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“The Experience is the Outcome”: A Journey for Pāsifika
Teachers Through Culturally Responsive In-Service
Professional Learning in Mathematics

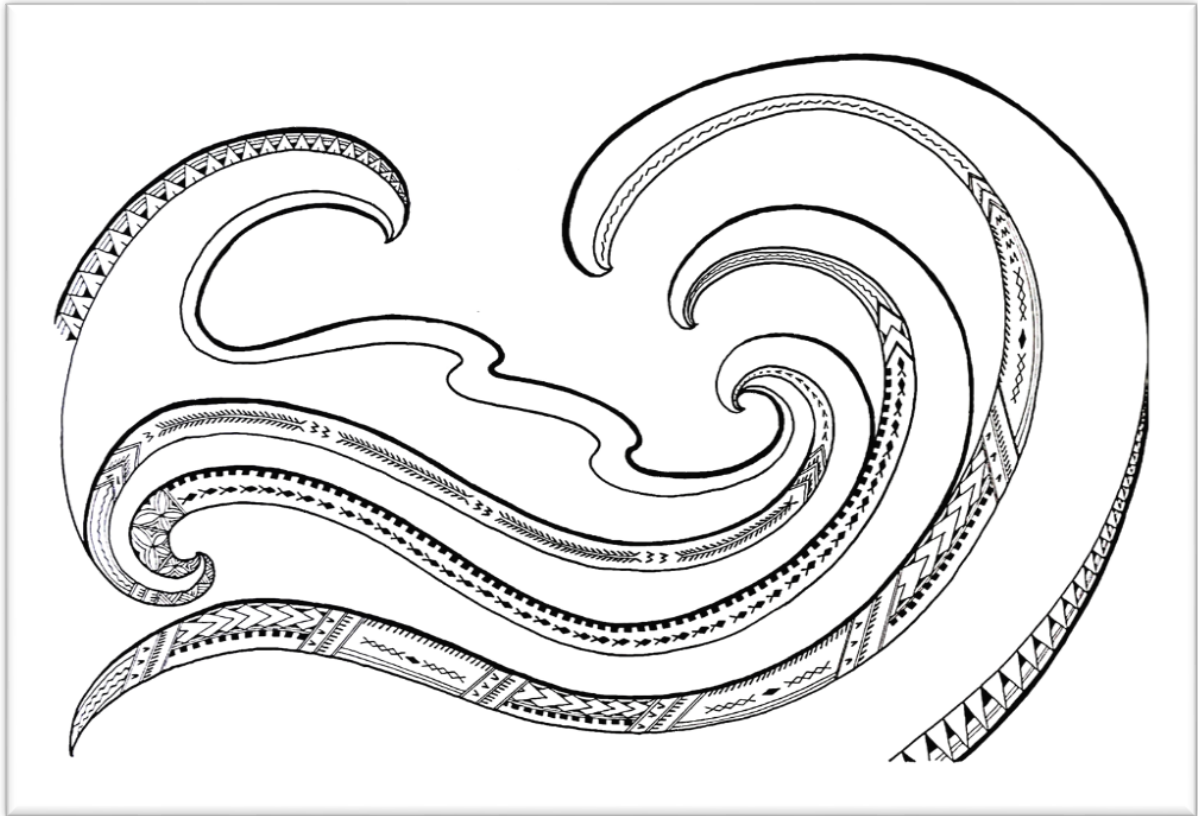
A thesis presented in partial fulfilment of the
requirements for the degree of

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Daniel Tupua-Siliva

“The Experience is the Outcome”



(Sione Sialaoa 2022)

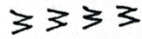
Figure 1. *Visual representation of the learning experiences for the participants and researcher throughout the in-service professional learning and research journey.*

This image was manifested from the many talanoa Sione Sialaoa and I had as I wrestled with the shape this study could take. Sione is a tufuga ta tatau (master of traditional Samoan tattooing). The humble knowledge Sione holds around Samoan culture and custom guided much of this journey. From our talanoa, he drew this image that honours the journey taken by the brave, determined and loving participants in this study. This image represents the ever-changing journey we take each day in teaching and learning. The use of the stars, waves, currents, winds, and flight of seafaring birds that give way to the calm and serenity which in turn fold back into themselves and are never the same. It is a visual representation depicting the courageous collective voyage undertaken, the

traditions and values maintained and the adoption of new skills to thrive and not merely survive.



Atualoa – Tautua symbolises service.



Gogo Sina – Fa'amoemoe symbolises hope.



Vae'ali – Su'e Malosi symbolises restoring strength.



Anufe – Fa'aleagaga symbolises spiritual path.



'Ia – Malosi ole Tino symbolises nourishment and strength.



Palolo – Tapenapena means expecting the unexpected.



Fa'atala Fe'e – Atamai is strength and wisdom.



Pula Tama – Fa'afetai is to give thanks.



Tafa fa ole Malu – Alofa is shelter and meeting in the village.

ABSTRACT

The objective of this study is to unpack the complexities involved for Pāsifika teachers undertaking in-service professional learning in mathematics (ISPL). In particular, the following research question is addressed: *How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?* This study also aims to illuminate the sophisticated nature of teaching and learning of mathematics for Pāsifika teachers to support the development of a personal awareness and open wider discussion and action around the unaccounted nuances involved in mathematics pedagogy for Pāsifika teachers.

This study was proposed to and humbly and graciously agreed to by nine brave, dedicated Pāsifika practitioners of varying teaching experience within an urban Auckland high school setting. The participants engaged in ISPL centred around Culturally Sustaining Pedagogy (CSP) in mathematics. The research participants comprised of two groups. The first group consisted of seven teachers of Pāsifika culture and heritage. None of the participants in this group are 'specialist' maths teachers. This primary group of teachers are involved in the day-to-day implementation and participation in the professional learning. The second group comprised of two Pāsifika teachers who were members of the senior leadership team.

This study uses fa'afaletui, which is a Pacific research methodology that utilises indigenous philosophy, knowledge circles and promotes a holistic approach to research. Data were collected via talanoa promoting holism, validating indigenous knowledge systems allowing for in this case, data and accounts of Pāsifika worldviews to be systematically gathered and formulated.

Thematic analysis of the data revealed three key findings: the value society places on mathematics and specifically Pāsifika cultures; the systemic design of 'school mathematics' and its tradition as a 'gatekeeper' which influences pedagogy and subsequent design of and engagement with professional learning; and how the human condition is often not factored into the equation when designing or revising curriculum and informing ISPL in mathematics.

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My unconditional love!

To the brave, agile, inspiring, and unwavering teachers, the open and responsive leadership, and forward focused Board of Trustees, this study would not have been possible without your willingness to be vulnerable and utilise your superpowers to fight the most genuine fight!

**God never said the journey will be easy,
but did say that the arrival would be worthwhile.**

To John, Sione, Trevor, and Bobbie thank you, thank you & thank you for opening my world to what was hidden in plain sight but that I struggled to see. Let's pull the wall down one brick at a time and know and value our individual worth and collective wealth!

Friends are the family you choose!

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Let's not run it back!

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Glossary of Pāsifika Terms

(in order of appearance in thesis)

Talanoa: in many Pacific languages, talanoa means to tell a story or a conversation.

Pāsifika: a multi-ethnic group of indigenous peoples from Pacific Island nations, including both those who were born in New Zealand and those who have migrated from the Pacific Islands.

Vā: a space between, for Pāsifika people, sacred relationships exist between people, as well as between people and the environment.

Fono: is used in different countries of Polynesia. In general, the term means councils or meetings (great and small).

Tofā Sa'ili: tofā in Samoan is wisdom and sa'ili is the search. Tofā Sa'ili is a search for wisdom, the ongoing search for truths.

Tofā mamao: to have vision and a plan for the future.

Polynesian Triangle: is a region of the Pacific Ocean with three island groups at its corners: Hawai'i, Easter Island (Rapa Nui) and New Zealand (Aotearoa).

Aiga: a wider family group of blood, marriage, and adopted connections.

Fa'afaletui: ways of [fa'a]; 'weaving together' [tui]; deliberations of different groups or 'houses' [fale].

Mana: prestige, authority, control, power, influence, status, spiritual power, or charisma.

Fa'a: the way.

Fale: the houses.

Tui: weaving together.

Va'a: 'boat', 'canoe' or 'ship'. A larger traditional seagoing vessel for long-distance voyages is referred to as va'a tele (big ship).

Alofa: compassion, empathy, love.

Palagi: pakeha, New Zealand European, or European

Manava: stomach, gut feeling

Chapter One - Introduction

This chapter provides the background information that framed this research. Section 1.1 unpacks the rationale for this study born from the personal experiences and the noticing's around teachers involved in professional learning in mathematics. Section 1.2 sets the contextual circumstances of the study and describes the many layers involved for both those taking and those providing in-service professional learning (ISPL) in mathematics. Section 1.3 provides the objectives of the study and presents the specific research question that this study investigates. Finally, an overview of the chapters is provided in Section 1.4.

1.1 Rationale

My interest and passion for this research grew from my first-hand experiences as a facilitator of mathematics, mentoring teachers in culturally sustaining professional (CSP) learning in mathematics. Being privileged enough to co-construct teaching and learning opportunities alongside practitioners across many varying circumstances afforded me numerous opportunities to not only unpack teacher pedagogy in the moment but also talk and connect with these teachers. Every mentoring session was unique but also very similar in regard to the emergence of personal challenge for teachers. These either stemmed from their own experiences with learning mathematics, their pre-service training or how they were instructed to teach mathematics. From my observations, carrying these experiences into the professional learning impacted on the fidelity of uptake and engagement in the professional learning from these teachers. My observations led me to ponder how these

experiences could be better understood and supported to inform professional learnings design, engagement and therefore teaching and learning in mathematics.

1.2 Background to the Study

An oversimplified view and solution towards successful teaching and learning within mathematics is often propagated by individuals from across society's spectrum, educationalist included. The correct answer determines success, working out must follow set procedures and then 'rinse and repeat.' These espoused notions typically account for only but one or two primarily surface level factors. These may contribute only sparingly to effective teaching and learning. Deeper level actions orbiting mathematical learning, such as context, practical application, along with collaboration and justifying your working are not priorities. For teachers engaging with in-service professional learning in mathematics this study aims to illustrate the complexities of all the moving parts, histories, experiences, and the considerations that must inform the design of and engagement in ISPL.

This study aims to illuminate the sophisticated nature of teaching and learning of mathematics for Pāsifika teachers to support the development of a personal awareness and open wider discussion and action around the unaccounted nuances involved in mathematics pedagogy for Pāsifika teachers. This study was proposed to and humbly and graciously agreed to by nine brave and dedicated Pāsifika practitioners of varying teaching experience within an urban Auckland high school setting. The professional learning this faculty engaged in centred around culturally sustaining pedagogy (CSP) in mathematics.

This study aims to be a catalyst to opening talanoa* for learners, parents, educators and ISPL providers. It draws on experiences and lessons from the journey taken by individuals and a collective. With this providing situational examples to add to the aggregation of educational research around ISPL through the experiences, values and collaborative practices that are drawn from Pāsifika ways of being.

1.3 Research Objectives

The objective of this study is to unpack the complexities involved for teachers undertaking ISPL in mathematics. In particular, the following research question will be addressed to journey towards this objective:

How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

1.4 Overview of Chapters

Chapter Two reviews perspectives from both Aotearoa and international literature providing a background to historical and current research findings and reports relevant to this study. In Chapter Three, the methodology for the study is described, and the qualitative approach of using an ethnographic case study is explained. The research setting is defined, and the participants are introduced. The data collection and data analysis are discussed, the timeframe for the case study is outlined and ethical concerns addressed. Chapter Four presents the findings and emerging themes that came to the surface in talanoa fono. For Chapter Five, the findings are discussed in detail which builds on and adds to the theories and descriptions discussed earlier in the literature review. Finally, Chapter Six outlines the implications and

recommendations for in-service professional learning. It unpacks the limitations of the study, opportunities for further research and concluding thoughts.

Chapter Two - Literature Review

This chapter summarises the relevant literature relating to this study. The nature of the study meant the literature reviewed fell into four categories. These categories are interdependent, illustrating the complexity of considerations that this study must be aware of and describe. This review is guided by the study's research question:

How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

The literature related to these four categories is reviewed in this chapter to gain an insight into the lived and unfolding narratives within this study. Section 2.1 defines in-service professional learning (ISPL), describes intentions espoused for ISPL within education and how both professional and personal realities present factors that impact teacher engagement and uptake. Section 2.2 details the design and development of ISPL pertaining specifically to mathematics teaching and learning in New Zealand since the turn of the century. Section 2.3 illustrates how a teacher's mathematical content knowledge, anxieties, traditions, unconscious and conscious biases along with the overarching role mathematics plays as a gate keeper subject impacting ISPL engagement and design. Lastly, Section 2.4 unpacks culturally sustaining pedagogy's (CSP) origins and rationale in relation to mathematical pedagogy and the professional learning undertaken in this study.

2.1 In-Service Professional Learning for Educators

The ideal of lifelong learning is especially applicable to teachers having to add to their 'teaching repertoire' in order to be better equipped to cater for the evolving needs of their students. Avidov-Ungar (2016) describes ISPL for teachers as an experience to facilitate and nurture "personal and professional empowerment" in which the "professional identity of the teacher is formed" (p. 654). Darling-Hammond (2005) state that ISPL is intended to support teachers with navigating the dynamic, ever-changing nature of teaching, supporting the development of knowledge and pedagogical skills throughout one's career. However, since the turn of the last century up to the present day, policymakers and school leaders have employed a 'revolving door' strategy towards teacher ISPL. Schools and members of staff are often engaged in one, if not multiple professional learning programmes within their school to maintain and improve professional standards, integration of information, communication, behaviour management or pedagogy. This has meant teachers have and are in a constant state of flux regarding their professional learning often without time to consolidate what they have learnt and embed it into practice (Eisner, 1992, 2005; Gatto, 2002, 2010). This has tended to dilute or even derail the purposes mentioned earlier for professional learning.

With this, when undertaking ISPL, providers, administrators, and school leadership need to understand that participation is different from engagement and what is being sat through is not automatically adopted into practice. Servage (2008), Steyn (2008), and Maskit (2011) state teachers may not be open and willing to make micro-adjustments or, in some cases, totally reconceptualise what effective pedagogy may mean for them. Along with systematic and pedagogical shifts, Servage (2008)

pinpoints another significant barrier to change is ‘the terribly humankind’ (p. 79). Teaching and learning do not happen in a vacuum, and it is a social enterprise. With this, the stage a teacher is at in their career, workload, previous experiences with ISPL, and held views on best practice for student learning must be on the peripheral for those charged with facilitating the professional learning. It is, therefore, crucial that ISPL design and engagement is geared towards both merging factors that aligned to current teacher practice and curriculum requirements whilst challenging others (Eisner, 2000; Steyn, 2008).

2.1.1 Personal and Professional Experiences

When attempting to implement or embed pedagogical or structural development within schools, providers must be aware of factors that can support engagement and maintain individual and organisational stability. This section details specific aspects and considerations in the literature reviewed that identified and described what teachers may bring with them into ISPL.

