

University of Canterbury - Te Whare Wānanga o Waitaha

Determinants of Learning Success among Pacific Children Aged Six Years in New Zealand

A thesis submitted in partial fulfilment of the requirements for the Degree of
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Abstract

Pacific people in New Zealand originate from the neighbouring Pacific Islands such as Samoa, Tonga, Tuvalu, Fiji and the Cook Islands and they constitute a relatively young, diverse and fast growing ethnic minority. Pacific people's cultural heritage is diverse and their values and adherence to traditions importantly shape their views on education, health and wellbeing. From this vibrant cultural legacy, Pacific students bring their own rich cultural and linguistic funds of knowledge to school. However, in an environment where the English language is the dominant language of instruction, disadvantages in language, literacy and school achievement levels for Pacific children have been documented in the education literature and research papers commissioned by the Ministry of Education. The scholastic disadvantages can potentially lead to detrimental consequences in Pacific children's future education, health and career trajectories. Given the close associations between health, educational and social outcomes, it is important to consider an integrated and holistic framework when studying Pacific children's early development. While many researchers have attempted to understand the reasons behind the educational disparity, they have often faced methodological restrictions – such as relatively non-representative samples and a limited set of variables – in conducting their investigations. Despite all good intent, without a robust evidence-base, strategies and interventions are unlikely to be efficacious. Perhaps this could, in part, explain why Pacific students, as a group, remain the most disadvantaged within New Zealand. However, there is now an unprecedented amount of information on Pacific and other ethnic children growing up in New Zealand due to the availability of large, contemporary and comprehensive datasets.

One source of comprehensive information on Pacific children growing up in New Zealand is the Pacific Islands Families (PIF) Study, a contemporary, longitudinal birth cohort study of Pacific children and their families. This doctoral study investigated the social and health determinants of Pacific children's early learning success using data on 1,001 children from the 6-years measurement wave of the PIF Study. The following three main research objectives were investigated in this study: 1) quantitative analyses of different perceptions of Pacific children's academic performance in the first year of school held by Pacific children, their mothers and teachers; 2) construction of a classification tree model

for Pacific children's early English language development using a measure of children's English receptive vocabulary at age 6 years as the outcome variable; and 3) ethnic-specific analyses of Pacific children's English receptive vocabulary. These separate studies were used to analyse the common traits of successful Pacific learners and to identify children who would benefit the most from early, targeted interventions.

Overall, the study found that Pacific children, their mothers and teachers had very different perceptions when it came to assessing children's academic performance and that those perceptions were strongly influenced by the families' cultural, linguistic and socio-economic backgrounds. The results from the subsequent prediction study highlighted the role of early cultural environment, birthweight, age-appropriate early childhood development and parenting behaviour in accurately distinguishing children with strong English receptive vocabulary at age 6 years. The ethnic-specific analyses, however, revealed that disparate factors or distinct configurations of factors may be relevant across different ethnic groups. The nationally and internationally novel findings add to the relatively scant quantitative evidence-base for cultural and ethnic diversity across Pacific children and suggest that future research be conducted in a manner that takes this heterogeneity into account. The results also indicate that Pacific children's early language development is truly multifaceted and a framework that integrates cultural factors, physical and psychosocial health, and education may be necessary to better serve Pacific children and families. These empirical findings emphasise the importance of cultural considerations and improving home-school communication and cultural continuity for achieving optimal intervention and academic outcomes.

Acknowledgements

‘E tipu e rea mo ngā rā o tō ao – Grow and branch forth for all the days destined to you’ were the words gifted to a young Māori student by Tā Apirana Ngata. The thoughts and *korero* around what it means for New Zealand children to thrive and the best setting for doing so take the centre stage in the National Science Challenge: A Better Start - *E Tipu e Rea*. The funding for the Challenge and for this doctoral research was made available by the New Zealand Ministry of Business, Innovation and Employment. The author would like to acknowledge the Ministry for making this multi-institutional endeavour possible and for continuing to support the research into delivering the best outcomes and services for children.

This doctoral research is dedicated to studying the determinants of educational success among Pacific children. The Pacific Islands Families Study graciously allowed me to access and analyse their data. The author is indebted to the Study Director and his dedicated team for providing counsel throughout the research process. The Pacific families who have committed to investing their time and efforts into the Study are true pioneers and their contributions to the Pacific communities in New Zealand are immense. The impact their participation in the Study is making on improving the welfare of Pacific families is clear in the research outputs spawned from that collaboration and the knowledge created from that research.

