidentiality will be preserved except where participants disclose something that causes me to be concerned about a risk of harm to themselves and/or others.

The information from my research will be used in my PhD dissertation and/or academic publications and conferences. I will also provide your school with a report summarising the results of the research.

If you accept this invitation, what are the rights of your organisation?

You do not have to accept this invitation if you don't want to. If you do decide that your organisation will participate, you have the right to:

- ask any questions about the study at any time.
- withdraw your school's participation from the study before *30th July 2019*, however, individual participants retain the right to decide if their data will be withdrawn.
- be able to read a report of this research

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact [either/me]:

Student:	Principal Supervisor:	Supervisor:
Name: Margaret Vaka-Vivili	Name: Dr Azra Moeed	Dr. Dayle Anderson
University email address:	Role: Associate professor	Role: Senior Lecturer
margaret.vakavivili@vuw.ac.nz	School: Faculty of Education	School: Faculty of Education
	Phone: 04 4639643	Phone: 04 4639630
	azra.moeed@vuw.ac.nz	Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research you may contact the Convenor of the Victoria University of Wellington Human Ethics Committee: Dr Judith Loveridge, email hec@vuw.ac.nz or telephone +64-4-463 6028.

Self-efficacy beliefs influencing students' achievement in science

INFORMATION SHEET FOR TEACHER PARTICIPANTS [Classroom observation]

You are invited to take part in this research. Please read this information before deciding whether to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a Doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project *aims at finding out and understanding the influence of self-efficacy on a student's achievement of science. In this research, I am focussing on Pasifika students. Self-efficacy is an inner drive that propels students' interest and motivation in attempting something or propels an interest to learn something or carry out an activity. There are four ways in which self-efficacy works; mastery, vicarious experience, verbal persuasion, physiological emotional arousal.*

Your participation will support this research by allowing me to document some of the realities faced by science teachers in the classroom and as teachers of students with multiethnic backgrounds. Results of the findings may also be used for future professional training of teachers who teach multiethnic students including Pasifika. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

You have been invited to participate because *you are one of the teachers in Wellington that has the highest number of Pasifika students under your care studying Level 1 science.*

If you agree to participate, you would be giving me the opportunity to witness the dynamics of a science classroom while being a silent observer and making my own notes. I will be observing the whole class even though my students of interest are Pasifika students.

I will audio record each classroom session with your permission and write it up later. You can withdraw from the study by contacting me at any time before *30th July 2019*. If you withdraw, the information collected in your classroom will be destroyed.

What will happen to the information you give?

This research is confidential*. This means that the researcher named below will be aware of your identity, but you and your school's identity will be protected. You and your school will be identified using pseudonyms and will not be revealed in any reports, presentations, or public documentation. However, you should be aware that in small projects like this one, your identity might be obvious to other teachers in your school.

Only my supervisors and I will read the notes collected during each classroom observation. The transcripts, summaries and any recordings will be kept securely and destroyed on 30th of July 2024.

What will the project produce?

The information from my research will be used in my PhD dissertation and academic publications and conferences.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- ask me not to make note of any activity.
- ask for the recorder to be turned off at any time during the class.
- withdraw from the study before 30th July 2019
- ask any questions about the study at any time.
- be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either me or my Supervisors.

Student:
Name: Margaret Vaka-Vivili
University email address:
margaret.vakavivili@vuw.ac.nz

Principal Supervisor:
Name: Dr Azra Moeed
Role: Associate professor
School: Faculty of Education
Phone: 04 4639643
azra.moeed@vuw.ac.nz

Supervisor:
Dr. Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

Self-efficacy beliefs influencing students' achievement in science

INFORMATION SHEET FOR TEACHER PARTICIPANTS [for Interviews]

You are invited to take part in this research. Please read this information before deciding whether to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a Doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project aims at finding out what influence self-efficacy can have on student achievement of science. In this research, I am focussing on Pasifika students. Self-efficacy is an inner drive that propels students' interest and motivation in attempting something or propels an interest to learn something or carry out an activity. There are four ways in which self-efficacy works:

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged, or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

Your participation will support this research by providing a teacher's perception of Pasifika students' self-efficacy and how it may influence their learning and achievement in science.

This research will help us understand teacher perceptions of their students' self-efficacy and student beliefs about their own self-efficacy. The findings will help inform teacher practice and professional

development of teachers of Pasifika students in science. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

You have been invited to participate because *you are one of the teachers in Wellington that has the highest number of Pasifika students under your care studying Level 1 science.* If you agree to take part, I will interview you *at the school.* I will ask you questions about *your perceptions of Pasifika students' self-efficacy in science and some of your teaching experiences as a teacher of science to students of mixed cultures.* The interview will take *30 – 40 minutes* and I will audio record the interview with your permission and write it up later. You can choose to not answer any question or stop the interview at any time, without giving a reason. You can withdraw from the study by contacting me at any time before *30th of July 2019.* If you withdraw, the information you provided will be destroyed.

What will happen to the information you give?

This research is confidential*. This means that the researcher named below will be aware of your identity, but the research data will be combined, and pseudonyms used where appropriate. You and your school will be identified using pseudonyms as well and your identity will not be revealed in any reports, presentations, or public documentation. However, you should be aware that in small projects like this, your identity might be obvious to other teachers in your school.

Only my supervisors and the transcriber (who will be required to sign a confidentiality agreement) and I will read the notes and the voice recording of the interview. The interview transcripts, summaries and any recordings will be kept securely and destroyed on *30th of July 2024*

What will the project produce?

The information from my research will be used in my PhD dissertation and/or academic publications and conferences.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question.
- ask for the recorder to be turned off at any time during the interview.
- withdraw from the study before *30th July 2019.*
- ask any questions about the study at any time.
- read over and comment on a written summary of your interview *before I include it in my study.*
- be able to read any reports of this research by emailing the researcher to request a copy.

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact me or my supervisors:

Student:	Principal Supervisor:	Supervisor:
Name: Margaret Vaka-Vivili	Name: Dr Azra Moeed	Dr Dayle Anderson
University email address:	Role: Associate professor	Role: Senior Lecturer
margaret.vakavivili@vuw.ac.nz	School: Faculty of Education	School: Faculty of Education
	Phone: 04 4639643	Phone: 04 4639630
	<u>azra.moeed@vuw.ac.nz</u>	Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION SHEET FOR PARENTS

Researcher: *Margaret Vaka-Vivili, School of Education, Victoria University of Wellington.*

Your child has been invited to take part in this research. Please read this information before deciding to allow your child to participate or not to take part. If you decide to allow him/her to participate, thank you. If not, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project is aimed at finding out more about how Pasifika students feel about their science learning. It will help me to build an understanding as to why they feel this way and how it can influence their overall learning and achievement in science.

In this research, I am working on a topic called self-efficacy. What is self-efficacy?

Self-efficacy is an inner drive that propels students' interest and motivation in attempting something or poses a strong desire or interest to learn something or carry out an activity. There are four ways in which self-efficacy works; mastery, verbal persuasion, vicarious experience or modelling and physiological/emotional arousal.

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged, or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

Your child has been invited to participate because the views of Pasifika students in New Zealand secondary schools are important in this research. Not much has been written about how Pasifika students feel about their learning and achievement in science, therefore your child's participation is important because we can learn from what he or she says and that view will go a long way to helping other Pasifika children studying science in future. If you decide to allow your child to take part, he/she may be required to take part in one or all three of the following activities.

1. Take part in completing a Questionnaire which I will provide.
2. He/she may also be part of a focus group of about 5-7 students from the same class whom I will interview. All will be a group of classmates and I will ask the questions and details about some of the questions they may have seen and answered on the Student Questionnaire sheet and some more questions which I have prepared.

Not everyone will take part in both. Most of them will only take part in the Questionnaire.

3. His or her assessment standard results plus NCEA results when they become available will be studied together to see if self-efficacy does influence their achievement in school. However, I am not looking at all subjects but only science.

*** Please note that this study is totally voluntary and there won't be any assessment credits that come with it.

What will happen to the information they give?

This research is confidential*. This means that the researcher named below will be aware of their identity, but the research data will be combined, and their identity will not be revealed in any reports, presentations, or public documentation.

Only my supervisors and I will read the notes or transcript of the focus group. The focus group transcripts, summaries and any recordings will be kept securely and destroyed after 3 years.

What will the project produce?

The information from my research will be used in my PhD dissertation and academic publications and conferences.

If you accept this invitation, what are your child's rights as a research participant?

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

Your child does not have to accept this invitation if they do not want to. If they do decide to participate, they have the right to:

- choose not to answer any question.
- leave the questionnaire blank.
- ask for the recorder to be turned off at any time during the focus group.
- withdraw from the focus group while it is taking part however it will not be possible to withdraw the information you have provided up to that point.
- ask any questions about the study at any time.
- request a copy of the written summary of the focus group
- If you wish to receive a summary of the findings, please leave your name and email address on the consent form that is attached.