At times professional learning can have a disconnect with current practice. It is essential that ISPL connects with and builds on current teaching and learning for participants and providers to come together mutually. Timperley et al. (2007) assert that quality ISPL is not merely training and must directly link with theory and practice. Hill (2009) states that ISPL programmes that reinforce and or add to existing practices are essential in making a meaningful impact. These concrete links provide the impetus that ISPL needs to allow teachers to make connections and build momentum.

Building a collaborative learning community is a key feature in supporting teacher learning and embedding new practices espoused by ISPL. Lee (2005) posits that teachers need to share their experiences including what is working well, doubts, feeling disorientated, commonalities and goals. Wenger (2010) describes the importance of intertwining people's experiences to define social competence and solidify the collectively occurring learning. Wenger (1999) insists a mutual commitment within a community of practitioners fosters a more profound development of practice through sharing and taking responsibility for their own and each other's learning. Artman et al. (2020) note a need to support teachers in building a sense of community, increasing motivation, and combating feelings of isolation. With these factors, ISPL programmes that explicitly incorporate collaboration increase teacher engagement, embedding practice and professional accountability to one another that flows into student learning.

The genuine involvement and visibility of leadership in professional learning explicitly expresses the value that is put on it. The impetus for participants when 'done with' rather than 'done to' impacts on ISPL fidelity. Bishop (2011) and Robertson and Timperley (2011) postulate that 'potent leadership' must have a conceptual depth of theoretical understanding of the professional learning and plan for practical application within the teaching and learning. Cohen (1991) highlights that the complex instruction required in the classroom means leaders should naturally be organised, involved, visible and open to being vulnerable. Timperley et al. (2007) identify that experienced educators' hands-on involvement, helps to negate those who conspire to maintain the status quo. Steyn (2008) affirms that visible leadership engagement that shifts from talking the talk to walking the walk is the critical determinant to an organisation's ability

to build self-renewal and adaptation capacity. School leaderships' prominence models the importance of ongoing engagement with professional growth for everyone.

Teacher consensus with identifying an inherent need for specific professional learning has a greater influence on engagement than the frequency or whether participation is compulsory or voluntary. Timperley et al. (2007) outline that teacher 'buy in' is not predicated on whether teachers volunteer or are compelled to take part but rather "more to the content and form of the professional development" (p. 105). Clandinin (2004) states that durable outcomes are not found in time and frequency but in processes and experiences that penetrate deeply into education's core. Artman et al. (2020) state that systematic, planned development and follow-through surpass the extended duration and intensified frequency with professional learning. Peshkin (1985) outlines that neither voluntary nor mandated professional learning opportunities produce more favourable outcomes for student learning. For teachers, the 'why?' must be addressed before the 'how?' and 'when?' for ISPL to move from participation into engagement.

2.1.2 Personal and Professional Challenges

ISPL will present varied challenges for everyone. Servage (2008) suggest that a parallel awareness of the emotional and social demands must be a key consideration of ISPL design, as a technical or theoretical focus alone will not meet the needs of teachers. Therefore, in design, providers need to have a specific curriculum and pedagogical knowledge but also understand the nature of teaching at the 'chalk face.' The literature reviewed for this study highlighted security, vulnerability, and teacher isolation as challenges for ISPL.

Education is steeped in top-down power-based relationships. The primary example is between a teacher and their student[s]. This provides teachers with a strong sense of security in the sanctity of their classroom (Eisner, 1992). Timperley et al. (2007) assert that teachers need a good reason to change anything when existing theories steeped in long histories are suddenly challenged. Eisner (1998) asserts that it ultimately comes down to power, as teachers, we tend to keep the game as it is, notably if we have been winning, as “power, control, and admiration are not easy to share” (p. 13). When ISPL differs or confronts current practices Eisner (2005) states, “it is difficult to be pedagogically graceful when you are lost in unfamiliar territory. Teachers are often reluctant to relinquish teaching repertoires that provide an important source of security for them” (p. 137). The introduction of ISPL can disrupt or challenge this security for teachers that can draw resistance in the form of an economy of effort on the behalf of the teacher or varied forms of dissonance.

Espoused notions of ‘collaboration’ and ‘integration’ in education premise a willingness to share best pedagogical practices within and across schools. The widespread use of these words camouflages the reality and highlights the struggle faced when teachers are tasked with surrendering their isolation and being vulnerable. Teachers can experience little collegiality in the classroom context. Classrooms remain siloed, whereby teachers' day to day practices remain secret. The de-privatisation of the learning space is very threatening for teachers whose practices have primarily been kept between themselves and their students (Lee, 2005; Steyn 2008; Servage, 2008; Wenger, 1999). With ISPL that requires collaboration and at times another person alongside them as they teach, curriculum content knowledge,

biases, competencies, strengths, and weaknesses are suddenly made public, which means teachers become vulnerable. Steyn (2008) identifies that for ISPL programmes to gain traction, a vital action must be to break down the isolated systems that teachers operate within so that they can work together meaningfully.

2.2 Mathematics ISPL since 2000

The literature reviewed in this section is more than ten years old and reflects the breadth of the NDP but also highlights the void in any new nation-wide focus and limited educational research in mathematics pedagogy from the MoE since the NDP was discontinued. From the year 2000 to 2009 the Numeracy Development Project (NDP) was the primary ISPL enacted by the Ministry of Education (MoE) in its attempt to improve teaching capabilities in mathematics and, therefore, student achievement over the last twenty years in New Zealand schools (Higgins & Bonne 2009; Higgins & Parsons 2009; Timperley et al., 2007). With this prominence, the NDP is focused on in the literature review due to its influence on recent mathematics professional learning. The scope of the NDP meant that most primary teachers and high school math teachers up to year eleven from the year 2000 to 2009 engaged in the project in some capacity, whether in professional learning or through the mathematic planning and programme employed in their school (Higgins & Bonne, 2009). By 2009, 95% of primary schools had participated or were taking part in the project and 25,000 teachers and 690,000 students were involved in the project (Higgins & Parsons, 2009). Young-Loveridge (2010) identified that the New Zealand Curriculum (NZC) “embedded the Number Framework within the system of expected outcomes that apply to all students in New Zealand schools” (p. 15). The NDP focused on showing identifiable progressions in how children develop number concepts (Thomas & Tagg, 2005). This

teacher professional development programme placed significant importance on student number knowledge and strategies utilised by learners through the Early Numeracy Project (years 0-3), Advanced Numeracy Project (years 4-6), Intermediate Numeracy project (years 7-10), Secondary Numeracy Project (year 11) and Te Poutama Tau for the Māori medium (Thomas et al., 2002).

2.2.1 A System-Wide Adoption of the Numeracy Development Project

The NDP became a national directive adopted by a large majority of New Zealand schools. The scale of the NDP, as noted earlier, presented an 'all in' approach from the MoE to improve teaching and learning in mathematics. For schools and teachers in this period, it meant that it was not a matter of if but when you undertook this ISPL and with this approach there were positive outcomes. Timperley et al. (2007) outlined that this professional learning engaged teachers at the same starting point and meant there was always some form of collegial support, either within schools or externally. Higgins & Parsons (2009) posit that this concentrated focus "enabled teachers to deepen their professional knowledge, change their instructional practice and improve their responsiveness to students' diverse learning needs" (p. 231). Higgins & Bonne (2009) described the NDP as "professional development that gets to the core of the educational practice is important in projects aimed at system-wide change" (p. 129). This meant for teachers that the NDP planning templates, teaching resources, and its pedagogical approaches were adopted and implemented across the entire school. Compulsory uptake allowed for collective adoption as the faculty were all a part of the same journey (Harvey & Averill, 2009).

2.2.2 Affirmations from the Numeracy Development Project

There were observed positive assertions from teachers about pedagogy and planning with the NDP. At the time of the introduction of the framework, teachers reported a “vagueness” with what they were teaching in mathematics and that the NDP gave their “teaching more structure” (Higgins & Parson 2009, p. 236). Hughes and Laxman (2013) describe that the experimentation required by primary and secondary teachers drove change, and teachers reacted sharply with an increased awareness of their students thinking strategies rather than right or wrong responses. The teachers undertaking the professional development reported increasing their content knowledge of mathematics and understanding of how their students learn mathematics (Higgins & Parsons, 2009). Harvey & Averill (2009) outline that secondary teacher’s felt more confident at developing and accessing student mathematical understanding. Teachers reported that resources such as teaching booklets, diagnostic interviews, and online resources were beneficial components supporting their development (Higgins & Parsons, 2009; Thomas & Tagg, 2005).

2.2.3 Challenges and Motivation

With the NDP’s sheer scale, there were challenges, adjustments, and nuances that practitioners had to contend with as they unpacked what the NDP required of them in their planning, student grouping, and instruction. There was also teacher conflict between ‘traditional’ pedagogical approaches and the NDP focus on student thinking and guiding to extend students (Cheeseman, 2007; Timperley et al., 2007). Cheeseman (2007) describes that “accommodating the reform-orientated approaches was extensive and difficult to achieve for many teachers” (p. 202). Each teacher’s willingness to take on the NDP fell into the categories of “personal” or the “external”

influences with reforming their practice (Walshaw & Anthony, 2006, p. 368). In this case 'personal' describes each teacher's willingness to reflect on and adapt their practice based on the professional learning model that is being engaged. The 'external' describes the collegial, leadership and external support received throughout the duration of the ISPL.

2.2.4 The New Zealand Curriculum, and National Standards

From 2007 to 2010 Mathematics teaching and learning in New Zealand transitioned through three substantial policy enactments that would have an impact on not only mathematical teaching and learning but also professional learning development in mathematics for teachers right up to this current study.

In 2007 the New Zealand Curriculum (NZC) was launched by the MoE. Schools were supported over a three-year period to help implement the new curriculum. The revamp of the NZC was partially in response to the long term and ongoing decline in achievement in mathematics for school aged students in New Zealand (Morrow et al., 2020). The NZC reforms for mathematical teaching learning saw a concerted shift to teacher autonomy in curriculum knowledge focus (Mills, 2018; Morrow et al., 2022; Whyte, 2022). Mills (2018) described that teachers and schools narrowed their teaching to develop "procedural knowledge at the expenses of conceptual understanding" (p. 28). Mathematics in the NZC is made up of three strands; number and algebra, geometry and measurement, and statistics, however guidelines given with the revamp indicate "numeracy be given the priority, especially in Years 1 to 8" (Whyte, 2022 p. 5). Morrow et al. (2022) detailed an "emptying out of mathematical knowledge in the New Zealand curriculum" meant a "profound change to the teacher's role—from subject expert to facilitator of learning" (p. 62). In 2009 the NDP ended,

meaning professional support from external facilitators ceased, along with the shift towards greater teacher and school autonomy on how and what mathematics was taught from the NZC. Higgins & Parsons (2011) posit that this meant that there was insufficient support for shifts in teacher practice from this point onwards. In term one 2010 it was expected that teachers and schools would begin to teach and assess against expected mathematical outcomes for learners from year one to eight of their schooling (National Standards, 2010). With the introduction of the Mathematical Standards there was an expectation of a continued focus on number which was the primary focus of the professional learning in the NDP would be maintained:

“A strong understanding of number is vital if students are to succeed in mathematics. For this reason, the expectations for number are the most critical requirement for meeting a standard” (Ministry of Education, 2009, p. 12).

In 2010, the government of the time fundamentally changed how ISPL was funded, moving away from a focus on universities covering a region for all subjects to a contestable model in which 'providers' compete to gain contracts offered by the MoE. This exacerbated the fragmentation of ISPL. When coupled with the introduction of National Standards in Mathematics that same year requiring a prescription to age and stage mathematical outcomes, piecemeal skirmishes from schools followed with in-service professional learning in mathematics.

The NDP was the primary professional learning experienced for six out of nine teaching participants in more recent times and the other three participants were taught mathematics in high schools under NDP pedagogy. The NDP primarily focused on

number knowledge and provided grouping strategies, resources which kept lesson consistent and uniform. The majority of professional learning engagement consisted of one to one meetings between the facilitator and teacher. Understanding the personal learning and professional learning histories in mathematics of the participants provides context around the experiences, practices and mostly likely pedagogical perspectives of the participants.

2.3 The Challenges within Teaching Mathematics

This section unpacks the personal challenges teachers may confront within themselves when teaching mathematics. These impact on willingness to be open to ISPL, take risks, be vulnerable, and see the value of their teaching practices for their students.

2.3.1 Mathematical Content Knowledge

A personal influence on the level of teacher commitment towards engaging with ISPL is the content knowledge teachers may or may not have to teach mathematics. This factor plays a part in uptake by teachers in the professional learning. The structure of New Zealand primary schooling requires teachers to teach across the eight key learning areas in the New Zealand Curriculum (Ministry of Education, 2007). Herts et al., (2019) outline a lack of specialisation in the role of teaching mathematics. With this, a primary classroom teacher is often tasked with teaching mathematics even though they did not necessarily pursue a “career specific to math” (p. 195). Timperley et al. (2007) posit that most primary teachers come from an art or language-based background. This often has negative consequences on their mathematical content knowledge, but more importantly confidence, enthusiasm, and the ability to cater to a

wide range of students' needs. Eisner (2000) states; “when changes require teachers to employ skills they do not normally possess and when they are provided with little or no time to acquire those skills, the outcomes are predictable” (p. 348). Artman et al. (2020) believe factors often not considered are varying degrees of subject experience and application across varying year levels. Although specialised knowledge does not necessarily equate to excellent teaching and learning outcomes, proficiency impacts a teacher’s confidence and openness to the nuances of ISPL in mathematics further compromising their ability to cover the broad bandwidth of coverage expected in mathematics curriculum (Karunakaran, 2020; Mutlu, 2019; Szczygiel, 2020). Limited confidence in their own content knowledge in mathematics presents a challenge when developing ISPL and the level of willingness from teachers.

2.3.2 Mathematical Anxiety

Avancini & Szúcs (2019) describe mathematical anxiety as a “debilitating negative emotional reaction to mathematical tasks” (p. 42). Teachers are not immune to this anxiety, whether it developed from their own educational experiences, a rote understanding of a single method of solving a multidimensional problem, or the fear of making a mistake whilst either learning or teaching. Mathematical anxiety must be acknowledged, understood, and recognised as a potential challenge for those facilitating ISPL. Providers must anticipate and plan to cater for this anxiety in teacher engagement.

Maths anxiety has traditionally been oversimplified and primarily attributed to an individual’s poor working memory, or a weak application of the four basic computations of multiplication, division, addition, or subtraction (Wolfmeyer, 2017). The present-day

understanding now links it to broader psychological, social, cognitive, and cultural constructs that make it difficult to attribute to one specific causal factor (Ashcraft, 2019). However, the most common factor attributed to math anxiety for teachers is their own negative experiences with their schooling (Herts et al., 2019; Karunakaran, 2020; Mutlu, 2019; Szczygiel, 2020). Hence, societal norms around the teaching practices within math are perpetuated, maintaining a vicious cycle of negative beliefs around one's personal ability within mathematics and their ability to teach it enthusiastically and confidently. Several authors identify that this anxiety encourages surface-level teaching with practices such as rushing through substantial amounts of content, strict adherence to procedural skills, promoting the importance of the correct answer and poor explanations of concepts and vocabulary (Herts et al., 2019; Karunakaran, 2020; Mutlu, 2019; Szczygiel, 2020).