The College of Education, Health and Human Development at the University of Canterbury is the home for this doctoral research and the *‘Eke Pānui, Ake Tamaiti’* project of the ‘Better Start’ Challenge. There were many external challenges during this research that the University as a wider community has had to contend with. I applaud the compassion and the inclusiveness with which the University and the College leaderships have embraced the students facing these difficult times. Personally, I have accessed and utilised many resources available at the University. I am grateful for the help I received from the subject librarians, information and communication technicians and the medical and health professionals at the University. I especially enjoyed the sessions at the Academic Skills Centre and would like to acknowledge Dr. Judith Coullie at the Centre for her dedication and for never failing to smile and encourage me during our review sessions.

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A doctoral research experience would be incomplete without the camaraderie and friendships we form with other doctoral students. I am fortunate to have met and worked alongside many talented students. My colleague doctoral students have intellectually stimulated and challenged me to go further and explore broader implications of my research. I thank Dr. Melissa Derby, Sali Aukuso, Leona Harris and Nikita Gregory for taking this unique National Science Challenge together. I am grateful to Sarath Samaraweera Gamaralalage, Abdul Saeed, Ginj Chang, and Mimisha Nesan for their friendship. I am most indebted to Dr. Jean Kim who embarked on the doctoral thesis journey first and provided me with candid advice and consistent support throughout my own.

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My doctoral advisors, all five of them, have been with me on this journey from the beginning. Each of them with their unique area of expertise has guided me and broadened my perspectives beyond anything I could possibly have imagined. Dr. el-Shadan (Dan) Tautolo embraced my research with patience and encouragement. He made this research possible by making sure that I received all the data and guidance I had needed from the Pacific Islands Families Study. I am truly grateful to him for endorsing and believing in my research. Tufulasi Taleni’s support for this research has been invaluable not just because

of his standing as a Pasifika community and educational leader but also because of his warmth and kindness with which he guided me in *fa'a Pasifika*. His in-depth knowledge of Pacific education and embodiment of Pacific cultural values had a profound impact on my growth as a wellbeing researcher. Both Dan and Tufulasi have taught me to care deeply about Pacific people and to analyse the data not as numbers but to see the people behind those numbers.

I have been blessed with a team of experienced doctoral advisors whose skills and areas of expertise complemented each other's seamlessly to provide me with the exposure to a broad perimeter of theoretical frameworks and concepts. In addition to their contributions to broadening my academic tenet, my advisors have been heroic in their efforts to create opportunities and open doors for me. I genuinely enjoyed our supervisory meetings and relied on them to feel uplifted and rejuvenated so that I can continue in my research with a fresh set of eyes. Professor John Everatt often regaled us with the tales of his adventures abroad and jokes about his political incorrectness. But all jokes aside, John brought to the team his extensive experience in supervising students and always knew exactly what I needed to hear to make me feel centred and supported. Associate Professor Brigid McNeill embodies that unique combination of academic prowess, professionalism, dedication to her students, character, and integrity and is, for me, a rare role model to aspire to. And she has a sense of humour, too.

This journey all started when I answered an advertisement for a doctoral candidacy under the supervision of Professor Philip Schluter. The research into addressing inequity in children's educational and health outcomes appealed to me above anything else. I am grateful that Philip, Brigid and John took a leap of faith and gave me the opportunity to study this important topic. Professor Thomas Lumley first introduced me to the field of Medical Statistics and I am indebted to him for giving me a strong foundation and for providing a reference that resulted in this scholarship. Adjunct Associate Professor Ross Ihaka deserves a special mention in this dedication. He has not spared his time and knowledge in helping me advance my skills in statistical analysis since his supervision for my Master's in Statistics. Philip's efforts at scholarly supervision and preparing me for an academic career could be described as nothing short of being Herculean. It is a mystery to me as to how he does everything he does. I am truly honoured to have been supervised by such a dedicated teacher and to have got to know him and his family. This doctoral research is inspired by my parents and siblings. It is inspired by their love and support and them being just who they are. I admire their fortitude and resilience. It is a great privilege to witness their lives unfold and to share this experience with them.

Last but not least, I would like to dedicate this work to Ross, whose true friendship and *aroha* got me through some of the toughest times in my life. Thank you.

Statement of Co-authorship

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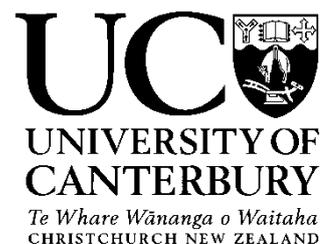
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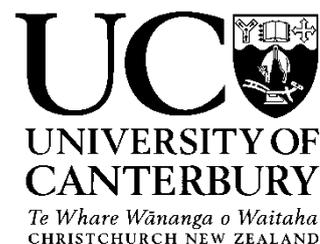
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Māori Consultation

In accordance with the terms of *te Tiriti o Waitangi* and recognition of the Māori as *tangata whenua* of Aotearoa, this researcher acknowledges the need for consultation with Ngāi Tahu, the local iwi, and the appropriate Māori advisory board or personnel regarding the implications of this research on Māori people and other peoples of Aotearoa. Further, due consideration has been given to Māori rights - to equally share in power over decision making; protection of treasures that are vital to sustaining their way of life; and the equality of opportunity - in planning and conducting all aspects of this research. The Pacific Islands Families Study, which is the main source of data for this research, has received and has on-going Māori and Pacific consultation, as have this doctoral research within the National Science Challenge: A Better Start - *E Tipu e Rea* project.