If you have any questions, either now or in the future, please feel free to contact me or my supervisors:

Student:
Name: Margaret Vaka-Vivili
University email address:

margaret.vakavivili@vuw.ac.nz

Supervisor:
Name: Dr Azra Moeed
Role: Associate professor
School: Faculty of
Education
Phone: 04 4639643
azra.moeed@vuw.ac.nz

Supervisor:
Dr. Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

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Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION SHEET FOR PASIFIKA PARENTS

Researcher: *Margaret Vaka-Vivili, School of Education, Victoria University of Wellington.*

Your child has been invited to take part in this research. Please read this information before deciding to allow your child to participate or not to take part. If you decide to allow him/her to participate, thank you. If not, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project is aimed at finding out more about how Pasifika students feel about their science learning. It will help me to build an understanding as to why they feel this way and how it can influence their overall learning and achievement in science.

In this research, I am working on a topic called self-efficacy. What is self-efficacy?

Self-efficacy is an inner drive that propels students' interest and motivation in attempting something or poses a strong desire or interest to learn something or carry out an activity. There are four ways in which self-efficacy works; mastery, persuasion, Vicarious experience or modelling and Physiological/emotional arousal.

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious Experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged, or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

Your child has been invited to participate because the views of Pasifika students in New Zealand secondary schools are important in this research. Not much has been written about how Pasifika students feel about their learning and achievement in science, therefore your child's participation is important because we can learn from what he or she says, and that view will go a long way to helping other Pasifika children studying science in future. If you decide to allow your child to take part, he or she may be required to take part in one or all the following three activities.

1. Take part in completing a Questionnaire which I will administer and collect.

AND

2. If you decide to allow your child to take part, he or she may also be part of a smaller focus group (about 5-7 students) whom I will interview. They will be from the same class. I will ask questions and details about some of the answers they wrote on the Student Questionnaire and some more questions about their learning in science which I have prepared.

Not everyone will take part in both. Most of them will only take part in the Questionnaire.

AND

3. If you decide to allow your child to take part, I will be given access to his or her science assessment standard results and NCEA results when they become available from the teacher. This will be studied together with the results from the survey and interview to see if self-efficacy does influence their achievement in school.

*** Please note that this study is totally voluntary and there won't be any assessment credits that come with it. Students will be provided with lunch or afternoon tea depending on what time of the day they do the survey and interview.

What will happen to the information they give?

This research is confidential*. This means that the researchers named below will be aware of their identities, but the research data will be combined, and their identities and that of the school will not be revealed in any reports, presentations, or public documentation.

Only my supervisors and the transcriber (who will be required to sign a confidentiality agreement) and I will read the notes and the voice recording of the interview. Only my Supervisors and I will have access to the achievement standards and NCEA data. The interview transcripts, summaries and any recordings will be kept securely also and destroyed on 30th of July 2024.

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

What will the project produce?

The information from my research will be used in my PhD dissertation and academic publications and conferences.

If you accept this invitation, what are your child's rights as a research participant?

Your child does not have to accept this invitation if they do not want to. If they do decide to participate, they have the right to:

- choose not to answer any question.
- leave the questionnaire blank.
- ask for the recorder to be turned off at any time during the focus group.
- withdraw from the focus group while it is taking part however it will not be possible to withdraw the information you have provided up to that point.
- ask any questions about the study at any time.
- request a copy of the written summary of the focus group
- If you wish to receive a summary of the findings, please include your name and email address on the consent form that is attached.

Please indicate by circling Yes or No and state your language if you need a translated version of this letter. Yes or No. Language: -----

If you have any questions, either now or in the future, please feel free to contact my supervisors or me:

Student:
Name: Margaret Vaka-Vivili
University email address:

margaret.vakavivili@vuw.ac.nz

Supervisor:
Name: Dr Azra Moeed
Role: Associate professor
School: Faculty of
Education
Phone: 04 4639643
Email:
azra.moeed@vuw.ac.nz

Supervisor:
Dr. Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

Appendix H: INFORMATION FOR ALL STUDENT PARTICIPANTS (CLASSROOM OBSERVATION)

Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION FOR ALL STUDENT PARTICIPANTS (CLASSROOM OBSERVATION)

You and your science class are invited to take part in this research. Please read this information on how you can take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project aims at finding out what influence self-efficacy can have on student achievement of science. Self-efficacy is an inner drive that propels students to attempt something or want to learn something. There are four ways in which self-efficacy works; Mastery, persuasion, modelling and vicarious experience.

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged, or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

Your participation will support this research by helping me to document beliefs that drive the self-efficacy of Pasifika students at Year 11 and to build a better understanding of how it may

influence your overall performance in science. The findings will also help teachers of other Pasifika students who study science in future. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

You do not have to do anything special. I need your permission to be present in your classroom to make some observations of how you and your class interact with your science teacher in your classroom environment. It will help me to understand how self-efficacy is built among young students of science and provide information on how self-efficacy might influence science achievement. Although I am particularly interested in the views of Pasifika students, their interaction with the teacher and with other students in class is just as important in this research. Your participation in being part of the study group will go a long way to help us understand and document how young students study science in the present and equip us for professional teacher development in future.

For your participation, you are not required to do anything but to know I will be present in all your science classes for one week making observations and my own notes. I will also be audio recording all the lessons for my own backup.

*** Please note that this study is totally voluntary and there won't be any assessment credits that come with it.

What will happen to the information you give?

This research is confidential*. This means that your identity will not be known to anyone else but the researcher and her supervisors. The research data will be combined, and your identities and that of your school will not be revealed in any reports, presentations, or public documentation. Only my supervisors and the transcriber (who will be required to sign a confidentiality agreement) and I will read the notes and the voice recording of the classroom sessions. The transcripts, summaries and any recordings will be kept securely also and destroyed on 30th of August 2024.

What will the project produce?

The information from my research will be used in my PhD dissertation to Victoria University of Wellington and/or academic publications and conferences.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either my supervisors or me:

Student:
Name: Margaret Vaka-Vivili

Principal Supervisor:
Name: Dr Azra Moeed

Supervisor:
Dr. Dayle Anderson

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

University email address:
margaret.vakavivili@vuw.ac.nz

Role: Associate professor
School: Faculty of Education
Phone: 04 4639643
azra.moeed@vuw.ac.nz

Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

Appendix I: INFORMATION FOR PASIFIKA STUDENT PARTICIPANTS

Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION FOR PASIFIKA STUDENT PARTICIPANTS

You are invited to take part in this research. Please read this information before deciding whether to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project aims at finding out what influence self-efficacy can have on student achievement of science. Self-efficacy is an inner drive that propels students to attempt something or want to learn something. There are four ways in which self-efficacy works; Mastery, persuasion, modelling and vicarious experience.

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

Your participation will support this research by helping me to document beliefs that drive the self-efficacy of Pasifika students at Year 11 and to build a better understanding of how it may influence your overall performance in science. The findings will also help teachers of

other Pasifika students who study science in future. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

You have been invited to participate because *you identify as Pasifika and you are studying science at Level 1. I have chosen your school because it is also one of the schools in Wellington that has a high number of Pasifika students.* If you agree to take part, you can help me with the following ways. Not everyone will do all three.

1. Survey

If you agree to take part, you will be asked to complete a survey. The survey will ask you questions about *your interest in learning science.* The survey will take you *30 minutes* to complete.

2. Focus Group Interview

If you agree to take part you will be part of a focus group I will be interviewing right here at the school. I will ask you and other participants questions about how you are finding your learning in science. The focus group interview will take about 30 to 40 minutes. I will audio record the focus group with your permission and write it up later.

The information shared during the focus group is confidential. That means after the focus group, you may not communicate to anyone, including family members and close friends, any details about the identities or contributions of the other participants of the focus group.

You can withdraw from the focus group at any time before the focus group begins.

You can also withdraw while the focus group is in progress. However, it will not be possible to withdraw the information you have provided up to that point as it will be part of a discussion with other participants.

Focus group rules

- *You do not need to agree with others, but you should listen respectfully as others share their views.*
- *I would like to hear a wide range of opinions: please speak up on whether you agree or disagree.*
- *There are no right or wrong answers, every person's experiences and opinions are important.*
- *The meeting is audio recorded, therefore, please one person speaks at a time.*
- *Please turn off your phones before we begin.*

3. Access to your standards assessment and NCEA results when they become available

If you agree to participate, your teacher will share with me your standards assessment

results in science this year and your NCEA Level 1 science results when they become available. This will be used to compare with the survey and interview analysis we carry out in activities 1 and 2.

What will happen to the information you give?

This research is confidential*. This means that your identity will not be known to anyone else but the researcher and her supervisors. You will only be identified by a code number and that number will appear in my thesis or any reports in relation to this research. The data will be combined, and your identities and that of your school will not be revealed in any reports, presentations, or public documentation.