With this foundation ISPL that contrasts with, or even challenges these long held practices must be prepared for hefty resistance to even get practitioners to entertain pedagogical change (Eisner, 1998; Servage, 2008). Timperley et al. (2007) outline anxiety as a critical influence in learning and what teachers know. Teachers' attitudes and dispositions towards teaching mathematics have profound implications on their student's disposition towards the importance of mathematics as a subject and what constitutes ability in mathematics. Ashcraft (2019) denotes the plausibility of highly math-anxious teachers negatively influencing their students' attitudes and application in mathematics. In this situation, Mammarella et al. (2019) posit that mathematical anxiety within a teacher means their students' journey towards numerical competence becomes significant.

Within the design and roll out of the professional learning, mathematical anxiety in all its forms must be explicitly acknowledged and unpacked. Deliberately giving time to firstly internalise and reflect on this for each teacher. Providing time and space to share with a colleague or group when they are comfortable during the professional learning. This allows them to feel safe, continue to look inward and stay engaged. Mathematical anxiety must be factored in by facilitators and school leadership as an area to explicitly identified and unpacked alongside teachers in a genuine effort to merge ISPL with existing pedagogy.

2.3.3 Entrenched Belief in Best Practice and Ability

The fact that mathematics is steeped in and remains entrenched in skill and drill teaching traditions is a situation outlined by many researchers (Eisner, 2000, 2005b; Mason, 2018; Pais, 2015; Pia, 2015; Timperley et al., 2007). These pedagogical practices are tightly held onto as they provide security, routine. Meaningful change of this position will require “major shifts from what is described as ‘traditional’ mathematics teaching that practitioners are not willing to relinquish” (Timperley et al., 2007, p. 73). Eisner (2005b) describes historically instructional practices cement precision and uniformity in mathematics and that for most teachers, this remains the high watermark when performing and exhibiting mathematical ability. Young-Loveridge (2010) states, “teachers are up against a systemic problem that dates back to their schooling and of their teachers” and even those before them (p. 29). Eisner (2000) termed this form of schooling as “modus vivendi” following a set of codified rules stuck deeply in the past and “requires forms of adaptation that teachers may not be able to provide” (p. 348). Skemp (1976) posits that the problem goes back

generations with procedural rather than conceptual teaching deeply ingrained in the psyche of mathematical pedagogy.

With these conditions remaining the status quo Pia (2015) postulates that this leads to students following procedures without reason and continued practice of shallow pedagogy. Of course, there is more to doing mathematics than carrying out procedures. However, these practices remain a part of education and society's schema. Combined this with a pedagogical cycle orbiting around and towards a 'back to basic' and the 'tried and true' modus operandum ISPL will always struggle for meaningful shifts towards best practice (Mason, 2018).

2.3.4 Unconscious and Conscious Bias

A teacher's expectations inform their belief in their students' own mathematics ability and therefore the level of challenge they provide for their students. These expectations can manifest from negative perceptions of a specific ethnicity's or gender's ability to learn mathematics (Karunakaran, 2020). Gorski (2008) defines the propagation of these views through "well-established stereotypes" and "ignoring systemic conditions" that perpetuate inequitable access to education (p. 3). Likewise, Crespo & Featherstone (2012) believe that "status is everywhere" and "systematic ranking insidious", undermining students' self-concept of their ability to comprehend existing and newly introduced mathematic concepts competently based solely on their ethnic and social background (p. 166). Timperley et al. (2007) maintain that a teacher's social construction of a student determines the rigour they afford to the curriculum.

The perception of belief in innate ability in mathematics is a social construction supported by conscious or unconscious bias around naturally being good at mathematics. This is a standard narrative penned by students, parents, and teachers alike, maintaining an entity view of ability with the idea of either having a 'math brain' or 'not being a math person' which lets everyone off the hook in a hopeless situation (Crespo & Featherstone, 2012; Dweck, 2008; Dweck & Leggett, 1988; Upadyaya & Eccles, 2015). For students, while being schooled, an accumulation of these experiences and interactions shapes their expectations. As these students grow older, they become more socially aware of these cues, and it can grow into a self-fulfilling prophecy (Riegler-Crumb & Humphries, 2012). Harvey et al. (2016) coin this impact on performance as a "stereotype threat", causing those exposed to the threat to perform more poorly than they are capable. With these lowered expectations, the learning situations presented to these cohorts typically have decreased cognitive demands with a repetitive focus on computational abstract functions (Karunakaran, 2020). In-service professional learning must challenge these preconceived notions and attempt to amend or remove structures and tendencies within the frame of a 'typical maths lesson.'

2.3.5 Mathematics as a Gatekeeper

So far, this chapter has described the various challenges teachers may face around content knowledge, anxiety, innate ability, conscious and unconscious bias when teaching mathematics and engaging with ISPL. All the described feelings, structures and struggles outlined in this literature review are a mirror of what many may have faced and for those who are learning mathematics currently in compulsory schooling may still be facing. These challenges are attributed to the role of mathematics as a

gatekeeper subject. As a gatekeeper how far, you get in schooling with mathematics severely compromises your opportunities for higher education and even the fields of higher education you may be eligible for regardless of mathematics' relevance to your field of study. With the nature of this study, it is important to review literature around this precept of mathematics education as the reach, influence and consequences of mathematics education goes beyond the classroom into society and culture. Mathematics content, curriculum and pedagogy is designed to serve a specific purpose.

Mathematics as a gatekeeper is a concept traced back over 2000 years to Plato's *The Republic* (Stinson, 2004). The views of Hall (1904) encapsulate the rhetoric from social efficiency educators towards mathematics education's role in providing privilege for a select few and oppressing "the great army of incapables, shading down to those who should be in schools for dullards or subnormal children, for whose mental development heredity decrees a slow pace and early arrest" (p. 510). This foundation of design and instruction in compulsory schooling from the later part of the nineteenth century and early in the twentieth century has been maintained and described in more recent times. Many researchers (e.g., Boaler, 2000; Bryk & Treisman, 2010; Gutstein, 2016; Martin et al., 2019; Ryan et al., 2021; Stanic, 1986; Stinson, 2004) describe the deliberate exclusionary design of the mathematics curriculum and pedagogy continues to have a huge influence on who succeeds in mathematics, who is believed to be better at mathematics and what gender and ethnicity will continue to dominate seats of power.

The implications for ISPL for this study are with the professional learning undertaken being in opposition and challenging the gatekeeper design of conventional pedagogy

and therefore adds another dimension to the already complex reality facing the participants.

2.4 Culturally Sustaining Pedagogy

CSP is a part of this literature review as the in-service professional learning the faculty engaged with introduced this pedagogical approach into their mainstream mathematics classroom. The amalgamation of the current with the new no matter how natural it may feel or how much it may complement the participants' teaching philosophy still add layers of complexity.

2.4.1 Culturally Sustaining Pedagogy within Mathematics

The literature on CSP in education has been around for some time. Hymes (1976) identifies that "schools have long been aware of cultural differences, and in recent years have attempted to address them, rather than punish them" (p. 8). Cazden & Leggett (1976) state, "the goal is education that will be more responsive to cultural differences among children. Specifically, school systems are asked to consider cognitive and affective aspects of how different children learn" (p. 3). Dean (1989) describes "the further the distance from mainstream culture... the more difficulty students from outside that culture will have in acquiring it through the education system" (p. 25). With mathematics culturally sustaining pedagogy challenges traditional modes of transmission and memorisation aligned with mathematical teaching and learning.

Mathematics problem solving often requires specific conceptual understanding typically aligned with the dominant hegemony frames of experiences and cultural practice (Wilburne et al., 2011). Culturally sustaining pedagogy in mathematics

requires a significant shift in traditional engagement for teachers with their students and the reconceptualization of learning tasks. The implications for ISPL are the potential clashes between existing practices and systems with new or opposing actions espoused by CSP. Teachers' personal perspectives, history of practice combined with the energy and time needed to be invested are all factors that facilitators must be aware of and be able to offer the varying support each individual may require in the professional learning.

2.4.2 Reimagining the Teacher's Role in Mathematics Learning

The positioning of the teacher within the mathematics lesson has traditionally been unchallenged in terms of determining the style and direction of learning. Standing in front of the class the teacher would explain how to solve a concept or use a set of prescribed steps. Boaler (2000) states these practices are premised “upon assumptions of knowledge independence and stability, which lead to expectations of unproblematic knowledge transfer” (p. 380). A shift to pedagogical practices that elicit and value multiple pathways, representations, and strategies for solving one problem demand a lot in teacher anticipation and conceptual understanding of the content being taught. Kazemi, Franke, & Lampert (2009) detail that CSP in mathematics opens teachers to specific vulnerabilities with conceptual understanding of mathematics and the threat of not having all the answers. Averill & Clark (2012) state that respect must be earned and is not given. The importance of students being respected by their math teacher influences the development of a sense of community, willingness to take risks, to be heard with more in-depth discussions and varying cultural perspectives on working together.

This moves away from imparting understanding towards facilitation, growing an environment requiring conjecture, risk-taking, multiple representations and encouraging participation. Such pedagogical actions promote student voice, pro-social skills and improve mathematical disposition (Hunter & Hunter 2017). Bills & Hunter (2015) outline that the typical New Zealand mathematics classroom reflects dominant Western views and beliefs espousing the importance of speed, competitiveness, and individual success. The relinquishment of power, requiring conceptual agility to anticipate and validate different pathways in problem solving ask a lot of teachers combined with the unlearning while learning.

2.4.3 Reconceptualisation of Knowledge and Culture within Mathematics

CSP in mathematics requires an increased understanding of the complexity of culture, the multifaceted, dynamic, and evolving nature of students and who is doing the knowing. Bartell & Johnson (2013) describe the unearned benefits and advantages granted to individuals who are centralised within the dominant hegemony at the expense of oppressed groups. Repositioning pedagogy to value indigenous knowledge and cultural practices is demanding and requires educators' head-on contention (Paris & Alim, 2017).

Ethnic minorities and those students from low socioeconomic circumstances have served as “canaries in the mineshaft” with content focused on mathematics education (Martin et al., 2010, p. 16). Hawera and Taylor (2011) describe how an absence of appreciation and connection of school mathematics to everyday practices in students' lived realities compromises the potential learning experiences. CSP in mathematics allows mathematics teachers to de-silence race and address whiteness, power, and

critical equity in mathematics education (Macfarlane et al., 2007; Rubel, 2017). Knowledge is not static, and educators must include students' culture, language and relatable context allowing active participation in the learning process and corresponding perspectives (Izmirli, 2011). Bills & Hunter (2015) posit that culturally sustaining teaching bridges the gap between the status quo for mathematics teaching and empowers Pāsifika, Māori & English language learners whose values and funds of knowledge that are typically left in the periphery of lessons. Culturally sustaining pedagogy infuses culture and critical consciousness into learning (Ladson-Billings, 1995). The argument that classes may not contain many minority learners is countered with the belief that good teaching for some is good teaching for everyone.

2.5 Conclusion

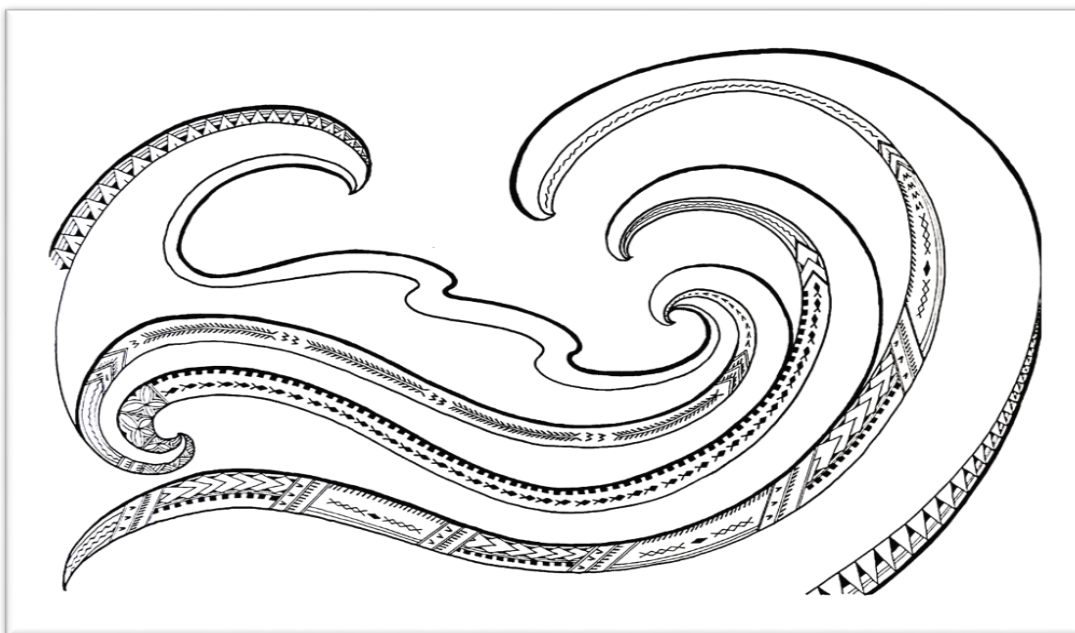
This chapter reviewed the literature around the personal and professional experiences and influences that framed both the learning and teaching of mathematics for the participants up to the professional learning. It also reviewed literature around CSP that was the key focus of the in-service professional they were a part of. The complex nature of this study gave rise to a plethora of considerations and debate around mathematical disposition, mathematics' place in society, teaching and learning and finally professional learning in the mathematics space.

Chapter Three – Methodology

This chapter outlines the design and methods used in this study. Section 3.1 presents the research rationale that feeds into the methodology and methods presented in this study. In sections 3.2 – 3.6, this study's ethnographic and indigenous methods are unpacked. Section 3.7 outlines the research setting, and 3.8 introduces the participants in the study. Section 3.9 details the research outline. Sections 3.10 – 3.12 outline data collection methods and analysis. Section 3.13 covers reliability and validity considerations with the methodologies that the study fell within. Section 3.14, the closing section considers concerns identified and actions taken to ensure that the study aligned with cultural and ethical practices.

3.1 Research Rationale

The Journey: Tofā Sa'ili - Tofā mamao



(Sione Sialaoa 2022)

Figure 1. *Visual representation of the learning experiences for the participants and researcher throughout the in-service professional learning and research journey..*

This research aims to identify and unpack the complex, multifaceted layers involved when Pāsifika teachers undertake in-service professional learning (ISPL) to develop teaching and learning in mathematics. The researcher in this study is of Samoan descent and took part in the ISPL and therefore was acutely aware of the journey undertaken by the participants. These types of journeys in Samoa are described as Tofā Sa'ili a search for truth-wisdom and Tofā mamao to have a vision and plan for the future. Pāsifika own a storied lineage of navigating the open Pacific Ocean, the largest ocean on earth where contact was made with nearly every island in the vast Polynesian Triangle. This was accomplished by utilising wayfinding techniques. These techniques were honed through an astute and acute noticing of patterns and relationships in the natural world. These skills were passed down from generation to generation through oral traditions. Although this journey was not undertaken on the ocean but within an educational setting, metaphorical links to these wayfinding techniques alongside Pāsifika values are used to support the study's narrative. This metaphorical parallel is utilised to be able to illustrate Pāsifika knowledge, cultural protocol, and tradition within aiga, villages, church, and education alongside the epistemological beliefs that help shape this study (Goodyear-Smith & 'Ofanoa, 2021).