Pacific Research Framework

The focus of this doctoral research is on improving the outcomes for Pacific children and their families. The research was conducted using the information provided by the Pacific families participating in a contemporary New Zealand longitudinal study. The Pacific Islands Families Study was chosen as the data source based on their intention and focus on improving Pacific children's and their families' health and wellbeing outcomes in New Zealand. Their focus on Pacific population and the cohort size provided them with *mana* and *tino rangatiratanga* to analyse important issues related to Pacific people's welfare.

This scientific research, using quantitative statistical methods, utilised the current pre-eminent Western scientific approaches and Western lens when planning, analysing and interpreting the data. However, when possible, efforts have been made to uphold the values of Pacific culture and be informed by the processes and framework of Pacific research. To this end, the relevant industry practice guidelines including the Pacific Health Research Guidelines published by the Health Research Council of New Zealand and the Pasifika Education Programme of the New Zealand Ministry of Education have been reviewed and referred to in all matters and conduct pertaining to this research. The doctoral research has been conducted in close collaboration and consultation with Pacific advisors, formally named as Associate Supervisors, and other Pacific researchers with expertise in Pacific health and wellbeing research. The Pacific advisors and researchers were consulted over matters concerning the treatment, analysis, interpretation of data and the dissemination of outputs from this research.

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List of Outputs

Journal Publications Directly Resulting from the Doctoral Research

Kim HM et al. (2019): Kim HM, McNeill B, Everatt J, Taleni LT, Tautolo e-S, Gillon G & Schluter PJ. (2019) Pacific children's English receptive vocabulary at age 6 years: ethnic-specific analyses. (In preparation).

Kim HM et al. (2019): Kim HM, McNeill B, Everatt J, Taleni LT, Tautolo e-S, Gillon G & Schluter PJ. (2019) Perceptions of Pacific children's academic performance at age 6 years: a multi-informant agreement study. *PLoS ONE*. (Under submission).

Kim HM et al. (2019): Kim HM, Schluter PJ, McNeill B, Everatt J, Sisk R, Iusitini L, Taleni T, Tautolo e-S & Gillon G. (2019) Integrating health, education and culture in predicting Pacific children's English receptive vocabulary at 6 years: a classification tree approach. *Journal of Paediatrics and Child Health*. (Published online, in press) doi:10.1111/jpc.14397.

Other Publications During the PhD Process

Kim HM et al. (2019): Kim HM, Stewart AG, Schluter PJ. Natural experiments in a hazard context. In: Clarke M, Murray V, Chan E, Kayano R, Abrahams J, O'Sullivan T, editors. WHO Guidance on Research Methods for Health Emergency and Disaster Risk Management. Geneva: WHO; 2019. (In press).

Schluter PJ, Kim HM (2019): Schluter PJ, **Kim HM**. Databases and registers as a tool for disaster epidemiology. In: Clarke M, Murray V, Chan E, Kayano R, Abrahams J, O'Sullivan T, editors. WHO Guidance on Research Methods for Health Emergency and Disaster Risk Management. Geneva: WHO; 2019. (In press).

Schluter PJ et al. (2018): Schluter PJ, Kokaua J, Tautolo E-S, Richards R, Taleni T, **Kim HM**, Audas R, McNeill B, Taylor B & Gillon G. (2018) Patterns of early

primary school-based literacy interventions among Pacific children from a nationwide health screening programme of 4 year olds. *Scientific Reports*. (2018) 8:e12368. doi:10.1038/s41598-018-29939-w.

Presentations from the Doctoral Research

Schluter PJ, Kim HM, Gregory N (2019): The bigger picture of child health: Determinants of learning success among Pacific children aged 6 years. (Invited) Co-presentation with Schluter PJ, Gregory N. Child Well-being Research Symposium. (6 June, 2019) University of Canterbury, Christchurch, New Zealand.

Kim HM (2019): Determinants of learning success among Pacific children aged 6 years. *He Waka Eke Noa: Better together, A Better Start* Symposium. (24 May, 2019) The Kelliher Estate, Auckland, New Zealand.