Only my supervisors and the transcriber (who will be required to sign a confidentiality agreement) and I will read the notes and the voice recording of the interview. Only my Supervisors and I will have access to the achievement standards and NCEA data. The interview transcripts, summaries and any recordings will be kept securely also and destroyed on 30th of July 2024.

What will the project produce?

The information from my research will be used in my PhD dissertation to Victoria University of Wellington and/or academic publications and conferences.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either my supervisors or me:

Student:
Name: Margaret Vaka-Vivili
University email address:
margaret.vakavivili@vuw.ac.nz

Principal Supervisor:
Name: Dr Azra Moeed
Role: Associate professor
School: Faculty of Education
Phone: 04 4639643
Email:
azra.moeed@vuw.ac.nz

Supervisor:
Dr. Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION FOR PARTICIPANTS [for Surveys]

You are invited to take part in this research. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project *aims at finding out what influence self-efficacy can have on student achievement of science. Self-efficacy is an inner drive that propels students to attempt something or want to learn something. There are four ways in which self-efficacy works.*

first is called Mastery – if you are naturally good at something, you will be motivated to keep doing it.

Second, is by modelling- if someone shows another person how something is done, they'll want to try it out themselves and,

Third is by persuasion – if someone is not naturally good at something, if another person persuades him or her, they'll try to do it.

Fourth is by a vicarious experience- someone may not be very good at something, but if they see someone, they know of does it successfully, they get motivated enough to try it themselves.

Your participation will support this research by *helping me to document beliefs that drive the self-efficacy of Pasifika students at Year 11 and to build a better understanding of how it may influence your overall performance in science. Your participation in this research will also help us help teachers of other Pasifika students who study science in future.* This research has been approved by the Victoria University of Wellington Human Ethics Committee [#26833](#).

How can you help?

You have been invited to participate because *you are studying science at Level 1 and your school is one of the schools in Wellington with a high number of students of Pasifika origin*. If you agree to take part, you will complete a survey. The survey will ask you questions about *your interest in learning science*. The survey will take you *30 minutes* to complete.

What will happen to the information you give?

This research is confidential. This means that your identity will not be known to anyone else but the researcher and her supervisors. You will only be identified by a code number and that number will appear in my thesis or any reports in relation to this research. By answering it, you are giving consent for me to use your responses in this research. Your answers will remain completely confidential. Once you submit the survey, it will be impossible to retract your answer. If you have to do any writing, please write in the space provided.

What will the project produce?

The information from my research will be used in my PhD dissertation to Victoria University of Wellington and/or academic publications and conferences.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either me or my supervisors:

Student:
Name: Margaret Vaka-Vivili
University email address:
margaret.vakavivili@vuw.ac.nz

Principal Supervisor:
Name: Dr Azra Moeed
Role: Associate professor
School: Faculty of Education
Phone: 04 4639643
azra.moeed@vuw.ac.nz

Supervisor:
Dr. Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email: dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

APPENDIX K: INFORMATION SHEET FOR PASIFIKA PARTICIPANTS (FOCUS GROUP INTERVIEW)

Self-efficacy beliefs influencing Pasifika students' achievement in science

INFORMATION SHEET FOR PARTICIPANTS [for Focus Groups]

You are invited to take part in this research. Please read this information before deciding whether to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is *Margaret Vaka-Vivili* and I am a Doctoral student in *Education* at Victoria University of Wellington. This research project is work towards my thesis.

What is the aim of the project?

This project *aims at finding out what influence self-efficacy can have on student achievement of science. Self-efficacy is an inner drive that propels students to attempt something or want to learn something. There are four ways in which self-efficacy works.*

Mastery – if someone has had success in a prior experience or are naturally good at something, they would be motivated to do it again.

Vicarious Experience or modelling- someone may not be very good at something, but if they watch someone else do it (modelling) they may get motivated to try it themselves.

Verbal Persuasion – being verbally instructed, encouraged or persuaded to attempt a task.

Physiological/Emotional arousal – the emotions are involved when someone contemplates to attempt a task. Fear, anxiety may cause someone with low self-efficacy not to attempt a task for fear of failure. However, if someone sees someone like themselves achieve something, they could be motivated to attempt the task.

Using the three instruments I have designed for the students (Classroom observation, questionnaire, and focus group interview, I intend to collect data and compare how it may influence your grades for your achievement standard grades and NCEA overall result in science.

Your participation will support this research by *helping me to document beliefs that drive the self-efficacy of Pasifika students at Year 11 and to build a better understanding of how it may influence your overall performance in science. Your participation in this research will also help*

us help teachers of other Pasifika students who study science in future. This research has been approved by the Victoria University of Wellington Human Ethics Committee #26833.

How can you help?

You have been invited to participate because *you are studying science at Level 1 and you have indicated that you are of Pasifika origin.* If you agree to take part, you will be part of a focus group *I will be interviewing right here at the school.* I will ask you and other participants questions about *how you are finding your learning in science.* The focus group interview will take *about 30 to 40 minutes.* I will audio record the focus group with your permission and write it up later.

The information shared during the focus group is confidential. That means after the focus group, you may not communicate to anyone, including family members and close friends, any details about the identities or contributions of the other participants of the focus group.

You can withdraw from the focus group at any time before the focus group begins.

You can also withdraw while the focus group it is in progress. However, it will not be possible to withdraw the information you have provided up to that point as it will be part of a discussion with other participants.

What will happen to the information you give?

- This research is confidential* *The information shared in this meeting is confidential. You should not discuss the opinions and comments made by other focus group participants with anybody outside this room. However, I would like you and others to feel comfortable when sharing information.*
- This means that the researcher named below will be aware of your identity, but the research data will be combined, and your identity will not be revealed in any reports, presentations, or public documentation. However, you should be aware that in small projects like this one your identity might be obvious to others in your school but will be identified as a group and not as individuals.
- Only my supervisors and the transcriber (who will be required to sign a confidentiality agreement) and I will read the notes or transcript of the focus group. The focus group transcripts, summaries and any recordings will be kept securely and destroyed *on 30th July 2024.*

Focus group rules

- *You do not need to agree with others, but you should listen respectfully as others share their views.*
- *I would like to hear a wide range of opinions: please speak up on whether you agree or disagree.*

* Confidentiality will be preserved except where you disclose something that causes me to be concerned about a risk of harm to yourself and/or others.

- *There are no right or wrong answers, every person's experiences and opinions are important.*
- *The meeting is audio recorded, therefore, please one person speaks at a time.*
- *Please turn off your phones before we begin.*

What will the project produce?

The information from my research will be used in PhD dissertation and/or academic publications and conferences.

If you accept this invitation, what are your rights as a research participant?

You do not have to accept this invitation if you don't want to. If you do decide to participate, you have the right to:

- choose not to answer any question.
- ask for the recorder to be turned off at any time during the focus group.
- withdraw from the focus group while it is taking part however it will not be possible to withdraw the information you have provided up to that point.
- ask any questions about the study at any time.
- be able to read any reports of this research by emailing the researcher to request a copy.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either me or my supervisors:

Student:

Name: Margaret Vaka-Vivili
University email address:
margaret.vakavivili@vuw.ac.nz

Supervisor:

Name: Dr Azra Moeed
Role: Associate
professor
School: Faculty of
Education
Phone: 04 4639643
azra.moeed@vuw.ac.nz

Supervisor:

Dr Dayle Anderson
Role: Senior Lecturer
School: Faculty of Education
Phone: 04 4639630
Email:
dayle.anderson@vuw.ac.nz

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email hec@vuw.ac.nz or telephone +64-4-463 6028.

Appendix L: CONSENT TO PARTICIPATE (PRINCIPAL)

Self-efficacy beliefs influencing students' achievement in science

CONSENT TO PARTICIPATE (PRINCIPAL)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me. I understand that I can ask further questions at any time.
- I agree that my school will take part.

I understand that:

- I may withdraw this school from this study at any point before *30th July 2019*, and the information provided by members of this school will be destroyed.
- Any information the participants provide will be included in a final report, but the surveys/transcripts/observation notes/recordings will be kept confidential to the researcher and her supervisors and the transcriber.
- My staff member will review the summary of the interview transcript before the researcher can include in the study.
- My participating staff member will share the standards assessment results and the NCEA Level 1 results when they become available with the researcher for the purpose of this study.
- The identities of the participants will remain confidential to the researcher and her supervisors.
- The results will be used for a PhD dissertation to Victoria University of Wellington and academic publications and/or presented to conferences.
- The name of my school will not be used in reports and utmost care will be taken not to disclose any information that would identify the organisation.
- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

Appendix M: TEACHER CONSENT TO BE OBSERVED (Classroom Observation)

Self-efficacy beliefs influencing students' achievement in science

CONSENT TO BE OBSERVED (Classroom Observation)

This consent form will be held for 5 years.