This approach presents an ambiguity that can unsettle traditional research as claims cannot be tested, and there is no good way to find the 'truth.' The counter argument to this point is put aptly by Patton (1990) stating that it is essential to select "information-rich cases for study in depth, information-rich cases are those from which one can learn a great deal about issues of vital importance to the purpose of the research, thus the term purposive sampling" (p. 169). This study's ontological position will present a truth but not the truth. This metaphor presents the importance and

elegance of bringing together all points of view, past, present, future. When this weaving or construction is completed, it will have common threads but will also be unique.

3.2 Fa'afaletui Methodology

Fa'afaletui is a social-ecological framework used in this research to support the construction, collection, analysis for the researcher[s] and subsequent sharing and reciprocation of the findings with participants (Goodyear-Smith & 'Ofanoa, 2021). The reciprocation is the handing back of the knowledge and wisdom shared by participants for the collective good. This is the responsibility of an indigenous researcher to help contribute to knowledge, culture and ethically to ensure no harm to the participants and their communities. Their individual and collective mana must be maintained and enhanced. It takes account of multiple realities and for divergent perspectives associated with dynamic educational research (Anae, 2019; Eisner, 2005; Goodyear-Smith & 'Ofanoa 2021; Lamont, et al., 2020). The collective inquiry invites multiple perspectives and views based on collectivism and interwoven funds of knowledge (Goodyear-Smith & 'Ofanoa, 2021; Lamont et al., 2020). These multiple realities sit within the participant's individual experiences with learning mathematics, perceptions on mathematical pedagogy and general pedagogical philosophy.

The table below summarises the Fa'afaletui framework utilised in the study (as adapted from Goodyear-Smith & 'Ofanoa, 2021; Lamont et al., 2020; Tamasese, Peteru, Waldegrave, & Bush 2005).

Table 1

A summary of the Fa'afaletui framework

| Perspective | Description |
|---|---|
| Fa'a ways of: 'the way.' | From a distance, a view from the mountain looking out towards the vast ocean surveying the terrain (an etic perspective). Observing and learning of the participants' varying journeys taken. |
| fale: 'the houses' For this study, the view from the beach | The view from the roof of the fale or in this study's narrative the view from the shore as they look to step onto va'a* (an emic and etic perspective). These are the deliberations of individuals and group confluence. |
| tui: 'weaving together.' Weaving together the lashing that help hold the va'a together | The view from those in the room or for this study the experiences on the va'a (an emic perspective). Those close to the 'fire' or 'paddling' are directly engaged and experienced. |

Knowledge sharing and consensus-building through direct experiences, reflections, observations, and aspirations from all participants, supporting collective construction.

Fa'afaletui is a Pāsifika research methodology situated in the traditions of Samoan cultural ways of being. Attitudes towards professional learning and their position within the group hierarchy and willingness to engage. Cultural practices in respecting elders, or those positioned in the group with more experience are expected to take the lead also with the buy-in from school leadership (Mason, 2016). Eisner (2005b) argues the need for varieties of "human understanding", the "fresh metaphor", and that "diversified forms of meaning are related to different forms for knowing how to act in complex circumstances" (p. 156). Fa'afaletui, as a Pacific research methodology, utilises indigenous philosophy, knowledge circles and promotes a holistic approach to research (Anae, 2019). Fa'afaletui challenges the propositional discourse of theory and research with the practices of collectivity and "generalises more than particularises" (Eisner, 2005b, p. 114).

3.3 Utilising Group Talanoa in Data Gathering

Talanoa is a discussion promoting holism, validating indigenous knowledge systems allowing for, in this case, data and accounts of Pāsifika worldviews to be systematically gathered and formulated (Fairbairn-Dunlop & Coxon, 2014; Suaalii-Sauni & Fulu-Aiolupotea, 2014; Tualaulelei & McFall-McCaffery, 2019; Tunufa'I, 2016). Talanoa's, literal translation in the Samoan language, means to talk or be discussed. Talanoa

supports gathering information in the Pacific tradition of collective face-to-face knowledge sharing, removing the distance between researcher and participant (Vaiotei 2006). Fairbairn-Dunlop & Coxon (2014, p. 16) state that "talanoa fits the Pacific ontological standpoint and epistemological perspective that knowledge is socially constructed and validated." Vaiotei (2006) posits that talanoa fits qualitative research, grounded theory, and naturalistic inquiry.

Talanoa group interview is applied in this study alongside qualitative research, case study and Fa'afaletui methodology requiring access to multiple data sources. Suaalii-Sauni & Fulu-Aiolupotea (2014) describe talanoa as a cultural synthesis, weaving information, perspectives, emotions, individual and group experiences together. Smith (2021) explains the importance of "Kanohi kitea or the seen face" (p. 51) with the researcher developing an equal status and fostering reciprocal relationship with participants. Traditional researcher-participant relationships primarily position the researcher as the authority retrieving data from an objective position. Establishing trust, respect, anonymity, and clarity allows for a mutual construction of dialogue and data (Zuber-Skerritt, 2003).

3.4 Teu le va (clearing of the Vā)

To clear the vā illustrates intentionality, 'revving the engine' to unpack, be explicit or mitigate tension, possible previous traumas and establish a safe place to openly share across age, status, experience, ethnicity, and gender. Mila (2019) asks the question, "how do we cultivate more inner space so that we can respond consciously and mindfully?" (p. 14). The dynamic nature and social intricacies of group talanoa can 'muddy the waters' of the meaning or intention of participant responses. This can also

impact the authenticity of interactions between participants and the researcher in talanoa fono. Vā in Samoan or Wa in Māori is both physical and metaphysical. Clayton (2007) eloquently puts it as "the space between, the betweenness, not empty space, not space that separates but space that relates, that holds separate entities and things together" (p. 1). Anae (2010) states that awareness of the Vā and the practice of clearing assures personal-collective wellbeing and that through "protocols and etiquette", any imbalance between parties can be corrected, maintaining good relational arrangements bringing blessings (p. 13). On the researcher's behalf, the explicit acknowledgement and practice of addressing any potential entanglements for participants or the group before the initial talanoa, between and after further talanoa fono provide a platform for conscious sharing.

3.5 Qualitative Research

This study's ethnographic nature pivoted on the contrast between dominant Eurocentric views, practices in education and Māori and Pāsifika ways of learning and collectivism. Credible qualitative research entails developing communication and engaging in various conversations (Eisner 2005; Chenail & Chenail 2011). An interpretive approach attempts to understand and story phenomena within natural situations (Denzin & Lincoln, 2011). Education and educational research are not exempt from political and social influences. Qualitative research recognises the social context, discourses, ideologies, and humanistic construction of objective and subjective information within education and research findings (Punch & Oancea, 2014). Eisner (2005b) posits there is the need for educational research to "avoid methodological monism¹" and that academic research is constructed in as "many ways

¹ A theory or doctrine that denies the existence of a distinction or duality.

that bear fruit" (p. 74). Because qualitative research aims to enrich the understanding of an experience, it needs to select fertile exemplars of the experience for study. Such selections are purposeful and sought out; the choice should not be random or left to chance. The concern is not how much data were gathered or from how many sources, but whether the collected data are sufficiently rich to bring refinement, clarity and understanding of an experience.

3.6 Case Study

A case study is a commonly used approach in educational research that allows both the participants and researcher[s] to understand what is being researched beyond closed surface level wonderings (Yin, 2011). This case study involved teachers engaged in ISPL in mathematics and presented a typical situation whereby the researcher attempts to understand complex social phenomena in the participants' natural setting. Furthermore, a holistic approach allows for greater transparency, trust, integrity, and an open forum for honest responses (Polkinghorne, 2005). Creswell, Hanson, Plano Clark, & Morales (2007) state that a case study allows for sharing ownership of the research to be community-based and empower the oppressed and unheard. This study was compact, all the participants directly involved in the professional learning took part in the research. Punch & Oancea (2014) state that it is better to have a small scale or small sample size interview-based project as they can go into more depth rather than reaching for more participants based on the optics that greater quantity improves the quality and validity of the study. Merriam (1998) identifies that this affinity also allows the researcher to be flexible and aware of changes in direction or contextual conditions.

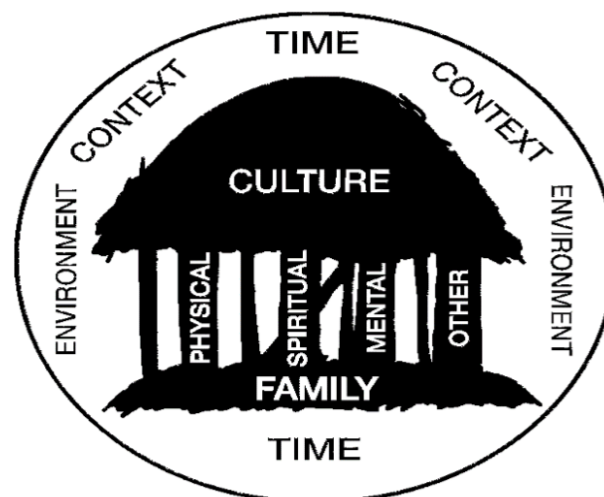
The application of a case study provides the researcher with this scope. The study is described as emic ethnographic in design, as an emic survey relies on immersion and

the "richness of detailed descriptions" (Zhu & Bargiela-Chiappini, 2013, p. 382). This allows for an increased reciprocal outpouring of past events, current happenings, and probable future developments. As the researcher is an active participant in the ISPL implementation and is enculturated within the learning community, awareness of this position was significant on the researcher's behalf to recognise aspects of data that could be taken for granted due to how the researcher was engaged in the study. By promoting practices that bring attention to the moment, the researcher presented a narrative of accessible, relevant findings for participants whilst also deriving valuable data for the study (Bergman & Lindgren, 2018).

The researcher being Samoan provides an emic perspective that is combined with a solid and robust analytical framework to maintain an etic awareness. Through this the researcher aimed to elicit objective renderings. A research journal was kept throughout the duration of the study. This was important as it captured informal discussions and included descriptions of interactions within the group and with individuals. With this, these interpretations of what was occurring, descriptions, comments and reflections can be accessed as reliable documentation of what happened (Kemmis, McTaggart, & Nixon, 2014). This intimacy contrasts with bigger scaled empirical studies that formally dominate educational research and, in some cases are superficially administered from afar. Peshkin (1985) describes how this lack of connection has negatively impacted studies "by virtue of subjectivity, I tell the story I am moved to tell. Reserve my subjectivity, and I do not become a value-free participant-observer, merely an empty-headed one" (p. 280).

3.7 Research Setting

This study is situated in an urban co-educational high school catering for students from Year 9-13. The participants of this study are the teachers within the junior cohort comprising of two year nine classes and two year ten classes. At the time of the study, eighty-nine per cent of students were of Pāsifika heritage. Pāsifika is used to refer to the "people, cultures, and language of Pacific groups including Samoa, Tonga, the Cook Islands, Niue, Tokelau, Tuvalu, and other smaller Pacific nations – who are now living in New Zealand" (Te Kete Ipurangi n.d.). The remaining eleven percent of students were Māori. The school intertwines fa'a Pāsifika values to promote teaching and learning engagement alongside the "Fonofale" model of wellbeing in a holistic view of teaching and learning (Pulotu-Endemann, 2009).



(Pulotu-Endemann 2009)

3.8 Research Participants

These participants were selected as they had all taken part in the ISPL for a minimum of twelve months up until the study. The research participants comprised of two groups. The first group consisted of seven teachers of Pāsifika culture and heritage.

None of the participants in this group are 'specialist' maths teachers. This primary group of teachers are involved in the day-to-day implementation and participation in the professional learning. The second group comprised of two Pāsifika teachers who were members of the senior leadership team. Altogether nine teachers were invited to participate in the research talanoa, and all agreed to take part. However, Covid lockdowns and the New Zealand Government traffic light system requirements severely interrupted the ability to be face to face for talanoa fono. Initially all nine teachers were slated to take part in three talanoa fono together. A request was made by the three younger participants. This request was made due to the awareness of cultural practice of respecting your elders or superiors. Their insight was that this practice could impact the nature of their responses and they may not be as open with sharing their experiences and feelings out of respect for their elders. With this, in turn it would impact the data collected from talanoa for this study. With this, three groups were formed, and each group contributed to the study with their own extended fono. Unpacking, describing, and storying their mathematical teaching and learning journeys.

Group one: the “Young Guns.” This group consisted of the three younger teachers within the teaching participant group. This group consists of one female and two males all in their mid-twenties who have been teaching for less than four years. The three participants are described in the findings as YG1, YG2 and YG3.

Group two: the “Aunties,” This consisted of four female teachers with over one hundred years of combined teaching experience between them. The four participants were described in the findings as A1, A2, A3 and A4.

Group three: “Tamā and Tinā,” meaning mum and dad, was the senior leadership group. They identified the school's need to undertake professional learning alongside the head of the mathematics department across the secondary school. This group was invited due to their role in supporting the junior school team with curriculum, assessment, structural considerations around pedagogy, teacher release and resourcing. The two participants were described in the findings as T1 and T2.

3.9 Research Outline

The study was conducted in five phases over a six-week period. The table below outlines the research activities undertaken during each study phase.

Table 2

Research Study Schedule

Phase One

- Initial information meeting with prospective participants and consent forms handed out.
- Information meeting with School Board of Trustees requesting permission to undertake the study with faculty and within the school.
- Consultation with school leadership concerning Treaty of Waitangi and considerations for Māori learners, whānau, and local Iwi.

Phase Two

- Teu le va
 - Talanoa fono with three teaching participants described as the “Young Guns”.
 - Individual check back sessions (untangling and clearing of the Vā)
-

-
- Maintaining research journal
 - Audio from talanoa fono transcribed and analysed
-

Phase Three

- Teu le va
 - Talanoa fono with the four teaching participants described as the “Aunties”.
 - Individual check back sessions (untangling and clearing of the Vā)
 - Maintaining research journal
 - Audio from talanoa fono transcribed and analysed
-

Phase Four

- Teu le va
 - Talanoa fono with school leadership described as “Tamā and Tinā”.
 - Individual check back sessions (untangling and clearing the Vā)
 - Maintaining research journal
 - Audio from talanoa fono transcribed and analysed
-

Phase Five

- Research data from the study was collated and analysed for findings, discussion and conclusions pertaining to the research question.
 - Sharing research findings with participants and Board of Trustees for possible amendments and final draft approval.
-

3.10 Data Collection

This study storied descriptions, perspectives, and experiences of individual and collaborative interactions for teachers engaging with in-service professional learning for teaching and learning in mathematics. Through two extended talanoa fono with the teaching team and one talanoa fono with the leadership team, the semi-structured

discussion centred around the three perspectives of the Fa'afaletui methodology. A semi-structured focus group involves several people at one time in a group situation where the researcher acts as a mediator supporting the natural outpouring of the individual and collective experiences that come to the surface (Punch & Oancea, 2014). The interview framework of fa'a: the view from afar, fale: the view from the roof and tui: the view up-close in the room asks participants to switch perspectives being investigated and allow for flexibility, reciprocity, and connections between their identities as learners of mathematics, teachers of mathematics and where mathematics sits within their cultural traditions and practices (Merriam & Tisdell, 2015; Punch & Oancea 2014).