Researcher: Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.

- I have read the Information Sheet and the project has been explained to me.
- I understand that I can ask further questions at any time.
- I agree to have the researcher be part of my class as a silent observer.
- I agree to have my class audio recorded as a backup by the researcher.

I understand that:

- I may withdraw from this study at any point before 30th June 2019, and any information collected will be destroyed.
- I understand that the findings may be used for a PhD dissertation to Victoria University of Wellington and academic publications and/or presented to conferences.
- I understand that the observation notes/recordings will be kept confidential to the researcher and her supervisors.
- I understand that consent has been provided by my Principal and my school will not be named in any of the reports.
- *I understand that* my name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.
- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Signature of participant: _____ Date: _____

Name of participant: _____ Contact details: _____

Appendix N: TEACHER CONSENT TO BE INTERVIEWED

Self-efficacy beliefs influencing students' achievement in science

CONSENT TO INTERVIEW (Teacher)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in an audio recorded interview.

I understand that:

- I may withdraw from this study at any point before *30th July 2019*, and any information that I have provided will be returned to me or destroyed.
- The identifiable information I have provided will be destroyed on *30th July 2024*.
- Any information I provide will be kept confidential to the researcher and the supervisors and the transcriber.
- I understand that the findings may be used for a PhD dissertation to Victoria University of Wellington and academic publications and/or presented to conferences.
- I understand that the interview notes and recordings will be kept confidential to the researcher and her supervisors and the transcriber.
- I understand my name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.
- I would like a summary of my interview to comment on before including in the study Yes ☐ No ☐
- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Signature of participant: _____ Date: _____

Name of participant: _____ Contact Details: _____

Appendix O: Parental Consent for Classroom Observation

Self-efficacy beliefs influencing Pasifika students' achievement in science

Consent form for parents/ caregivers (Classroom Observation)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me.
- The researcher will be present in my child's class to observe and take notes for one week.
- I am aware that during that time my child's class will be audio recorded as a backup for the researcher.

I understand that my child/s:

- will be taking part in the study on his/her own will.
- identifiable information provided will be destroyed on *30th August 2024*.
- information will be kept confidential to the researcher and the supervisors and the transcriber.
- interview notes, and recordings will be kept confidential to the researcher and her supervisors and the transcriber.
- name will not be used in reports and utmost care will be taken not to disclose any information that would identify him/her.
- Identity and school name will only be identified with a code name or pseudonym in the researcher's writing.
- may withdraw from this study at any point before *30th August 2019*, and any information that he/she is involved in will be destroyed.
- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Parents' section

I am happy for to participate in this research by:

(Child's name)

being in a class that is being observed by the researcher _____

(Please tick)

Parent's name: _____

Signature: _____

Date: _____

Appendix P: Parental Consent for Pasifika Parents

Self-efficacy beliefs influencing Pasifika students' achievement in science

Consent form for parents/ caregivers (Pasifika)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me.
- The researcher will be present in my child's class to observe and take notes for one week.
- I am aware that during that time my child's class will be audio recorded as a backup for the researcher.

I understand that my child/s:

- will be taking part in the study on his/her own will.
- Will take part in an audio recorded interview
- identifiable information provided will be destroyed on *30th August 2024*.
- information will be kept confidential to the researcher and the supervisors and the transcriber.
- assessment standards and NCEA results will be used for a PhD dissertation to be submitted to Victoria University of Wellington and academic publications and/or presented to conferences.
- interview notes, and recordings will be kept confidential to the researcher and her supervisors and the transcriber.
- name will not be used in reports and utmost care will be taken not to disclose any information that would identify him/her.
- may withdraw from this study at any point before *30th August 2019*, and any information that he/she has provided will be destroyed.

- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Parents' section

I am happy for to *participate in this research by:*

(Child's name)

1. being part of a science class that will be observed_____ (Please tick)
2. completing a student survey _____ (Please tick)
3. taking part in a focus group_____ (Please tick)
4. releasing his or her assessment standard results and NCEA result to the researcher for this study. _____ (Please tick)

Parent's name: _____

Signature: _____

Date: _____

Appendix Q: STUDENT CONSENT TO PARTICIPATE (CLASSROOM OBSERVATION)

Self-efficacy beliefs influencing Pasifika students' achievement in science

STUDENT CONSENT TO PARTICIPATE (CLASSROOM OBSERVATION)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- The researcher will be present in my class to observe and take notes for one week.
- I am aware that during that time the class will be audio recorded as a backup for the researcher.

I understand that:

- I have made the decision to take part in this study on my own.
- The information gathered by the researcher for the purpose as stated.
- My name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.
- I can request that the audio recorder to be turned off at any point during class.
- I can ask the researcher not to include any specific behaviour observed during the class if it implicates me in a negative way.
- The identifiable information I have provided will be destroyed on *30th August 2024*.
- I understand that the interview notes, and recordings will be kept confidential to the researcher and the supervisors and the transcriber.
- The results will be used for a PhD dissertation to be submitted to Victoria University of Wellington and academic publications and/or presented to conferences.

- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

I hereby consent to be part of a science class that will be observed by
the researcher. _____ *(Please tick)*

Name of participant: _____

Date: _____

Contact details: _____

Appendix R: STUDENT CONSENT TO PARTICIPATE (PASIFIKA)

Self-efficacy beliefs influencing Pasifika students' achievement in science

STUDENT CONSENT TO PARTICIPATE (PASIFIKA)

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- The researcher will be present in my class to observe and take notes for one week
- I am aware that during that time the class will be audio recorded as a backup for the researcher.

I understand that:

- I have made the decision to take part in this study on my own.
- By taking the survey/questionnaire, I give consent for the information I provide to be used in this study.
- The information I provide in the survey will be used by the researcher for the purpose as stated.
- I acknowledge that I am agreeing to keep the information shared during the focus group confidential.
- After the focus group, I must not communicate to anyone, including family members and close friends, any details about the identities or contributions of the other participants of the focus group.
- My name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.
- I can withdraw from the focus group while it is in progress however it will not be possible to withdraw the information I have provided up to that point as it will be part

of a discussion with other participants.

- The identifiable information I have provided will be destroyed on 30th August 2024.
- I consent that my achievement standard grades and my NCEA results to be shared by my teacher with the researcher and her supervisors.
- I understand that the interview notes, and recordings will be kept confidential to the researcher and the supervisors and the transcriber.
- The results will be used for a PhD dissertation to be submitted to Victoria University of Wellington and academic publications and/or presented to conferences.
- I would like to receive a copy of the final report and have added my email Yes ☐ No ☐ address below.

I hereby consent to:

- (1) *be part of a science class that will be observed*_____ (Please tick)
- (2) *complete the student survey* _____ (Please tick)
- (3) *take part in a focus group*_____ (Please tick)
- (4) *release of my assessment standard results and NCEA result to the researcher for this study.* _____ (Please tick)

Name of participant: _____

Date: _____

Contact details: _____

Appendix S: STUDENT CONSENT TO PARTICIPATE IN FOCUS GROUP

Self-efficacy beliefs influencing Pasifika students' achievement in science

CONSENT TO PARTICIPATE IN FOCUS GROUP

This consent form will be held for 5 years.

Researcher: *Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.*

- I have read the Information Sheet and the project has been explained to me. My questions have been answered to my satisfaction. I understand that I can ask further questions at any time.
- I agree to take part in an audio recorded focus group.

I understand that:

- I acknowledge that I am agreeing to keep the information shared during the focus group confidential. I am aware that after the focus group, I must not communicate to anyone, including family members and close friends, any details about the identities or contributions of the other participants of the focus group.
- I can withdraw from the focus group while it is in progress however it will not be possible to withdraw the information I have provided up to that point as it will be part of a discussion with other participants
- The identifiable information I have provided will be destroyed on *30th July 2024*.
- I consent that my standards assessment marks and my NCEA results to be shared by my teacher with the researcher and her supervisors.
- I understand that the findings may be used for a PhD dissertation to Victoria University of Wellington and/or academic publications and/or presented to conferences.
- I understand that the interview notes and recordings will be kept confidential to the researcher and the supervisors and the transcriber.
- I understand that my name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.

- I would like to receive a copy of the final report and have added my email address below. Yes ☐ No ☐

Signature of participant: _____ Date: _____

Name of participant: _____ Contact Details: _____

Appendix T: FOCUS GROUP INTERVIEW SCHEDULE

SELF-EFFICACY BELIEFS INFLUENCING PASIFIKA STUDENTS ACHIEVEMENT IN SCIENCE

Researcher: *Margaret Vaka-Vivili, School of Education, Victoria University of Wellington.*

Pasifika participants Focus group Semi-structured Interview schedule

Part 1: Greetings/pizza

Part 2: Interview (Indicative Questions)

Instructions: Good job everyone! You will all get the opportunity to answer a question. Just a reminder, this interview is recorded so can I quickly get you to stick your ID tag on the front of your shirt/jersey if you haven't yet, where I can see it.