Each group talanoa fono was audio-recorded and transcribed. The researcher utilised transcripts from the audio recording to discover and interpret themes and patterns related to the research question. Flexibility and localised cultural practises are cultivated to give the participants the 'floor' to share and story their experiences together with emotions, humour, reciprocity, and the open honesty talanoa can afford (Merriam & Tisdell, 2015). With this approach, the researcher can respond to the participant's outpourings in the moment and be aware of cultural nuances that play out beyond the scope of the audio captured (Suaalii-Sauni & Fulu-Aiolupotea, 2014). The check back sessions (as needed) were utilised on an individual basis and to quickly seek clarity and meaning on contributions made to support further acute unpacking of intended representation and analysis.

Throughout the study, the researcher-maintained notes, and further observations in the form of a journal. This journal allows the researcher to analyse the transcripts taken concerning notes and reflections scribed when data was collected. Along with this,

interview transcripts and individual check back sessions triangulation occurred from multiple data sources to strengthen the validity of findings (Merriam & Tisdell, 2015; Punch & Oancea, 2014). Along with the participant check backs, this supports the validity of the findings, discussion, recommendations, and implications for this study.

3.11 Data Analysis

There is no single right way to analyse data. Sutton and Austin (2015) argue that remaining true to the study's participants and maintaining their voice throughout is the most crucial part of data analysis. Peshkin (1985) define data analysis as finding meaning, making interpretations and judgements a process of complex sense-making. Qualitative data analysis aims to share and link interpretations to theory (Atkins & Wallace, 2012). The audio transcripts from talanoa were read and re-read. Thematic analysis was utilised to make sense of the data, identify reoccurring themes present in the data, and linked these themes to the research literature (Atkins & Wallace, 2012). This was maintained through iterative consolidation within each talanoa fono and ranging across the sum of all the parts to support a holistic analysis.

3.12 Thematic Analysis

Swimming in a sea of data meant that thematic analysis provided a robust nuanced rendering down of the transcription from talanoa to its essence. This interwoven and leveraged with the cultural location of the researcher meant a constant switch between inductive and deductive reasoning, revealing themes, interpretations, and the coding of responses to tell a story. Braun & Clarke (2022) posit “codes are heuristic devices we use, to foster our engagement, to enrich understanding, and push ourselves into interrogating the dataset and our meaning-making with it... the aim of understanding

diverse ways to approach coding is not about doing things perfectly, so much as understanding what you're doing, and why" (p. 59). The researcher recognised their involvement, positioning within Tofa Sa'ili. Tofa in Samoan is wisdom and Sa'ili is the search. Tofa Sa'ili is a search for wisdom, the ongoing search for truths.

3.13 Reliability and Validity

This ethnographic study method relied on the researcher's ability to employ reciprocal engagement with participants in the setting that the professional learning took place in and fell under the umbrella of qualitative ethnographic research. Qualitative research can be a contested space for the reliability and validity of research methods, responses, findings, and discussion within traditional research forums. Devitt & Sterelny (1999) state that experience and its accurate description and true meaning in language remain an area of contention when interpreting participants' responses in qualitative research. However, Eisner (2005) counters this statement and argues that scientifically acceptable research is never value-free and that all representation methods either limit or illuminate an experience somehow. With this, the researcher must maintain personal awareness of their own biases and assumptions that may influence the study's collection and interpretation of data (Merriam, 1998; Merriam & Tisdell, 2015; Punch & Oancea, 2014). Punch and Oancea (2014) note that sceptics of qualitative research claim a reduction in the rigour and dependability of the responses collected. This study posits that sample bias can be a feature of any research and is not a feature particular to qualitative research but rather an invalid method.

Pāsifika researchers have identified the need for greater consistency and reliability when utilising indigenous research methodologies. Tualaulelei and McFall-McCaffery (2019) highlight the need for more practical guidelines when undertaking talanoa for researchers. Vaioleti (2006) states that a researcher cannot just 'do' talanoa and that it may take years to learn this. With this, the researcher must envisage a design for tempo, open questioning, and interaction, allowing talanoa to flow naturally. Punch and Oancea (2014) identify this storying as valuable for empowerment and feasible collecting of data. Suaalii-Sauni and Fulu-Aiolupotea (2014) posit that "the general rules of analysis are largely the same: do the very best you can with your full intellect to fairly represent the information gathered" (p. 338). Tunufa'i (2016) espouses that the researcher must learn to use new forms of gathering evidence. For example, by involving ourselves in other cultures' ways of interaction and interpretation. Talanoa is an example of a Pāsifika research paradigm seen as a novel way of researching by previous generations of Western Academy (Fairbairn-Dunlop & Coxon, 2014; Tualaulelei & McFall-McCaffery, 2019). The construction of a specific narrative is derived from data themes arising and identified within this specific study. With talanoa, there is no set framework or formula for conducting this research. If this study were replicated in another institute or context using the same themes and research approach the new research would produce different results.

3.14 Ethical Considerations

This study was granted full ethics approval from Massey University Human Ethics Committee. To undertake the study, the researcher formally approached the school's board of trustees in writing, requesting signed permission to undertake the study on school premises with specific staff, also outlining confidentiality arrangements, study

information and the research schedule. The research participants were approached to take part in the study by a mutually known individual who had no direct involvement with the study.

The current study upheld the Massey University's Code of Ethical Conduct for Research, Teaching and Evaluations involving Human Participants providing ethical principles to be aware of and instruct the design, commencement, participation, and reporting of this case study. In addition, full ethics was applied for and granted after review from Massey University Human Ethics Committee (Massey University, 2015).

Written consent was obtained from all the participants, including school leadership and the Board of Trustees (see appendices). Permission to conduct the study on the school premises, with the staff, and a research information sheet was provided to the Board Trustees (see appendices). Providing the board with a research focus and the transparent dissemination of intentions, timelines, impact, and potential disruption to the staff and school. Provisions made meant reports were submitted throughout the research project culminating with handing all information and findings resulting from the project (Lodico, Spaulding & Voegtle, 2010). Research participants, including school leadership, were also provided research information and participation agreement (see appendices) for consideration before deciding on their part, if any, within the study.

Essential ethical standards that were strictly adhered to were informed consent, confidentiality, doing no harm, sensitivity, and honesty always maintained. This included the need to discuss what effect the study may have on individual teachers'

practice and self-efficacy or any potential impact on teacher collaboration and future professional learning development.

The nature of this study did provide some ethical challenges that require explicit acknowledgement and understanding for the participants and the researcher to uphold the reliability and authenticity of data, findings, discussions, and conclusions that arise. The primary role of the individual completing this study is as a student and as a researcher to fulfil their Master's in Education degree. However, this student has held a position as a facilitator supporting the school with their mathematics professional learning and is now a member of the teaching staff at the school. With the tight-knit, supportive whānau environment, trusting relationships with key participants were naturally fostered. Clear lines were drawn when stepping between the different worlds as a colleague, and as a researcher. (Johnson & Christensen, 2000; Lodico, Spaulding, & Voegtler 2010). Conscious attention was given to the potential biases and opinions the researcher could hold, allowing for thoughtful examination and reflection to maintain objectivity. Thus, ensuring the reliability and validity that this research project is carried out ethically.

Chapter Four - Findings

The previous chapter detailed the research design and methods used in this study. The collective openness of group talanoa provided narratives that formed a collaborative vibrance and detailed richness within responses. This chapter brings together experiences and expectations born from a shared past, a courageous present, and a hope filled future. Themes and sub-themes were identified through thematic analysis to form the findings based on the study's research question:

How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Traditional Pāsifika knowledge sharing is enacted through oral storytelling, the setting of the scene, the main characters, perseverance, wayfinding, course corrections, and the lessons we can take from bravery, selflessness, humility and alofa* whilst on this journey (Hanly & Lemon, 2015; Mila, 2019). Although this story will be told through the written findings and discussions in an academic thesis, the storytelling traditions are maintained. With the researcher being a known face, understanding the Vā and through talanoa fono the themes arose and unfolded organically to tell the story that formed this study's findings.

In keeping with the fa'afaletui methodology, the findings are presented in sections based on the varying views within fa'afaletui. Woven into all the sections and between them are the experiences prior to and during the in-service professional learning (ISPL) that gave rise to individual and collective challenges, disorientation, epiphanies,

and pedagogical growth that the findings reveal. Section 4.1 presents the findings through Fa 'a, ways of: 'the way' from a distance, a view from the mountain surveying the vast ocean expanse, observing, learning of and from the varying journeys taken by the participants in their own mathematical education. Section 4.2 takes place in the fale, the house's: the view from the roof of the fale or in this study's case from the view from the beach preparing for and contemplating the voyage through the participants initial or previous experiences with teaching mathematics. Section 4.3 tui, lashing together: is the view on the va'a experiencing the 'waves and currents' for those directly engaged in mathematics teaching whilst immersed within the professional learning and what it meant to their mathematical pedagogy moving forward.

4.1 Fa'a the View from the Mountain Top: Experiences Learning Mathematics

Society's educational hierarchy places mathematical ability at the top of the educational pyramid of importance (Pais, 2014, 2015; Pais & Costa, 2020; Pais & Valero, 2012). With the adoption of Western educational philosophies into Pāsifika society both in the islands and in Aotearoa, the high value placed on mathematics has become entrenched in the foundations of religious, cultural, and family expectations for educational success. Embeddedness was described often in talanoa and illustrated an undercurrent between culture and education that generated waves and tricky winds the participants had to adapt to in order to get through their schooling.

The epicentre of Pāsifika culture is family and community. Church plays a role in both these facets in varying capacities such as praise and worship, Sunday school, youth groups, charities, condolences, and celebrations. To set the context of this section and its findings it is important to understand the scale of mathematics influence. It was

evident from responses that there was no respite even on Sundays. Here one of the young guns recalls having math lessons in Sunday school; “It was something we were doing in Sunday school and now that I’m thinking about it, why on earth are you sitting singing one plus one is?” (YG3). Evident in the following vignette one of the aunties recalls as the daughter of a church minister having the added pressures of needing “to learn the timetables when we were like seven years old, because my father was a pastor” (A2). Even within their faith the mathematics murmur was present, and this influence had a trickledown effect in family and community. This is clear with the following exchange between the young guns as they grapple with the way their families and community clung to the construct of mathematical ability:

So, there is something built into the way our families think, yeah? (YG3).

Yeah, in what they view, like you’re smart if you’re able to do this (YG2).

Yo, my parents can go out and tell the other parents at church that they have a child that’s good at math (YG1).

Like that’s what we were fed our whole lives, and you don’t realise like how much that impacts you (YG3).

The sharing of experiences allowed the participants to identify and connect the juxtaposition of cultural values and the value their cultures give mathematics. The message is present at home, in church, in school and recycled into adulthood. This belief has become normalised within their cultures and only through recalling and reflecting on this within talanoa identifying “that’s what we were fed our whole lives” (YG3) do the participants gain an insight that their own experiences were not the exception in this case, but rather the norm.

Stories from their family naturally flowed into experiences during their own schooling. The gestures, intonation, and humor were palpable across talanoa fono. The following exchange recalls a discussion whereby other learning areas of interest are positioned as an adjunct to the seriousness and status mathematics holds. Again, illustrating how mathematics has been appropriated within the schema of Pāsifika educational success:

I've got like one certificate from Auckland Girls for math like endorsed with merit not even excellence. Anyways, um when I was close to like finishing high school and my dad's like "go and study math!" (YG1).

Hahahhahahahahahahah (YG2 & YG3).

I said to him, I want to audition for drama school and he's like "study math and drama" WHAT! (YG1).

That's a lethal combination (YG3).

And I am like nooooo! Typical Tongan mindset. You have to do math because you will become successful (YG1).

The nuanced agreement mitigated through the humorous quip from YG3 about the "lethal combination" illustrates the opposing values placed on these two subjects. The response of YG1 of "typical Tongan mindset" further reinforces how deeply rooted this is in her own culture and that this is a shared experience across their homes and cultures with the other young guns laughing profusely after her statement.

As the navigation undertaken moved from their families to schooling for the participants many examples of structural biases were shared which seem to chip away

at their self-efficacy. The required actions to negotiate or negate these conditions was an arising theme as described:

I actually struggled socially with it because as you went up to 5th form, 6th form, 7th form there were no brown kids taking math and so I kind of put myself in the dumb seat actually (T2).

The institutional arrangement of schooling had a significant and long-lasting impact on T2. These arrangements were also identified by other participants as one of the young guns states, “it might have been a bit of everything, but it’s exacerbated by the schooling system” reinforcing how high school arrangements projected deficit views of Pāsifika students’ ability in mathematics. This was a lived and realised reality for them; “everyone knew they were like the smart kids and there were like three brown kids in those classes, right and everyone knew them because they were like the three brown kids that didn’t hang around with us” (YG3). For the aunties, these arrangements were also noticed with “the palagis* were at the front” (A1) when it came to seating within their mathematics classrooms.

Although there is a generational gap with the teaching the aunties and young guns received when they were in high school, the talanoa made apparent that these arrangements impacted the teaching participants in the same way. For one of the aunties, where she sat in the classroom was a deliberate strategy to not have to engage with learning as recalled; “I was never naughty, but I would always find a way to sit at the back. But I think the wall was kind of my safe place” (A1). This “safe place”

was described by others with their positioning in the class as a strategy to avoid questioning in order to negotiate the class and teacher:

We used to always sit at the back of the class. We would be talking and then when asked a question we would not answer or whenever there was a question to be answered of us, we would all look down. Yeah, we did not want to be chosen (A4).

Yeah, please do not pick me! (A1).

For the young guns, their experiences with institutional arrangements were clearly impacted by the practice of ability streaming. This was the overt practice of placing students, in this circumstance mathematics learners, based on preconceived ability through standardized testing into classes with students of similar ability:

You know and as soon as you get there you do not even have to know anything about streaming. It impacts especially your attitude towards schooling, coz we are just making up the numbers. Like I really wanted to enjoy it, but my perspective had been shaped in that math was almost something that did not belong to me (YG3).

I love that you say that that phrase of a growing-up that it did not belong to us. It is so true, you were just so disconnected from it, and it is a goal, it is a thing that you have to try and reach for (YG1).

This excerpt illustrates the greater distance as learners they needed to travel in order to have some sort of place in the mathematics classroom. Although this talanoa and the previous responses were centered around mathematics education, the scope of

the data does not clearly define whether this engagement and the reactions of the participants were solely attributed to institutional arrangements for mathematics or could have also been the situational circumstance for them across all learning.

Another theme arising from the data when unpacking participants mathematical learning was their experiences and perceptions on innate ability in mathematics. The following comments indicate how this perception can sit in the subconscious and potentially pedagogical actions. One young gun describes ability in mathematics in terms of a “miracle that fell from the sky, blessed by the hand of God” and “something that we don’t have or it’s something that is scarce” (YG2). Another young gun adds on with “no-no questions asked you are one of the elites now sir (waving gesture) come through” (YG3). In the aunties’ talanoa God was attributed with the “math DNA he has put in there” and is “wired into the brain” (A3).

Descriptors used such as “miracle,” “blessed,” “elites,” “scarce” and “DNA” clearly illustrate beliefs that the participants need to negotiate in their mathematical pedagogy as the ISPL unfolds.

This view was from the mountain with the participants looking back on their past experiences from the present providing insight into the varying mathematical histories that colours and influences the participants' attitudes and engagement towards their own teaching and the professional learning in mathematics. The responses from both the aunties and the young guns indicate similar experiences and consequences. This talanoa meant descriptions were detailed and allowed for greater insight into their personal and shared experiences with mathematics.

The initial experiences recounted in talanoa were stormy. From the mountain top this could severely compromise them moving to the beach or even to be willing to step into the va'a. Dwelling in the view from afar allowed participants to establish solidarity in such a way that they could and did move onto the beach and closer to the va'a. Relational trust and familiarity allowed them to be vulnerable, to feel disorientated, perplexed, sad and happy at times. But they also have hope, resilience, determination, and a willingness to paddle through each wave and battle the undercurrents of their experiences to harness the optimal conditions for their learning journey.

4.2 Fale the Houses or on the Beach: Experiences with Teaching Mathematics

Teaching mathematics was not a part of pre-service teacher training for the young guns or a subject they ever intended teaching. The aunties' teaching journey meant exposure and experience over time to varying iterations of curriculum, best practice and professional learning developments within general curriculum and teaching pedagogy. It is important to highlight that as with the young guns, the aunties did not train as subject specialists in math. The findings in section 4.2 look into the ISPL journey from the roof of the fale or in the case of this study from the beach preparing to step onto the va'a. This view investigates grappling with teaching high school mathematics whilst at the same time undertaking ISPL. The themes arising centered around internal conflicts, anxieties, and frustrations that are confronted in order to disrupt the very narrative that led to the entanglements these teachers are now negotiating.

This section's findings start with the young guns describing the tension and the façade they felt they put on when they started teaching mathematics. Firstly, through

acknowledgement of limited mathematical confidence, pressure from always having to be right and have all the answers. Here one of the young guns vividly shares his thoughts around this:

Coz when you walk into the class and you say good morning class, you have this thing. I am the teacher, test me, ask me anything and I will give you the answer or I'll say, I'll get right back to you, but I'm looking cool the whole time. The moment they see me go hah? I am thinking shit, shit, shit, shit, shit, shit! Losing it scares me! It's almost like they have a rope that's tied to your respect, and they are like "hoooo" (pulling motion) got you! (YG2).

This anxiety with teaching mathematics was also expressed by the other young guns; "it was like do not worry, no pressure, but no there is" (YG3) and "I'm a baby when it comes to this" (YG1). The persona of 'the teacher having all the answers' is a long-held assumption that those who have been schooled tend to project onto teachers. Also, teachers themselves believe they must live up to this. Now, especially as a math teacher, that fear of not having all the answers or even being wrong is the tight rope these teachers felt they were walking every lesson.

Moving from the teacher's disposition to the disposition of their students towards mathematics. This was another layer that needed to be unraveled in order to support student engagement and in that increase the confidence and comfortability when teaching mathematics. Descriptions in the following excerpt detail the teacher's awareness of their student's dislike of mathematics lessons.

I could see it in the kids that were coming in. I could see without even saying anything, I could see without even seeing the lesson, I could see what they were thinking. 'Frick I'm back here, I hate this place, I suck at this um, and I don't want to be here' (YG2).

Man, I feel just so sad for them, just in terms of they seem so disconnected from the work and the beauty that math's can bring (YG1).

Whilst stepping into the role of teaching mathematics and believing in themselves, a similar challenge confronts them with growing this belief in their own students in mathematics lessons. It would mean less work and require the investment of a lot less emotional energy to maintain the status quo. This highlights another challenge to be negotiated in their teaching and in their professional learning.

The pressures of curriculum coverage are the expectation that teachers will cover certain amount of mathematical content within an academic year. The impact means time spent within each concept, the depth in which it is taught and the theoretical connection to contextual realities can be limited. These pressures mean teachers feel the quality of their teaching is compromised with having to drop the cognitive rigor in order to meet these time pressures. These pressures and the actions forced by this reality were regrettably described; "I felt stink for the kids, like I'm gonna teach you the bare minimum right now. That I wasn't teaching in-depth math, or enough for them to know enough" (YG1). Having to push through content meant the teachers had no time to allow all students to develop their understanding as "teaching was rushed. I had to prompt the kids or not really prompt them; I just tell them" (A2). Skimming through content meant concepts were learnt in isolation "I was like timetables worksheets,

here's your warmup. You know I was smashing those worksheets out" (YG3). The frustration around these pressures and the ill logic was stated using a coaching comparison; "it's straight up like someone coming to your school and teaching you how to pass the ball. You're going to pass the ball back and forth blah blah blah and never teaching them what a game of rugby is" (YG2).

4.3 Tui Lashing Together: Astute Noticing, a Willingness to Engage and Enact New Learning in Practice.

With the professional learning undertaken by the participants, there were two primary facilitators (one of the facilitators was the author of this thesis), who co-constructed the professional learning with the teachers. This provided reassurance for the participants with familiarity and earning mutual respect. For the facilitator it meant a nuanced understanding could be developed through a consistent and genuine attempt to know their story. Relationships form the foundation for meaningful engagement in any human endeavor including professional learning. One of the young guns described this importance for them; "there's something also in the relationship with the mentor, because I know it felt a lot more comfortable, a lot more comfortable with our mentor. I had to trust; I can trust Kawhi²" (YG3). Being familiar to everyone meant they were comfortable to share their true feelings in talanoa; "I would always get afraid that the students would sit there and think my teacher is dumb, she's being taught by another teacher" (YG1). Professional learning's primary design is to share or impart certain strategies, knowledge or understanding in order to address pedagogical gaps or blind spots to improve student progress and attainment.

²pseudonym for mathematics facilitator

These comments emphasize the humanistic considerations and allowance for the growth of soft skills, which go hand in hand with theoretical development in professional learning and also indigenous educational research.

Stepping onto the va'a meant you had to back your instincts and set your own course. A key connection was made and described across each talanoa fono with the realisation and validation in their own funds of knowledge. The discussions around this validation centered on a sense of belonging and pride. Seeing and giving themselves permission to be in the learning.

An example of the understanding and valuing these soft skills follows:

It was everywhere, the poles of the house, it's everywhere but it was the numbers, it's the symbols, it's the numbers that we were worried about not the everyday things (A2).

The realising and legitimising of their culture's lineage with traditions of high-level mathematics morphed into sinew that connected what they knew with what and how they were learning in the professional learning space, building momentum and teacher buy in pedagogical actions espoused in ISPL:

It was cool and felt natural and I was fresh and trying to teach. That that it is just as much ours, math is math and has been a part of our lives and culture for thousands of years. It was just that it was never shown to you, it was never put into your worldview (YG3).

Interactions during professional learning provided reassurance. This activated cultural intuitions and instincts that lay dormant needing permission to be awakened to replace the prescribed ones:

That was so mean³ the first time I saw a full problem being solved. Okay I'm gonna hear from group one and you are okay up to here. Then we are going to get group number two to add on. I was like oh jeepers, like the whole class we got to the end together. This child's one-liner eventually added to the pile that we have here, and the students will look at me and be like nailed it!
(YG3).

This excerpt recalls the first time a whole lesson came together from professional learning in its entirety for one of the young guns. The teacher realisation, “oh jeepers” and the contributions from various students “this child’s one-liner” that was added “to the pile we have here” meaning “we all got to the end together” and “nailed it!” Seeing the big picture of what was being unpacked in professional learning moving from abstract wonderings into tangible concrete examples. Seeing is believing, having, and making the time to reflect on, share and celebrate victories together during ISPL allows everyone to bounce off the collective energy. This begins to change the filters for what teaching and learning could look like in mathematics. The following discussion between the teachers is an example of this shift:

But do you know what the conversation is in my mind? It's bad, it's wrong.

The conversation that goes on in my mind is just don't care for a little bit just

³Aotearoa slang saying meaning amazing or awesome

stop worrying and just like have fun and enjoy the learning. Like don't care about the outcome. But the reality is let go of the outcome and create an experience (YG2).

Because the experience is the outcome. I know the answer and what I have to teach was, I had to teach the importance of the experience or the talanoa that comes out of that (YG1).

This passage demonstrates the complex considerations ISPL faces and must be geared towards. Learning is never pieced together seamlessly. This professional learning challenged contemporary mathematical pedagogy and led the participants to a crossroad. At that point it forced the teachers to either maintain the status quo or disrupt the very system which had also locked the teachers out of any valued place with their mathematics learning. You would think this would be a given, however ISPL experiences are never a linear but a multivariate experience.

The pivoting point in the closing section of the findings chapter fittingly came from doing what is best for their students. The relentless pursuit of improvement was modeled with the leader of learnings commitment. The tip of the paddle, first dipped into the water upon commencement of a professional learning journey was by this senior teacher. The example set by leadership through visible engagement and a nuanced understanding of the ISPL set the tone. The leadership's role was described often in talanoa with the following passage summing up what this looked like and meant to the teachers:

She is such an open learner. Coming down to the leadership of the leader you know? She kept that really wide and open, she uses herself as the student, she put herself in the student seat and she was just humble. That practice, she modelled it. It's holistic, not just that data (T1).

The example set above fostered the resilience to be comfortable with being uncomfortable. The ecosystem in which this study was conducted was that of a family. With family, your duty is to put others or the greater good ahead of yourself in service. The following excerpts are examples of the conscious shifts and actions that were taken by teachers to support one another and collaborate in order embed the professional learning:

That's the thing with teaching and isolation. Isolation from everyone else because we could be off doing our own thing; God knows what we're doing in our own rooms? (YG3).

I think, like having these two guys were like my safeguard in terms of like when I have anxieties about what I was teaching (YG1).

That's sharing and that's collaboration (YG3).

To not only learn, but more importantly challenge held views in pedagogy and be willing to unlearn these:

We are not set in anything. It is about us and unlearning our own experiences. So, if you think about how far we've come all of that has just been us

overcoming ourselves. So, if there's a teacher that has been teaching for like eight years, nine years, ten years plus. They have to unlearn all of that and then get over themselves (YG3).

To be genuine and consistent, trusting the learning and trusting the process:

Because even in that, if I'm just giving a problem to my kids and I say discuss. The kids can see you don't care and don't believe in what you are doing. I don't think you ever would be able to achieve the level of engagement that we have been able to achieve with our students, particularly in this subject (YG3).

This was the unlearning of certain facets of pedagogy, the merging of others while making connections to new learning. This requires a huge amount of faith and courage to be willing to step from terra-firma to the uncertainties and risk that exploration always presents.

Ultimately, the genesis of undertaking ISPL was to improve learning outcomes in mathematics for their students. The following statements define the empathy, motivation, and continued level of commitment towards this:

I personally turned off math and feel for kids that have to sit through it and don't get it like I did, and so, I am passionate about them not coming out of any classes feeling dumb (T2).

I just don't want my students ever walking away from my class thinking, okay that's their knowledge, that's not mine (YG3).

If you're not prepared to be sucked dry or sakimoto⁴, you're not going to make it. You're not going to make a difference. So, you have to ask that question of yourself. Are you prepared to give of yourself? (A4).

An ethic of caring always led the teachers back to the conditions they themselves negotiated and navigated when learning mathematics and this was the motivating factor to impact positive pedagogical change.

⁴Aotearoa slang for draining or sucking all of your energy out of you.

Chapter Five - Discussion

This study was undertaken to illustrate and better understand the experiences teachers take with them into teaching mathematics, while simultaneously storying engagement with in-service professional learning (ISPL) in mathematics. The fertile ground in which this study took place meant it organically evolved beyond surface level analytics. Rich and open talanoa presented the pleasant challenge of what to leave out. The findings went deep, and three key themes were dug up that are discussed in this chapter.

The previous chapter analysed the data collected over the course of the study to form the findings. The collective responses from this study indicated three key themes. The first theme in section 5.1 discusses the value of mathematics in society. This finding places its value not in betterment to society, but rather what it provides for the quality of life for an individual. This section confirms and adds to existing research with specific reference within this study's findings around mathematics reach beyond the classroom into pivotal cultural institutions of family and church for Pāsifika. Section 5.2 discusses the systemic design of 'school mathematics' and its tradition as a 'gatekeeper' which influences pedagogy and subsequent design of and engagement with professional learning. In this study's case, examining how institutional and curriculum traditions with mathematics acted as impediments for the participants as Pāsifika learners and teachers of mathematics. Section 5.2.1 discusses these institutional and curriculum arrangements in relation to when the participants were learners of mathematics themselves. Section 5.2.2 discusses the influence and impact of these arrangements on the participants' teaching of mathematics. Finally, Section

5.3 positions people at the centre of the endeavour. With mathematics learning, teaching, and professional growth the human condition is often not factored into the equation when designing or revising curriculum and informing ISPL. This section highlights and emphasises the importance of further educational research into identifying and understanding these complexities to support a broadening of professional learning for mathematics.

5.1 Input, Relationship, Output; Mathematics as a Function

Historically mathematics has held the top rank when determining one's level of intellect in education and therefore in society. Besides status, 'ability or inability in mathematics' has a significant impact on important socio-economic factors such as higher education, career choice, income status and even life expectancy (Martin, 2019; Wilson, 2014; Zacharopoulos, Sella, & Cohen Kadosh, 2021). With mathematics direct influence on 'quality of life' it was not surprising in the current study's context that this social construct was maintained. What was interesting within this finding was the extended influence of mathematics into culture, religion, and family. Throughout talanoa the participants recounted multiple situations and instances outside of their schooling whereby the value of mathematics was impressed upon them. The extent of this saturation and subsequent perceptions is vividly illustrated in these comments; "god has got that math DNA and he has put it in there" (A3) and individuals being "blessed by the hand of God" (YG2). These comments suggest how ability in mathematics can bring you closer to God. Numerous other accounts with reference to church, community and family were unpacked during talanoa, including descriptions of Sunday school lessons infused with mathematical content. Religion, praise, and worship are integral to who the participants in this study are and how they move

through the world. Camouflaged under the auspice of a higher power helped to insert mathematics value into their cultural framework. To learn mathematics for the soul purpose of realising its beauty and connection to the world around us is a utopian fallacy. Or for its touted contribution to the development of an individual's reasoning ability. Mathematics' real value is measured in the financial and economic opportunities and stability it can provide (Skovsmose & Valero, 2008; Wolfmeyer, 2017).

In general, therefore, this value and its influence has been and continues to be awkwardly wedged in the participants' cultural framework as a 'necessary evil' inadvertently influencing practices counterintuitive to the fundamental Pāsifika values of belonging, reciprocity, relationships, and inclusion. Stinson, (2004, p. 13) defines this wedge as the "situated perspective" one of the three domains of empowering mathematics coined by Ernest (2002). Stinson (2013) describes the "coupling of scholarship from cultural anthropology and cultural psychology" emphasising that there are "interactive systems that are larger in scope than the behavioural and cognitive processes of the individual" (p. 13.). This illustrating that despite one's own perceptions and positioning in this case around mathematics, larger schemes of influence and instruction surround them.

This finding details how this value is not only situated in education but also situated within cultural arrangements encircling them. Cobb & Hodge (2002) state that "diversity is located at the nexus of students' lives in classrooms and their participation in the practices of both broader communities in wider society and of the local home community" (p. 277). From talanoa, there was a correlation with this description in

relation to the participants as students, as teachers and then learners themselves with the ISPL. The chance to identify, unpack and realise that many of their challenges were in fact due to the deliberate design of mathematics as a function had a liberating effect on the teachers with the realisation; “that’s what we were fed our whole lives” (YG3).