During the interview, I will only be referring to you by your ID tag and not your name. Thank you, now let's get started.

1. *What do you most like about studying science?*
2. *Please tell me how you think science is useful in your everyday life?*
Can you give me some examples?
3. *Please tell me about some science ideas you can explained to your friends?*
When was the last time you explained a science idea to a friend?
Why was that?
4. *When the teacher is doing a demonstration what do you do if you are unable to see or hear? Please explain.*
5. *When the teacher asks you to get on with the practical work, does s/he need to remind you to get started? (Response)*
Why might that be? (Response)
6. *Are you always energetic and attentive in class?*
Yes/No

What are some reasons why you feel this way?

What are some things you do to make you feel more energetic and attentive in class?

Suppose you missed a class, what do you do to catch up?

Why do you think it is important to catch up?

7. *Do you normally ask your teacher for feedback on your work?*

Yes/No

Give me an example of when you last asked your teacher for feedback.

Why was it important to ask for that feedback?

If not, why are you reluctant to ask for feedback?

8. *Please tell me what encourages you to study and learn science?*

Who encourages you to study and learn science?

9. *What was a practical investigation you carried out recently?*

Tell me how you carried out your plan?

What did you find out?

Were you able to follow your plan or did you have to make changes to your plan?

Did you control any variables? Why?

What changes did you make? Why?

If another student were to carry out the same investigation, what would you advise them to do differently from what you did?

Did you enjoy this investigation? Why/Why not?

Did you repeat your trial?

Why did you repeat?

Why did you not repeat the trial? (If they answer they had not repeated the trial).

10. *What do you not like about science?*

Why do you say that?

What were your experiences?

How can your teacher help you like science better? Thank you for your time.

APPENDIX U: Student responses during the Focus Group interview (Sample)

	Question	Replies	Codes
1	What do you like most about science?	<ul style="list-style-type: none"> *The experiments *Finding answers *Gathering data *Learning about metals and their uses * Learning about stuff to help in their future 	<ul style="list-style-type: none"> * procedural *contextual * Like Hands-on activities, developing procedural knowledge; contextual knowledge for example, about metals; and future utility
2	Please tell me how science is useful in your everyday life?	<ul style="list-style-type: none"> *science has to do with everything; energy, the human body and the world around us. *finding out new things *knowing uses of metals 	<ul style="list-style-type: none"> *aware of science as the world around them *source of knowledge
3	Please tell me some ideas about science you can explain to your friends	<ul style="list-style-type: none"> *safe laboratory practices: no running, no eating, no playing in the lab, wear safety goggles *knowing about the body and be able to assist someone who might need help e.g., food poisoning. 	<ul style="list-style-type: none"> *aware of safety hazards and respect laboratory practice *mastery
4	When the teacher is doing a demonstration, what do you do if you are not able to see?	<ul style="list-style-type: none"> *change position to get a better view *Ask a friend who might have seen it Ask teacher to repeat the demonstration 	<ul style="list-style-type: none"> *understand the importance of modelling – seeing it done. *vicarious experience
5	Do you like working individually or in groups?	<ul style="list-style-type: none"> *Everyone preferred working in groups 	<ul style="list-style-type: none"> *prefer the comfort of friendship – vicarious experience
6	How important is friendship to you?	<ul style="list-style-type: none"> * All saw friendship as very important *Important for bonding In the safety of each other learn new ideas and learn off each other 	<ul style="list-style-type: none"> *Relationship building/bonding and vicarious experience
7	When the teacher asks you to get on with practical work, does she need to remind you to get started?	<ul style="list-style-type: none"> * No * Sometimes 	<ul style="list-style-type: none"> *‘No’ answer means Mastery and ‘sometimes’ means needy of verbal persuasion
8	Are you always energetic and attentive in class?	<ul style="list-style-type: none"> *Yes and No * Need for more ‘hands-on’ type of practical work 	<ul style="list-style-type: none"> *‘Yes’ answer means Mastery and others need more vicarious experience/modelling

9	Suppose you missed a class, what do you do to catch up?	<ul style="list-style-type: none"> *Ask the teacher or *get notes from friends * To help in future tests 	*Able to self-manage and ask for help
10	Do you normally ask your teacher for feedback on your work?	<ul style="list-style-type: none"> * Yes, and sometimes *So that she can help with incomplete tasks 	*'Yes' answer means needy for Verbal Persuasion, 'sometimes' may mean mastery
11	Please tell me what encourages you to study and learn science	<ul style="list-style-type: none"> *To pass and get credits <p>Mum or other family member</p>	*'achievement' an emotional source of self-efficacy with verbal persuasion from family member
12	What was a practical investigation you carried out recently?	<ul style="list-style-type: none"> *Energy * Metals *It was given to us 	*Instructions were given by the teacher
13	Did you have to repeat some of the stuff you did?	<ul style="list-style-type: none"> *Yes *To get proper average * To get Fair results *To get a fair test... *to get the true result 	*aware of Fair Testing.
14	How can your teacher help you better in class?	<ul style="list-style-type: none"> * Explain more * Yeah, more into detail...guide, like a bit of guidance like through the experiments and stuff, like get us started off I guess 	*Needy of more Vicarious Experience/modelling and Verbal Persuasion
15	Is there anything you don't like about science?	<ul style="list-style-type: none"> * No, all like science 	*A subject choice they are happy to stick with

Appendix V: Table of emergent codes for the Focus group interview (Sample)

The emergent codes from the focus group interview are summarised as follows.

Section	Codes allocated per question	Self-efficacy antecedent
6.2.1	Like Hands-on activities, developing procedural knowledge; contextual knowledge for example, about metals; and future utility	Vicarious experience
6.2.2	Nature of science; future utility; vicarious experiences	Vicarious experience
6.2.3	Awareness of hazards and safe practices; Mastery	Mastery
6.2.4	Usefulness of modelling; seeing it being done; vicarious experience	Vicarious experience
6.2.5	Preference for working with others; vicarious experiences	Vicarious experience
6.2.6	Friendships; relationships with peers; vicarious experiences	Vicarious experience
6.2.7	No coded as mastery and sometimes as verbal persuasion	Mastery, Verbal Persuasion
6.2.8	Yes, indicated mastery and others need more vicarious experience/modelling	Mastery, Vicarious Experience
6.2.9	Ask the teacher; friendship; manage themselves	Vicarious Experience?
6.2.10	Yes, response indicated need for verbal persuasion and sometimes as mastery.	Verbal Persuasion, Mastery
6.2.11	Grades and credits and family encouragement	Vicarious Experience, verbal persuasion, Physiological/Emotional
6.2.12	Instructions were given by the teacher	
6.2.13	Awareness of fair testing.	Mastery
6.2.14	Need more vicarious experience/modelling and verbal persuasion	Vicarious Experience, verbal persuasion
6.2.15	Happy to stay with science for future learning	Vicarious Experience?

Appendix W Student Questionnaire (Sample)

Self-efficacy beliefs influencing Pasifika students' achievement in science

Researcher: Margaret Vaka-Vivili, Faculty of Education, Victoria University of Wellington.

STUDENT QUESTIONNAIRE

SECTION A: Background Information (Please DO NOT write your names on the Paper)

School Code: CTC001 ~~BAC111~~ Gender: ☒ Male / Female (Please circle) Age: 15

1. Name the Pacific Island/s of Origin of your Parent/s: Tonga NZ
2. How long have your parent/s been living in New Zealand? (Estimate) 39 Yrs.
3. Name the country you were born in: NZ
4. How many years have you lived in New Zealand? (If not born in NZ): Born in NZ
5. Do you have difficulty in hearing? Yes/☒ No (Please circle)
6. Do you wear prescription glasses? Yes/☒ No (Please circle)
7. Do you have a problem seeing colour? Yes/☒ No (Please Circle)

SECTION B: Please read the following questions and indicate your answer by placing a tick (✓) under the appropriate column. I have provided a key below as well as on the table.

Questions 6, 8 & 14 have extensions where you need to provide more details. Those questions are written in italics. Please write in the spaces provided.