5.2 Institutional and Curriculum Arrangements

The next theme arising in this discussion centres around the institutional and curriculum arrangements experienced within mathematics education particular to this study that align to mathematics’ role as a ‘gatekeeper.’ Many scholars hold the view that mathematics serves as a barrier through marginalising certain sections of society and unduly granting privilege to others (Abraham & Bibby, 1988; Bartell & Johnson, 2013; Bryk & Treisman, 2010; Cobb & Hodge, 2002; Douglas & Attewell, 2017; Gutstein, 2016; Martin, 2019; Martin et al., 2010; Nasir, 2002; Ryan et al., 2021; Stanic, 1986; Stinson, 2004). Depending on the educational context and histories of instruction within a school, these measures impact or influence teacher pedagogy, student engagement and attainment to varying degrees. For this study’s context and from talanoa, these arrangements adversely influenced the teachers in some way when they themselves were learning mathematics and their teaching of mathematics.

5.2.1 When Learning Mathematics

During talanoa the participants recalled how certain arrangements had a negative influence on their self-efficacy learning mathematics. There are several explanations for how this negative disposition developed that were identified from talanoa. From their experiences with learning mathematics, a predisposed internalised oppression seemed to form towards not only their own but also the large majority of their Pāsifika

peers' ability to belong and flourish in a mathematics classroom. This belief was vividly captured in this powerful excerpt from the findings chapter "there were no brown kids taking math and so I kind of put myself in the dumb seat" (T2). This rhetoric was unanimous amongst the study group. A probable cause for this belief was the exclusionary design of school mathematics. With the aunts the institutional arrangements maintaining social class structure were visible in the seating arrangements described within their math classes with the "palagi" students always sitting at the front of the class.

For the young guns it was the overt arrangement of ability grouping they experienced. This is the practice of placing students into classes based on their perceived competence in mathematics, typically through results from standardised testing. The rationale behind this practice is for classes to be made up of students with 'similar ability' whereby the teacher can better cater for their current learning needs. The reality of this in most instances and was the case for the younger participants was with the higher banded classes noticeably having very few Pāsifika or Māori students in them; "there were like three brown kids in those classes" (YG3). Crespo and Featherstone (2012), Gorski (2008), and Karunakaran (2020) posit that systemic conditions such as this continue to undermine self-concept, perpetuating inequity, maintaining stereotypes, and therefore excluding but a select few from minority cultures into these classes.

Alongside class structuring, historically pedagogical approaches have also acted as impediments reflecting Eurocentric values that preserve race and class hierarchies (Martin, 2019). Mathematical instruction has traditionally been associated with a focus

on skill, drill, and memorisation of formulae that has had a limited relationship to real life application outside the sphere of the classroom theory (Boaler, 2000). Although these practices are not espoused in the New Zealand Curriculum. This practice was described by the aunties and a residue of this teaching and learning remained for the young guns in their learning. The experiences they described being not far removed from National Certificate of Educational Achievement (NCEA) detail struggles with learning primarily designed to memorise certain equations and formula for the purpose of accumulating achievement credits to complete each national certificate.

With the teachers as students, in this study's case as Pāsifika learners they described how pedagogical design made it hard to connect to and see the relevance of content to their lived realities and real-world application. The lack of relevance was described in talanoa and lamented as; "it was everywhere, the poles of the house, it's everywhere but it was the numbers, it's the symbols, it's the numbers that we were worried about not the everyday things" (A2). The discussion and body language within talanoa around the inability to understand abstract ideas taught in mathematics led to the assumption that the problem landed with them rather than with the pedagogy. Just as with ability streaming, this barrier was hidden in plain sight. However, blame for failure continues to fall at the feet of learners, families, teachers, and communities rather than with the deliberate mechanisms in pedagogy design remaining to purposely exclude (Eisner 2000, 2005; Mason, 2018; , 2015; Pia, 2015; Timperley et al., 2007).

Mathematics in relation to this study has been described and discussed in terms of a currency used to gain a better economic quality of life. Also, in terms of the lack of contextualisation in learning. The final part of this section discusses cultural relevance in mathematics learning. In the findings the participants spoke of a feeling of not

belonging when learning mathematics and it not belonging to them. These feelings stemmed from the lack of opportunity to see their culture valued and part of the learning compounding their struggle to see mathematics as meaningful. The infusion of culture into pedagogical design specifically indigenous or minority cultures is known as culturally sustaining pedagogy (CSP) or culturally responsive pedagogy (CRP). This ideal is not a new concept amongst educationalists (e.g., Cazden & Leggett, 1976; Dean, 1989; Hymes, 1976; Wilburne, Marinak, & Strickland., 2011) and for those from the outside of teaching looking in, this would seem like a logical component of existing pedagogy. However, the complexities of histories with traditional structures in the mathematics curriculum and pedagogy already described tend to stifle any meaningful attempts to enact this approach. Eisner (1998, 2005) & Timperley et al., (2007) reinforce the fact that comfort, security, power, and pride can circumvent any adjustments to practice that could support and increase participation and progress in mathematics teaching and learning.

5.2.2 When Teaching Mathematics

Through talanoa, when teaching mathematics and during the professional learning journey the teachers encountered both individual and group challenges. Each of these challenges presented themselves with differing levels of challenge depending on the individual's personal and professional realities. These realities gave rise to various forms of what can be described as mathematical anxiety. Mathematical anxiety is often oversimplified as a fear of solving problems, however various researchers (e.g., Ashcraft, 2019; Herts et al., 2019; Mutlu, 2019; Szczygiel, 2020) assert that social, cultural, and psychological factors also play a part in the formation of this anxiety. In this case for teaching, the mathematical content that was typically expected to be

covered through years nine and ten was perceived as substantial by the participants. The teachers expressed that these external influences challenged their integrity as they felt the quality and depth of their teaching was compromised and diluted with a pressure to cover everything.

Responses from talanoa describing the rush to get through content meant at times the participants would just give the answers to move on to the next concept. Lessons punctuated by students completing worksheets were described as a tick box exercise to be able to cover content. The impact of this meant the participants; “felt stink for the kids, like I’m gonna teach you the bare minimum right now’(YG1). A litany of researchers (e.g., Eisner, 2000; Mason, 2018; Pia, 2015; Young-Loveridge, 2010; Skemp, 1976) have identified and articulated that educators are up against a system whereby compartmentalised and piecemeal assembly ensure the continued reproduction of shallow pedagogy and the overproduction of mathematically disillusioned teachers and learners.

The cultural and social ethos intertwined into the fabric of this learning community meant this circumstance weighed very heavily on the consciences of the teachers. The feeling of being powerless and helpless and in a way expressing regret, and remorse. Anxiety was apparent with these Pāsifika teachers feeling weaponised to exact the same realities of alienation and disenfranchisement on their students that they also experienced due to the institutional and curriculum confinements maintained within mathematical instruction. For the teachers in this study, it was evident that even with the professional learning impetus being CSP in mathematics for these teachers

there was still unease and an extra layer of permission needed in order to be themselves and teach in a way that that feels natural and free.

A case can be made for not only Pāsifika but other minority learners and teachers experiencing similar circumstance when inserted into Westernised compulsory schooling. Although aware of how they should engage and vehemently wanting to teach, in effect their hands are tied. Shackled by the constraints of a matrix for determining competence that has remained primarily unchanged.

5.3 Humanising Mathematics

The humanising of mathematics education including professional learning for teachers was a prominent theme in talanoa. What was meant by this, is the need for the learner in this case the teachers in ISPL to be positioned as the central consideration in mathematics education including the professional learning undertaken by the teachers as adult learners. In mathematics education research, human shortcomings have often been described, scrutinised, and criticised, but rarely mobilised to the same extent as ISPL has tended to focus primarily on content knowledge, procedure, and resourcing within instruction. The findings from this study illustrate and suggest the need for greater focus on these facets within ISPL design and educational research.

The previous two sections detailed experiences that the teachers carried with them into the professional development as a part of their own mathematical learning journeys and then as they began teaching mathematics. These were only but a few considerations garnered from talanoa through thematic analysis. Of course, outside this study there are more factors that can be unpacked. These would inform the makeup and what ISPL in mathematics ideally should be geared towards. The intended outcome of ISPL in teaching is to positively impact the participation, progress,

and attainment of the participants learners. The second, is to become embedded in pedagogy, adding to a teacher's repertoire of tools, whilst also complementing and sharpening existing tools (Hill, 2009; Timperley et al., 2007). In the next section the discussion orbits around the intentionality of the participants' during ISPL and an ethic of caring that used alofa* as the ultimate intelligence.

All talanoa in this study when stripped down to their essence emphasised the essential consideration for others and to serve that drove the teachers to accept the challenge of teaching mathematics. This fostered an environment for everyone including those facilitating the professional learning to simply 'have each other's backs.' This meant making the effort to be aware of and bounce off one another's strengths and having a soft touch to cushion everyone's frailties.

The previous sections in this chapter have detailed how contested the mathematics space was for the teachers. Through maintaining the Vā and openly working through entanglements transparent and honest dialogue was able to be upheld. Collaborative flat management meant they became 'safeguards' for one another and able to develop trust in the facilitators as they co-constructed their professional learning. Achinstein (2002) insists an awareness of the formal and informal power relations that exist for participants and a consistent revisiting of this or with this study the clearing the Vā instills collective action. To be open to learning and willing to be vulnerable; "I would always get afraid that the students would sit there and think my teacher is dumb" (YG1). Lee (2005) states that teachers need to expect or be supported to be aware that these feelings are not unusual and that a community of practice helps to cushion this. Artman et al. (2020) and Wenger(1999, 2010) contend that a community that shares a commitment and responsibility for one another's success fosters a profound

development of practice. This was not a race to the finish line, but participants were agile, able to pivot and change direction when they or others required them to do so as illustrated with the fact; “we are not set in anything. It is about us and unlearning our own experiences” (YG3).

Mezirow’s (1993) framework for adult learning identifies that disorientation or an epiphany precede transformative learning. A timeline or trajectory is often aligned with professional learning that cannot be calibrated as each learning situation is unique. Time must be given to see the bigger picture and facilitators must be aware this happens only when the learner or in this case the teacher has a dilemma or an epiphany; “like don’t care about the outcome.... let go of the outcome, and create an experience” (YG2), “because the experience is the outcome” (YG1). Argyris (2004, p. 10) states that “asking human beings to alter their theory-in-use is asking them to question the foundation of their sense of competence and self-confidence.” The engagement in ISPL was not seen as a ‘quick fix’ or ‘silver bullet,’ but a conscious and arduous step forward. Ultimately, for this study, it is in the asking not in telling. This is inviting teachers to be a part of the journey instead of merely forcing them to do so. As illustrated through this study, ISPL is simply not a ‘plug and play installation.’ The complexity, intangibles, disorientation, sacrifice, and epiphanies are part of the voyage, must be unpacked for professional learning to move beyond teachers contributing an economy of effort or metaphorically out lasting the professional learning storm. The design of the ISPL must involve this to get authentic buy in and commitment such as this declaring that; “if you’re not prepared to be sucked dry or sakimoto, you’re not going to make it. You’re not going to make a difference” (A4).

Chapter Six - Conclusion

The previous chapter presented the discussion in relation to the study's findings. This chapter concludes by reviewing the main findings in relation to the study's research question:

How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

With this question in mind three key themes emerged from the group talanoa fono. The first theme discussed how the participants saw the value of mathematics was not in its contribution to society and humanity but rather with it means towards providing a better quality of life for the individual. This included the mechanism of mathematics as a gatekeeper and the privilege it affords to those from the dominant hegemony. The second theme which surfaced detailed the institutional and curriculum arrangements within mathematics education that meant the participants struggled to learn mathematics themselves and added to their struggles when teaching mathematics. The third theme, orbited around the human condition and endeavour in the mathematical teaching and learning space. Specifically, how this needs to be more prominently positioned as a key consideration in the evolution of pedagogy and professional learning.

Section 6.1 summarises the implications and recommendations for in-service professional learning (ISPL) from this study. Limitations of the study are addressed in section 6.2. Section 6.3 outlines opportunities for further research. Finally, section 6.4 will be the concluding thoughts.

6.1 Implications and Recommendations for ISPL

This study illustrated how the intangibles really matter. In this study's case for Pāsifika teachers one intangible was their individual experiences with learning mathematics within their cultural frame and mainstream schooling. This had a negative influence on their own mathematical disposition that needed to be addressed. Being trained teachers did not mean that these fears and traumas went away, but rather had the potential to be magnified. The way this was addressed along with the other intangibles was primarily through the Pāsifika practice of maintaining of Vā. The awareness of the space between them. These spaces being mathematics, school, learning, teaching and between one another. This did not mute the challenges they were facing but provided a collective umbrella that provided support, trust, collaboration, awareness, humour and alofa. An awareness and consideration for the human condition and an understanding that everyone brings their own experiences with them into teaching and learning. The implication for professional learning is to be intentional and deliberate with its engagement. Having a clear understanding of what is being unpacked and making sure everyone involved also knows this.

This entails an integrated approach focusing on people as much as progress. This requires the identification of processes and actions deliberately aimed at supporting the teachers from where 'they' are, both as an individual and within the collective perspective. For Pāsifika teachers in this study, it was the ability to share their stories and find common ground with where they had come from, where they are and where they were heading together. The maintaining of one's independent and collective mana along this journey supersedes any data, results, or accolades for Pāsifika. This must remain at the forefront of engagement for not only Pāsifika teachers in ISPL but Pāsifika learners in general.

A focus on where they initially come from, as they begin, and throughout their professional learning journey. Yes, this increases the complexity, but it also offers the opportunity from the outset to talanoa and begin to understand what is on top and moving from there. With this, ISPL design may have to consider the recalibration of its duration and how it measures the effectiveness of its programme. This study presented a mere snapshot of the ongoing evolution of the participants' pedagogy. ISPL should be designed to reach clearly defined landmarks with co-construction and a timeline specific to each individual's trajectory. Learning is not linear and having the autonomy to negotiate this maintains mana but also allows all to progress as they need.

The evidence presented from this study suggests that the intangibles which cannot be measured should not be expected to be measured. Providers do not determine the make-up of staff they engage with or the dynamics within them. Each learning community or situation means a new context, histories, and personalities. Regardless, ISPL needs to be prepared with practitioners' and meta-practices that support the formation of understandings about a new context and the enactable practices once they are known that allow them to operate within any micro-climate. The facilitators must be versed in the intricacies of the classroom as much as their programme being agile and able to pivot just as much as the participants in this study did.

6.2 Limitations of the Study

The current study took place amongst the junior cohort in one urban high school. The narrative formed within this learning community presented their own truth. It does not claim to be *the truth* and it is hoped more journeys will take place and more stories will be told. This will add to the collective knowledge and examples of practice. This study

organically unfolded into a narrative about a journey that presented intangible circumstances and collaboration which cannot be measured using a conventional matrix. As a result, generalisation of the findings for teachers is limited given the complex nature of teaching and learning. The short timeframe, and the number of participants, the interpretation of the results can only provide an emerging understanding. With this, it is the case that if this study's methods and design were replicated in another setting it would conclude with its own unique truth.