Key: 1. Strongly agree 2. Mostly agree 3. Somewhat agree 4. Disagree 5. Strongly disagree

No.	Question	1 Strongly agree	2 Mostly agree	3 Somewhat agree	4 Disagree	5 Strongly Disagree
1	I can explain some science ideas we have studied this year		✓			
2	I know the science I learn in school is helpful to my everyday life		✓			
3	The science I learn in school will help me in my future career		✓			
4	I am able to ask questions and communicate my doubts with my teacher well		✓			
5	My teacher answers my questions well to my understanding		✓			
6 (a)	I know how to use science laboratory equipment.		✓			
(b)	State at least five examples of laboratory equipment you know how to use.	Eg.1 Bunsen Burner	Eg.2 Tongs	Eg.3 Glasses	Eg.4 Ruler	Eg.5 Pen
7	My teacher gives me plenty of opportunity to do practical work	✓				
8 (a)	I am able to plan a practical investigation			✓		
(b)	Please provide an example of a practical investigation you are able to plan and carry out.	None IDK				
9	I am able to explain to my friends how to carry out a practical investigation.			✓		
10	I am able to identify which variables I need to control in an investigation.			✓		
	Provide an example of one variable.	IDK				
11	I am able to explain why it is important to gather reliable data in science			✓		
12	My teacher encourages me to plan my own investigations		✓			
13	I would like to do practical work in class more often			✓		
14 (a)	I am able to explain how the science I learn in class is useful in my everyday life.			✓		
(b)	Please provide one example of how science is used in your everyday life.	learning different metals				

No.	Question	1 Strongly agree	2 Mostly agree	3 Somewhat agree	4 Disagree	5 Strongly disagree
15	During science practical class, I can read the instructions and confidently set up the apparatus.			✓		
16	During science practical class, I wait for my group mates to carry out a task before I take a turn.			✓		
17	During practical class I always ask the teacher to check my set-up before proceeding with the experiment.		✓	✗		
18	During practical class I always ask my group mates to check and help me to see if I am doing it correctly.		✓			
19	I can understand the symbols of scientific apparatus.			✓		
20	I always need my teacher's encouragement to complete set tasks.		✓			
21	I always let my teacher check my work before handing in an assessment task.		✓			
22	I feel I need constant encouragement to study science.		✓			
23	I have a physical impairment that doesn't allow me to handle laboratory equipment quite well.					✓
24	During practical demonstrations, I am always able to see what the teacher is demonstrating.			✓		
25	I am always attentive during science class.		✓			
26	If I miss a science class, it takes me longer to catch up.				✓	
27	When I achieve in my internal assessment it encourages me to learn.			✓		
28	My teacher's feedback makes me improve in my assessment.			✓		
29	When I get a merit' or 'excellence' it gives me the confidence to persist in studying science.		✓			
30	I can obtain the correct scientific apparatus to carry out a practical investigation		✓			

Thank you very much for your time.

Appendix X: Sample of Questionnaire Analysis (categorisation of statements into antecedents and allocation of Likert values to ticks)

****Microsoft Excel charts, frequency charts and frequency tables were drawn and extracted from this primary data for all three schools.**

Mean, median mode								
Grace College								
Mastery Questions	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole
1 I can explain some science ideas we have studied this year	3	2	5	4	5	4	3	3
6a I know how to use science laboratory equipment	5	3	5	4	5	4	5	5
8a I can plan a practical investigation	4	3	3	4	5	3	3	3
9 I can explain to my friends how to carry out a practical investigation.	0	2	5	3	4	3	3	3
10 I can identify which variables I need to control in an investigation.	3	3	4	3	4	3	3	3
11 I can explain why it is important to gather reliable data in science	4	2	4	3	5	3	3	3
14a I can explain how the science I learn in class is useful in my everyday life	4	3	4	4	4	3	3	3
15 During science practical class, I can read the instructions and confidently set up the apparatus	5	3	5	4	5	3	3	3
19 I can understand the symbols and obtain the correct scientific apparatus	4	2	4	3	5	3	3	3
30 I can obtain the correct scientific apparatus to carry out a practical investigation	0	3	3	3	5	4	4	3
Average	3.2	2.6	4.2	3.5	4.7	3.3	3.3	3.2
Max	5	3	5	4	5	4	5	5
Min	0	2	3	3	4	3	3	3
Range	5	1	2	1	1	1	2	2
Mode	4	3	5	4	5	3	3	3

Vicarious experience	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole
7 My teacher gives me plenty of opportunity to do practical work	4	3	4	3	4	5	3	3
13 I would like to do practical work in class more often	5	5	5	4	5	3	3	5
16 During science practical class, I wait for my group mates to carry out a task before I take a turn	4	5	2	3	3	3	3	3
17 During practical class I always ask the teacher to check my set-up before proceeding with the experiment	3	5	2	4	5	4	3	3
18 During practical class I always ask my group mates to check and help me to see if I am doing it correctly	4	5	4	4	5	4	3	4
24 During practical demonstrations, I am always able to see what the teacher is demonstrating	4	5	4	4	2	3	3	3
Average	4	4.666667	3.5	3.666667	4	3.666667	3	3.5
Max	5	5	5	4	5	5	3	5
Min	3	3	2	3	2	3	3	3
Range	2	2	3	1	3	2	0	2
Mode	4	5	4	4	5	3	3	3

Verbal Persuasion	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole
4 I am able to ask questions and communicate my doubts with my teacher well	4	4	3	4	5	4	3	4
5. My teacher answers my questions well to my understanding	5	4	4	4	5	4	3	4
12 My teacher encourages me to plan my own investigations	5	4	5	4	4	4	3	5
20 I always need my teacher's encouragement to complete set tasks	5	2	3	4	2	4	3	4
21 I always let my teacher check my work before handing in a assessment task	0	3	4	4	5	4	3	4
22 I feel I need constant encouragement to study science	0	3	2	4	2	4	3	4
28 My teacher's feedback makes me improve in my assessment	0	4	4	4	5	3	3	5
Average	2.714286	3.428571	3.571429	4	4	3.857143	3	4.285714
Max	5	4	5	4	5	4	3	5
Min	0	2	2	4	2	3	3	4
Range	5	2	3	0	3	1	0	1
Mode	5	4	4	4	5	4	3	4

Physiological/Emotional	Maikolo	Matai	Kolo	Nunu	Keasi	Hema	Fatai	Tole
2 I know that the science I learn in school is helpful in my everyday life	4	2	3	4	4	4	2	3
3 The science I learn in school will help me in my future career	4	1	4	2	5	4	3	3
23 I have a physical impairment that doesn't allow me to handle laboratory equipment quite well	0	2	1	3	2	1	3	3
25 I am always attentive during science class	0	4	3	3	4	4	3	4
26 If I miss a science class, it takes me longer to catch up	0	4	2	3	2	2	3	2
27 When I achieve in my internal assessment it encourages me to learn	0	3	3	4	5	3	3	5
29 When I get 'merit' or 'excellence' it gives me the confidence to persist in studying science.	0	4	3	4	5	4	3	3
Average	1.142857	2.857143	2.714286	3.285714	3.857143	3.142857	2.857143	3.285714
Max	4	4	4	4	5	4	3	5
Min	0	1	1	2	2	1	2	2
Range	4	3	3	2	3	3	1	3
Mode	0	4	3	4	5	4	3	3

Analysis of statement 6b showed all students listing more than three pieces of basic laboratory equipment. There was an even split in statement 14a. For question 8b, no one could suggest another Practical investigation other than the one they were working on - Metals.

Appendix Y: TEACHER INTERVIEW SCHEDULE

SELF-EFFICACY BELIEFS INFLUENCING PASIFIKA STUDENTS ACHIEVEMENT IN SCIENCE

Researcher: *Margaret Vaka-Vivili, School of Education, Victoria University of Wellington.*

SEMI-STRUCTURED TEACHER INTERVIEW SCHEDULE

There are two parts to this Interview: Here are the indicative Questions

PART A: Background Information

School Code: _____ Gender: Male/ Female (Please circle)

1. Which country were you born in? _____
2. Were you raised in the Country you were born in? If not where?
3. Which country/countries are you a citizen of? _____
4. How many languages can you communicate in? _____
5. In which country did you acquire your first Degree? _____
6. What is the qualification on your first Degree? _____
7. In which country did you acquire your teaching qualification? _____
8. For how many years have you been teaching in general?
9. For how many years have you been teaching science? _____
10. For how many years have you been teaching at this school? _____
11. What year levels do you teach? _____

12. How many science classes are you teaching? _____

13. How many students are in each of your science classes? _____

14. How many Pasifika students do you teach science to in total? _____

**** Justification: Questions 1- 14 are for background information of the teacher.*

SECTION B:

1. What are some challenges you face as a teacher of science in a diverse classroom?
2. Please describe some of the challenges you face when teaching Pasifika students science.
3. What are some learning needs of Pasifika students you have identified?
4. How do you adapt instruction to meet the needs of your Pasifika students?
5. Please describe some of your positive achievements teaching Pasifika students.
6. Please describe some challenges in class when teaching Pasifika students.
7. Please describe some challenges with Pasifika students during practical classes.
8. How often do you communicate with the parents or whanau of your Pasifika students and how?
9. In your teaching experience, list some challenges Pasifika students face when attempting an individual task.
10. In your teaching experience, list some challenges Pasifika students face when attempting a group work
11. In your conversations with Pasifika students about careers in science, what are some of the ideas they have shared with you?

Thank you for your time

Appendix Z:

Self-efficacy beliefs influencing Pasifika students' achievement in science

Researcher: Margaret Vaka-Vivili, School of Education, Victoria University of Wellington

Classroom Observation schedule

School Code: <i>CTC-001</i>	Day: <i>Tuesday</i>	Date: <i>19/09/2019</i>
--------------------------------	------------------------	----------------------------

The purpose is to record Teaching and learning behaviours; content taught, student motivation to learn and culturally responsive practices in the classroom.

*** Data collection methods are given in italics; however, the class will also be audio taped as a backup of a running record and other notes made during the class.

Classroom environment:

Layout <i>Tight/spacious</i>	Lighting <i>poor/good</i>	Room temperature <i>cold/cool/warm/hot</i>
---------------------------------	------------------------------	---

Lesson Overview: <i>Use of ticks ✓ and field notes</i>			Teaching and learning behaviours: <i>Field notes</i>	
Uses an advance organiser	✓		Teacher welcomes the students	✓
Shares learning objective	✓		Makes sustained eye contact with students	✓
Science Content/theory	✓	<i>Field notes</i>	Smiles/person-to-person communication	✓
Focus of the lesson: Use of ticks ✓ and <i>Field notes</i>			Other: <i>Use of field notes</i>	
Theory ✓	Practical ✓	Assessment <i>Metals Research.</i>	✓	

Checked homework: <i>Field notes</i>	✓	Body language	Affirming ✓	Neutral	Negative
Set homework: <i>Field notes</i>		Students' response	Positive ✓	Neutral	Negative

Student behaviours Engagement: <i>Field notes</i>		Quality of Engagement: <i>Field notes</i> (Vicarious/Mastery/persuasion)			
First ¼ of class	Some start Some wait	Enthusiastic (keen/eager to start)	Most ✓	Some	Few
Second ¼ of class	Busy.	Perseverance (carry it through)	✓		
Third ¼ of class		Attentive (Behaving within the guidelines of class expectation)			
Last ¼ of class		On task behaviour		✓	.
		Other			

Teacher input: Use of tick ✓ to indicate column followed with *Field notes/Running record* of what the teacher is doing versus what the students are doing. Of interest are the Pasifika students identified to be observed in the classroom.

Teacher-led	Demonstration	Posed as a problem	Student driven	Teacher as mentor
<i>Vicarious/Persuasion</i>	<i>Vicarious/modelling</i> ✓	<i>Mastery</i>	<i>Mastery/modelling/vicarious</i>	<i>Mastery/persuasion</i>

Culturally responsive practices	
Conversation	<i>Vicarious, persuasion *** Use of Running record</i>
Demonstration	<i>Vicarious, persuasion, modelling *** Use of Running record</i>
Practice (Trial & Error)	<i>Mastery *** Use of Running record</i>

Classroom Observation Running Record Format.

Self-efficacy beliefs influencing Pasifika students' achievement in science
 Researcher: Margaret Vaka-Vivili, School of Education, Victoria University of Wellington.

Class Running Record
 Date: 17/09/19 School Code: CTC 001 Time: 8:35 am.

Presenter:	What Teacher is doing	Whole Class	Participants
	Introduces work.	Listens	Listens
Topic:	Metals (Research).		
5 min	Students to choose which station they wish to start from - Practical or reading (Laptops)		Keasi ✓ Kolo ✓ Fatai ✓ Nunu ✓ Tola ✓ Malakui ✓ Matai ✓ Hema ✓
10 mins	Teacher lets them choose group makes not more than 2.	working in groups.	P moves quickly to oxidation T - discussion with Keasi before electricity.
15 mins	Teacher moves between groups	Class Busy in own groups - Some rotate.	Hema - sits. - Wai Kolo joins Fatai at maleable bench.
20 mins		class rotates	They rotate Fatai & Tola at Oxidation Hema to hot water Keasi at maleability.
25 mins	Teacher calls for attention - suggests - Quiz and research on internet using Laptops.	Listens	Keasi works fast Hema at acid bench. Fatai & Malakui at acid
30 mins	Moves between groups and assist	Busy	Buses

		Busy	Busy. Fatai waves. Malakai and goes to Tole
35mins	Teacher moves between groups	Discussion in groups - busy	Kolo to electricity Malakai & Fatai at lustre. Nunu at desk Tole to desk
40 mins	Teacher goes over to Hema's group to assist with density measurements.	Most at their desks.	Kolo at malability Kiasi at desk Fatai walks around, distracting Tole & Malakai
45mins	Kolo calls for help as he spilled acid & help him at oxidation * Teacher busy with Malakai & Fatai	Most at their desks	Fatai collars Malakai then tussles with Tole
50mins	Teacher reminds class to clean up.	Class busy.	Teacher with Fatai & Malakai.
55mins	Teacher reminds them to bring Lap tops up and help return them → Bell rings class ends.	Help with putting away Lap tops	Help with clean up procedure.

Appendix A1: Classroom Observation and Running record (Sample)

Classroom Observation Transcript 2: School: Grace College

School Profile

School: Grace College

Grace College is a Co-ed Decile 8 school in Wellington. All students in the Level 1 science class studied consented to be observed during my five-day visit. In a teaching week cycle, there are four 50-minute periods of science per week. Therefore 5 observations were carried out with the first being an introductory lesson. The layout of the science classroom was spacious with ample lighting, ambient room temperature and adequate room for the teacher to move around and assist students individually. Students mostly chose where they wanted to sit in a seating plan that had desks facing inward and towards the front however, the teacher did assign a few students to seating arrangements occasionally based on their progress and group preferences. She invited me to be part of the class and allowed me to interact with my participants as much as I felt during that time.

Teacher: Ms Smith

Ms Smith is a non-Pasifika teacher who has been teaching science in a mixed ethnic classroom for three years. She is highly organised with a daily lesson overview as, using an advanced organiser sharing the lesson's objective before beginning the lesson. She pleasantly welcomed her students at the beginning of every lesson with a warm smile and lovely personality, constantly referring to her students as 'team', an indication that they were all co-learners together. She made sustained eye contact and maintained her smile with an affirmative body language and responded positively to her students during classroom discourse. There was evidence the lesson being Teacher-led, sometimes posed as a problem and consistently teacher as mentor as the lessons observed were practical investigations and research activities. She was aware of the challenges and dynamics of teaching a mixed ethnic science class but has also enjoyed a lot of rewards when seeing them succeed in passing their Level 1 science.

Student Participant profile

There were 10 Pasifika students from a total of 22 however, only eight consented to participate in the student questionnaire and focus group interview. The students were very open, unreserved and very respectful towards their teacher.

Day of Observation: Monday 16/09/2019 Time: 2:20 pm

5 mins: T asks student volunteers to help bring laptops into class

Introductions

Teacher welcomes the class/ introductions. Teacher allows me to introduce myself, explain my research and what I will be doing during my time with them in the classroom.

10 mins: T introduces the lesson using an advance organiser from her laptop and projected onto the large white board at the front. The class is working on a Practical Investigation today. No homework was checked as it was a follow on from the last science class. Teacher instructs students to collect their research folders from the front and a laptop and have a look at the notes they have been making on metals and their properties.

Topic: Research Gathering of notes on Metals for assessment activity

(Continuation from the day before)

Discourse

T instructs they are testing metals suitable for the mast of the boat. Metal options are Cu, Fe, Mg, Al and Pb.

Option 1: T instructs they will need test-tubes, test-tube racks and probes what else they might need for practical activity. Student's respond safety goggles, metals, spotting tiles, she affirms, then repeats, they will need metals, then probes their knowledge of the symbols of Metals (elements) beginning with PB – students throw in their knowledge of acronyms such as Personal best, peanut butter, one student says it's a metal, then T asks which one, finally one student answers, lead. She affirms, then follows through with Aluminium, Magnesium, Zinc, Iron and Copper. T instructs, students to bring their spotting tiles to the front to get the metals from her. T asks about the two types of acid they looked at yesterday, and prompt them to name them. Students respond, Hydrochloric & Sulphuric acids. T probes if they remember the formula, they start out saying H2...but T assists them to correctly say H₂SO₄ ...then helps with HCl and expresses that they remember them. T reminds them they only need a tiny bit of metal for this test and should go the front to get it and only 5 mls of acid or two fingers worth marked off on the test-tube as measurement. If they have already done it, they don't need to do it again, but they can do another trial to confirm the results they had achieved previously.

Options 2: T then speaks about the other activity which was the Research into the metals and allows them to use both laptops and phones to do research.

Option 3: Reminds them of the workbooks – pages 18 – 24 for extra reading. Level one science in terms of metals, page 119. T elaborates further, stresses for them to make notes and focus on what the metals are, know what their properties are, know when you would use them, know why you would use them, why would you use them on some of the bits and not others.

Option 4: Worksheets.

Metal uses and their properties or metals in everyday life. Teacher puts out paper for students and instructs them to get the paper if they need them. No questions.