6.3 Opportunities for Further Research

This research adds to an aggregation of knowledge around mathematics as a social filter or gatekeeper. The need for ISPL to develop practices that allow them to operate in any context requires further investigation and research. The findings presented from this study continues the conversation for further research into the importance of those designing professional learning in mathematics to consider contact as much as, if not more than content. Contact is the relationships between the facilitator and the participants, and the participants with each other. Professional learning has tended to be designed as a one size and timeline fits all endeavour. There is abundant room for further progress in developing understanding around the maintaining of the Vā, understanding one another, building up the trust and being able to speak from not just head, not from your heart but from your manava* or have that 'gut check.' It would be timely to examine the importance of these approaches in line with the shifting awareness on the importance of supporting everyone's emotional and spiritual faculties realised with the Covid Pandemic forming the backdrop as this study was completed.

6.4 Concluding Thoughts

Mathematics and in this study's case in-service professional learning in mathematics for teachers has tended to focus on rigid static identities. Maintaining this univocal determination, has meant ignoring or not placing value on all the moving parts: the interactions, confluence, polarities, and fluidity woven into the fabric of mathematics learning. Mathematics is situated within social phenomenon and the design of teaching, learning and ISPL must reflect this. This study has provided a narrative about a journey to an undiscoverable island. What is meant by this is there will never be a definitive map detailing a way to arrive at optimum mathematics teaching and learning. A one-dimensional map may provide instructions and directions, but it does not predict the conditions, provide the crew, and mean you are going the come ashore to meet an identical reality to those who came before you. Deleuze & Guattari (2004) use the term rhizomatic learning to describe this notion of knowledge and learning. Comparing learning to a rhizomatic plant which is as described by Cormier (2008) as a plant "capable of growing and spreading on its own, bounded only by the limits of its habitat" (p. 1). For this study, the community became the habitat allowing the participants to grow and evolve in their own circumstances. This study centred around a courageous commitment and a collision with conventional methods to redefine and rehumanise mathematics in this learning situation. This study illustrates that despite the challenges, that despite the fears, and that despite the setbacks that these dedicated teachers continue to search for any practices that provide meaningful direction for their teaching and shine light on their students learning in mathematics. Are these circumstances unique to this learning community? Yes and no is the answer. Yes, as the teachers, their students and their experiences are specific to the reality presented in this study. No, because every other learning community has stories and experiences

that are particular to their situation and represents their truth. The action required is incapsulated best in words of José Ortega y Gasset "I am I and my circumstance, and if I do not save it, I do not save myself" (Gasset, 1922).

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Appendix A – Request to enter Kura 2022



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

Date: __/__/2022

Board of Trustees

Secondary School

Address: _____

RE: Permission to Conduct Research Study

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Dear Board Members:

Talofa, My Name is Daniel Tupua-Siliva, and I am doing a research project for a Master of Education at Massey University. For the past twenty-four months, I have been privileged to collaboratively work alongside the _____ Year 9-10 teaching aiga. On this journey, we have undertaken in-service professional learning in mathematics provided by Massey University. Over this period, I have been the primary mathematics mentor that has worked alongside the junior school teachers, and part of the senior leadership team.

I am no longer a mentor with Massey University and I am completing this study as a student.

The research will involve 2 talanoa group discussions with the seven teachers that make up the Junior School teaching whānau and 1 talanoa group discussion with two members of the senior leadership team.

I am writing to formally request your permission to:

- Allow teachers to participate in audio recorded group talanoa
- Allow Senior Leadership to participate in audio recorded group talanoa

- Allow these sessions to take place on school premises

All data will be stored in a secure location, with no public access and used only for this research. To maintain anonymity, all teachers' school name and names will be assigned pseudonyms in any publications arising from this research. By the May of 2022, a summary of the study will be provided to the school and made available for you to read.

If you agree, kindly sign below and return the signed form in the enclosed self-addressed envelope.

Board member: _____

Signature: _____

Date: _____

Alternatively, please kindly submit a signed letter of permission on your letterhead acknowledging your consent and permission for me to conduct this study at your institution.

Sincerely,

Daniel Tupua-Siliva
Masters Researcher
Email:
Phone:
Postal address:

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application SOB 21/55. If you have any concerns about the conduct of this research, please contact Dr Gerald Harrison, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 356 9099 x 83570, email humanethicsouthb@massey.ac.nz.

Appendix B: Teacher Confidentiality Form



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

Confidentiality Agreement **CONSENT TO PARTICIPATE IN TALANOA FONO SESSIONS**

This agreement is between: Daniel Tupua-Siliva – Student Researcher and the Research Participant.

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

This consent form will be held for five years.

- 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 audio recorded Talanoa Fono Sessions.

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. the participants will have
- Participants will have the opportunity to review/edit their transcribed contributions.
- 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 5 years after the completion of the study. I understand that the findings may be used for a Masters research thesis and academic publications and/or presented to conferences.
- I understand that the recordings and notes will be kept confidential to the researcher and the researchers' supervisors.
- I understand that the Board of Trustee consent has been provided and the school will not be named in any of the reports.
- My name will not be used in reports and utmost care will be taken not to disclose any information that would identify me.
- I consent to information or opinions which I have given being attributed to me in any reports on this research: Yes No

Signature of participant: _____

Name of participant: _____

Date: _____

Contact details: _____

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application SOB 21/55. If you have any concerns about the conduct of this research, please contact Dr Gerald Harrison, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 356 9099 x 83570, email humanethicsouthb@massey.ac.nz.

Appendix C: Study Information Sheet



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Teacher research information sheet

Dear _____

As you know, I am a student completing my Master of Education at Massey University. My research thesis investigates how teachers as individuals and as a collective group navigate the challenges and affirmations when taking part in In-Service Professional Learning (ISPL) in mathematics and the consequent influence on their teaching in mathematics.

I am formally inviting you to be a part of this research process in which we look at the journey both you personally, and the Junior School teaching whānau have and continue to be on while being a part of professional learning in mathematics.

We would like to invite you to attend talanoa fono. Fono held with the Junior School teaching whānau to collectively discuss and reflect on the journey we have taken as an aiga.

We would also ask (only if required) that you are available for individual check back sessions between talanoa fono. These check backs are to seek further clarity on your contributions made. These are intended to be quick in nature and will only cover what you said that may require further unpacking for accurate interpretation and analysis.

As part of the research, I will be keeping a journal, taking notes and reflections throughout the study. Any notes on individuals will be made available to them and only them. All generic group observations will also be made available to the group.

As coordinator of the project, I am writing to formally request your permission to:

- Participate in talanoa group fono at mutually determined dates and times outside of typical school hours with the intended time not going beyond 60 minutes.
- Audio record talanoa fono and transcribe recordings taken for analysis.
- Participate in check back sessions to seek further clarity on your contributions made (not recorded).
- Researcher to maintain a research journal.

All data (electronic audio files and journal entries) will be stored securely, with no public access and used only for this research. To maintain anonymity, participants' school name and names will be assigned pseudonyms in any publications arising from this research. At the end of the study, a summary will be provided to the school and made available for you to read. Any clarification and amendments required by individuals, groups, schools or the board of trustees will be completed before official publication.

Please note that you have the following rights in response to the request to participate in this study:

- decline to participate;
- decline to answer any particular question (in interviews and questionnaires);
- can withdraw from the study at any point with any responses or contributions removed only prior to submitting the thesis.
- ask any questions about the study at any time during participation
- provide information on the understanding that your name will not be used in the completed research thesis;
- be given access to a summary of the project findings when it is concluded.

If you have further questions about this project, you are welcome to discuss them with me:

Daniel Tupua-Siliva
 Phone:
 Email:

Or contact my supervisors at Massey University

Dr Brian Tweed: Massey University, School of Education. B.Tweed@massey.ac.nz

Dr Raewyn Eden: Massey University, School of Education. R.Eden@massey.ac.nz

Dr Peter Rawlins: Director Academic Studies: P.Rawlins@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application SOB 21/55. If you have any concerns about the conduct of this research, please contact Dr Gerald Harrison, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 356 9099 x 83570, email humanethicsouthb@massey.ac.nz.

Appendix D: Focus Group Schedule



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Focus Group Schedule

Research proposed to be undertaken March through May 2022.

Young Guns Talanoa Session:

Date: __/__/2022

Participants:

Location:

Researcher review of transcribed notes and research journal.

Check back: individual check back with participants (as needed) clarifying contributions from talanoa sessions.

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Aunties' Talanoa Session:

Date: __/__/2022

Participants:

Location:

Researcher review of transcribed notes and research journal.

Check back: individual check back with participants (as needed) clarifying contributions from talanoa sessions.

Mathematics Teaching and Learning: How do Pāsifika teachers experience culturally responsive in-service professional learning for mathematics?

Leadership Talanoa Session:

Date: __/__/22

Participants:

Location:

Researcher review of transcribed notes and research journal.

Check back: individual check back with participants (as needed) clarifying contributions from talanoa sessions.

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application SOB 21/55. If you have any concerns about the conduct of this research, please contact Dr Gerald Harrison, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 356 9099 x 83570, email humanethicsouthb@massey.ac.nz.

Appendix E: COVID-19 Alert Level Action & Contingency Plan



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

COVID-19

Alert Level Action and Contingency Plan

As per New Zealand Government and Ministry of Education Guidelines for in person meetings that may take place on school premise at or below Covid Alert Level 3.

Alert Level 3 areas, the ongoing testing options for partially vaccinated staff up until 1 January 2022 (when full vaccination is required to be onsite) are:

- a nasal or throat swab once a week
- a saliva test twice a week with at least two days between tests.

Based on domestic and international studies, the Ministry of Health is now updating its position on saliva testing. Saliva testing will be reduced from twice weekly to once a week – that is, those who have chosen saliva testing to meet their testing requirements will only need one saliva test within a seven-day period.

In addition to this, there is no need for a follow-up nasal swab to confirm a positive saliva test result.

All participants will be contacted personally and privately via email prior to talanoa fono to discuss their personal position on the fono taking part in person. Any participants with unease or reservations will result in the researcher' s scheduling the fono online via zoom.

These meetings will take place in a well-ventilated room as per Ministry guidelines. Participants will keep a 2-meter seated distance and are required to wear face masks.

Participants will not require any personal devices or stationery. As per participation agreement and talanoa will be transcribed.

All seating and desks will be sanitized and hand sanitizers will be available upon entering, throughout and upon leaving talanoa location.

In person option for talanoa: for the purpose of this study in person talanoa is the optimal mechanism for the execution of this research. This will happen on school premise and as per the mandated vaccine testing requirements and sanitization as outlined above for faculty to take part.

Secondary option depending on participants preference, alert level and time and date considerations due the research schedule is zoom talanoa.

We could be presented with a combination of these options due to the shifting circumstances of the Covid 19 Pandemic moving forward. For the purpose of this study these safety precautions have been outlined in order for the study to take place and also meet study deadlines.

Appendix F: COVID-19 Protection Framework Traffic Light & Contingency Plan



MASSEY UNIVERSITY
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TE KURA O TE MĀTAURANGA

COVID-19

Protection Framework Traffic Light and Contingency Plan

Aotearoa has moved to the next stage of our COVID-19 response.

The framework will continue to protect New Zealanders, while also providing more certainty and new opportunities. It minimizes the impact and provides protection from COVID-19 through three settings - Green, Orange and Red.

Under the traffic light system Education services are mandated to operate under certain conditions.

Education at Red: open with public health measures in place. Where confirmed cases occur within a school or kura, it may be necessary to limit the number of Year 0-8 students/ākonga.

Record keeping/ scanning: encouraged.

Face covering: Encouraged on site.

My Vaccine Pass: Teachers and staff, volunteers and workers are required to be vaccinated for onsite delivery of teaching and learning.

Education at Orange: open with public health measures in place. Where confirmed cases occur within a school or kura it may be necessary to limit the number of Year 0-8 students/ākonga.

Record keeping/ scanning: encouraged.

Face covering: required for staff working to provide or support the provisions.

My Vaccine Pass: Teachers and staff, volunteers and workers are required to be vaccinated for onsite delivery of teaching and learning.

Education at Green: open with public health measures in place. Where confirmed cases occur within a school or kura it may be necessary to limit the number of Year 0-8 students/ākonga.

Record keeping/ scanning: encouraged.

Face covering: Encouraged but not required indoors at school.

My Vaccine Pass: Teachers and staff, volunteers and workers are required to be vaccinated for onsite delivery of teaching and learning.

All participants will be contacted personally and privately via email prior to talanoa fono to discuss their personal position on the fono taking part in person. Any participants with unease or reservations will result in the researcher' s scheduling the fono online via zoom.

These meetings will take place in a well-ventilated room as per Ministry guidelines. Participants will keep a 2-meter seated distance and are required to wear face masks.

Participants will not require any personal devices or stationery. As per participation agreement and talanoa will be transcribed.

All seating and desks will be sanitized, and hand sanitizers will be available upon entering, throughout and upon leaving talanoa location.

In person option for talanoa: for the purpose of this study in person talanoa is the optimal mechanism for the execution of this research. This will happen on school premise and as per the mandated vaccine testing requirements and sanitization as outlined above for faculty to take part.

Secondary option depending on participants preference, alert level and time and date considerations due the research schedule is zoom talanoa.

We could be presented with a combination of these options due to the shifting circumstances of the Covid 19 Pandemic moving forward. For the purpose of this study these safety precautions have been outlined in order for the study to take place and also meet study deadlines.

Appendix G: Full Ethics Approval



MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MĀTAURANGA

Full ethics application to undertake the study was applied for and was granted by Massey University Human Ethics Committee

| Name | ID | Date |
|------------------------------------|----|------------------------|
| Application Approved | 20 | 25/01/2022 03:50:29 PM |
| Sent to EO Review Post | 19 | 21/01/2022 04:20:20 PM |
| Committee Review Completed (Admin) | 18 | 18/01/2022 04:52:51 PM |
| SUP_HOD Approved_HR-SecondReview | 17 | 12/01/2022 07:32:21 AM |
| Rework Submitted (Provisional) | 16 | 24/11/2021 08:43:47 PM |
| Sent for Rework (Provisional) | 15 | 23/11/2021 09:08:47 AM |
| Committee Review Completed (Admin) | 14 | 23/11/2021 09:08:39 AM |
| Sent for Committee Review | 13 | 29/10/2021 01:27:26 PM |
| Meeting Date Notified | 12 | 29/10/2021 01:27:19 PM |
| SUP_HOD Approved_HR-FirstReview | 11 | 27/10/2021 08:58:57 PM |
| Initial Submission | 10 | 21/10/2021 07:56:11 AM |

| Name | ID | Date |
|---------------------------------|----|------------------------|
| Risk Assessment Completed | 9 | 21/10/2021 07:54:22 AM |
| Initial Submission | 8 | 14/10/2021 05:22:24 PM |
| Risk Assessment Completed | 7 | 14/10/2021 03:21:31 PM |
| Reset Risk Assessment | 6 | 14/10/2021 02:58:59 PM |
| SUP_HOD Returned_HR-FirstReview | 5 | 11/10/2021 11:56:07 AM |
| Initial Submission | 4 | 11/10/2021 11:32:48 AM |
| Initial Submission | 3 | 11/10/2021 11:31:28 AM |
| Initial Submission | 2 | 11/10/2021 11:29:39 AM |
| Risk Assessment Completed | 1 | 6/10/2021 07:44:31 PM |