Then reminds them to get safety glasses if they are going to deal with acids. T asks, any questions? They respond No, so gives them the go ahead to begin reminding them to work in the groups they had begun working in. T refers to everyone as "TEAM" throughout the whole time.

15 mins: Students move off in pairs to the different workstations...4 groups work on metals, one group on the quiz and two PI groups moves between the different groups just observing what others are doing. T has to settle CTC001F and CTC001T. Class continues with group activities. T moves between groups and checks with each.

CTC001C accidentally splashes water on herself, while trying to clean up. Asks her groupmate to get

her some tissues to wipe up. I walk over to CTC001C to observe what are doing. They correctly identify each test-tube to me. One group check with T for the time.

20 mins: CT001T calls for class attention checks and informs the class that she will be putting up the Quiz option as another option for them to work on if the workstations are busy. C continues with acid reaction. F asks T if he can sit with N for to work on the Quiz, T says yes. Other groups busy at their workstations. T puts up results table on the board and asks students to add to the table their findings. C asks T if she can sit down and observe the reactions in the test-tube, T says No, and prompts, “what happens if the acid accidentally falls?”, P answers, “..it falls on you”... T says thank you P.

T reminds the class the quiz is already up and they can join the online quiz at any point in time. C & friend are frustrated with the slow rate of reaction and talk about ways to speed it up...but friend says, they can't do anything because then, it wouldn't be fair testing. I walk over to chat and enquire saying it's the first time I heard someone mention fair testing this morning, C's friend responds, “we try to make it the same”. C is getting uneasy as reaction is slow. Another group enquires with T about magnesium and teacher suggest an emergency kit for the Waka Hauora and T prompts their knowledge of Magnesium. C and friend still discussing bubbling effect with friend. I assist and suggest they compare colour change of copper in air and in acid to draw a conclusion about reactivity of copper. CTC001C's group make conclusions based on acid reactivity of the metals they tested. Which metal they saw reacted faster in acid.

25 mins: CTC001T keeps moving between groups. CTC001M1 and friend at density station

T moving around the different groups assisting suggesting H does something. H is slow to move. Suggests to M2 to put up his group results on the board. T asks who is KOPS who took the quiz? K answers it's him and so congratulates him “well done!”. T assists M2 & F at the board. F and M2 write on the board. T keeps prompting, why is copper used for wiring and the solar panel of the house? F answers, because it is a good conductor. T asks, why would Magnesium make a good flare? Because it burns with a bright light. What element would react with iron to make iron oxide?

30 mins: T stops the class. Teacher calling M2 repeatedly to settle down.

T informs them that most are on the right track with 75% correct, one person got 95 % correct for the quiz and if someone wishes to re-enter the quiz, they can do so. Otherwise Those questions come up right at the end, they are very helpful and urges students to make summary notes from some of those questions.

T prompts the class with one of the questions in the assessment activity, Which metal is best for Galvanizing? Class responds Zinc, T affirms, “cool” and prompts again, what is galvanizing?

students reply; galvanising is applying a protective layer, T affirms again “cool” students still responding “iron” and “steel” as it applies that protective layer and protects against rusting.

T says she will leave the notes on the white board for anyone who wants to add to their notes to do so.

T prompts again, “Corrosion, what is corrosion?”. Student answers, corrosion is essentially rust. T prompts again, “so essentially where does rust come from? What is the reaction with?” Students reply, “water and air”. T clarifies, “water and air, so oxygen is in the air”. Reiterates again, that this research project is open book and encourages them to make notes to put in their folder as those notes will be helpful for them during the assessment.

T assists CTC001K on laptop with Quiz. CTC001C and friend move to desk and write and summarise observations.

T reminds class 10 minutes to go.

35mins: CTC001T moves to assist CTC001F and CTC001M2 to settle down and get focussed.

T reminds F 5 more minutes to go don't pack up yet. T asks group at acid and hot water benches to do some cleaning up. F still walking around.

40 mins: CTC001F moves around the room between friends distracting part of the time, observing part of the time.

45 mins: CTC001T stops class to ask them to clean up before taking a seat.

CTC001T fidgety, T asks him to leave her phone. T calls for attention and gives instructions for next week. Next week's assessment will be on metals, some of which they might be able to recognise.

50 mins: CTC001T indicates it is time to leave.

APPENDIX B1: Achievement standard on Metals

Internal Assessment Resource

Achievement Standard Science 90946: Investigate the implications of the properties of metals for their use in society

Resource reference: Science 1.7B v3

Resource title: Using metals

Credits: 4

Achievement	Achievement with Merit	Achievement with Excellence
Investigate the implications of the properties of metals for their use in society.	Investigate, in depth, the implications of the properties of metals for their use in society.	Investigate, comprehensively, the implications of the properties of metals for their use in society.

Student instructions

Introduction

This activity requires you to investigate the chemical properties of four metals (aluminium, lead, copper, and magnesium) and link these to their uses in society.

You will gather data from practical activities and secondary data your teacher provides for you to summarise. You will also need to do your own research on how these metals are used and link these uses to the properties of the metals.

You will present your findings in either a wall chart or written report, together with a completed worksheet.

The activity will take five to six weeks to complete, including teaching time.

Teacher note: Adapt the context and metals as necessary. To demonstrate the reactivity of some metals, you could add lithium or sodium. Students could observe their reactivity through secondary means, such as the Internet or a teacher demonstration with cold water. If the students are to undertake independent research, explain this process.

Adapt the time for completion, format of the final presentation, and expectations with regard to the recording and processing of data, as necessary.

Add instructions about group or individual work. For example, the students could complete their experiments and observations in groups, but work individually to complete other parts of the task.

You will be assessed on how well you investigate and explain the implications of the properties of metals for their use in society.

Task

Experiments

Teacher note: Adapt these instructions to suit the context you have chosen. In some instances, other properties will be more relevant to test. Provide students with detailed instructions for the experiments.

Complete a series of experiments to test the reactivity of aluminium, lead, copper, and magnesium with:

- cold water
- oxygen
- dilute hydrochloric acid.

Your teacher will provide detailed instructions for the experiments.

Record the results of your experiments on the worksheet provided in the Student Resource.

Include word and balanced symbol equations for any reactions you have observed.

Draw some initial conclusions about the reactivity of the metals you test and observe.

Process secondary data

Teacher note: Adapt these instructions to suit the context you have chosen. If students are to undertake independent research, you will need to explain this and provide relevant instructions.

Your teacher will provide you with secondary data regarding the physical properties of the metals.

Process this information and summarise the key points about these results and the physical properties of the metals you tested.

Include your summary points on your worksheet.

Report

Consider the data you have gathered and draw conclusions in which you link the chemical properties of the selected metals, their reactivity, and their physical properties with how they are used in society today.

In your conclusions:

- compare and contrast the chemical properties of the metals you have studied
- compare and contrast the physical properties of the metals you have studied
- explain why the different metals studied are actually suited for the particular uses and link this to the metals' properties
- consistently use chemistry vocabulary, symbols, and conventions
- provide word and balanced symbol equations for any chemical reactions that occur.

Present your conclusions as a wall chart or written report.

Hand in your worksheet with your conclusions.

Student Resource

Worksheet

Complete this worksheet before you begin your final presentation.

Teacher note: Adapt this worksheet to suit your context, the metals utilised, and the properties studied.

If you provide this worksheet to students, give them a digital copy so that they can expand the boxes themselves to fit their comments. Completing the template on a computer will allow this to happen automatically. If you give them a paper version, you may need to increase the row height for some tables first.

You may prefer students to use another method of recording and processing data such as portfolios, logbooks, or workbooks.

If students have undertaken their own research, ask them to reference all material.

Name: _____

Observations

In the table below record what you observed during your practical investigations.

Metal	Symbol	Reaction with water	Reaction with oxygen	Reaction with dilute acid
Lead				
Aluminium				
Copper				
Magnesium				

Using the information in the table above list the metals you have used in a reactivity series from (1) most reactive to (4) least reactive:

(1) Most reactive metal _____

(2) 2nd most reactive metal _____

(3) 3rd most reactive metal _____

(4) Least reactive metal _____

Explain why you have put them in this order.

1 =	2 =	3 =	4 =
Explanation:			

Write word and balanced symbol equations for any reactions that did occur below.

Describe two main uses of each metal in society today. You should link the uses you have described to the chemical and physical properties of the metal.

Physical properties of metals

	Lead	Aluminium	Copper	Magnesium
Relative Conductivity	0.48	3.65	5.88	2.33
Ductility	3 rd most ductile	2 nd most ductile	Most ductile	Least ductile
Malleability	Malleable	Malleable	Very malleable	Malleable
Appearance	Grey	Silver	Red-pink	Silver
Relative hardness (Moh Scale)	1.5	2.8	3.0	2.5
Density (g cm-3)	11.4	2.7	8.9	1.7