Kim HM (2018): Agreement between Pacific children, mothers and teachers on their perceptions of children's academic performance at age 6 years. Poster presentation. *He Ora te Whakapiri: Unleashing the Potential of New Zealand Life Course Research* Conference. (18 October, 2018) Te Papa, Wellington, New Zealand.

Kim HM (2018): Agreement between Pacific children, mothers and teachers on their perceptions of children's academic performance at age 6 years. Poster presentation. Resource Teachers of Literacy Annual Conference. (26 September, 2018) Rydges Latimer Hotel, Christchurch, New Zealand.

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Abbreviations

A Average

AD Anno Domini

ADST Australian Developmental Screening Test

AN Always No

AOR Adjusted Odds Ratios

AY Always Yes

B4SC B4School Health Checks

BPVS British Picture Vocabulary Scale

CBCL Child Behaviour Check List

CC Concordant

CI Confidence Interval

CP Complexity Parameter

CPC Partially Concordant

CV Cross Validation

E Excellent

EAL English as an Additional Language

ECC Early Childhood Centre

ECE Early Childhood Education

ED Extremely Discordant

ERO Education Review Office

ESC The New Zealand House of Representatives' Education and Science Committee

GEQ General Ethnicity Questionnaire

GHQ General Health Questionnaire

GUINZ Growing Up in New Zealand

HRC Health Research Council of New Zealand

IDI Integrated Data Infrastructure

L1O Leave-One-Out

LD Learning Difficulties

LSAC Longitudinal Study of Australian Children

MoE The New Zealand Ministry of Education

MoH The New Zealand Ministry of Health

N Child understands the sentence but does not state yes or no

NCEA National Certificate of Educational Achievement

NI Needs Improvement

NICHD National Institute of Child Health and Human Development

NZ New Zealand

NZCER New Zealand Council of Educational Research

NZQA New Zealand Qualifications Authority

OECD Organisation for Economic Co-operation and Development

OR Odds Ratios

P Poorly

PASA Peer- and Self- Assessment

PBC Parent Behavior Checklist

PEDS Parents' Evaluation of Developmental Status

PIF Pacific Islands Families

PIRLS Progress in International Reading Literacy

PISA Programme for International Student Assessment

PPTA The New Zealand Post Primary Teachers' Association

S Satisfactory

SD Standard Deviation

SDH Social Determinants of Health

SE Standard Error

SGA Small for Gestational Age

SN Sometimes No

SNZ Statistics New Zealand

STROBE STrengthening the Reporting of OBservational studies in Epidemiology

SY Sometimes Yes

UK United Kingdom

US United States of America

VG Very Good

VP Very Poorly

VW Very Well

W Well

WHO World Health Organization

Key Terminology

The following list provides terminologies that are frequently used and the definitions applied in this research:

Child(ren): In the literature review section, *children* is used in the general sense; however, if a particular meaning is intended, this will be clearly stated when not apparent from the context. For the most part of the analyses, however, *children* is used to refer to the specific group of children: the cohort of Pacific children aged 6 years from the PIF Study.

Educational outcome(s): In the literature review section, *educational outcomes* or *educational performance* are used in the general sense unless otherwise indicated. In the analyses sections, these terms are used to refer to the school work performance of the group of children studied.

Early literacy: This refers to the general set of literacy and language skills obtained by children prior to or in the first few years of their formal instruction. These skills may include, but are not limited to, letter and phoneme awareness, reading and comprehension, spelling, and writing skills.

Direct measure: This refers to the outcomes from a standardised test of skills or actual-performance-based measurements.

Objectively measured outcome(s): For the doctoral analyses, an *objectively measured outcome* is used in the synonymous sense with the term *direct measure*.

Pacific Islands (Pacific/Pasifika) children: Following the conventions of the New Zealand Ministry of Education (MoE) in using the terminology, *Pacific/Pasifika* will be used to refer to the peoples living in New Zealand who identify with the cultures and the customs of the neighbouring Pacific Islands such as Samoa, Tonga, Cook Islands, Fiji, Tuvalu, Niue. Pacific peoples may be the first or the second generations of the immigrant families and may or may not speak their native language. The terms, *Pacific Islands* and *Pacific* will be used interchangeably with *Pasifika*.

Pākehā: The term *Pākehā* is used to refer to the European descent New Zealanders.

Palagi: *Palagi* is generally used to refer to foreigners, in particular European Westerners, in Samoa. Here, this term is used in the synonymous sense with *Pākehā* or the dominant European ethnic group in New Zealand.

Parent: In this study, a *parent* means the natural birth mother or father or a figure who plays the equivalent role in a child's life.

Primary caregiver: *Primary caregiver* will be used to refer to a parent (see the definition above) who performs the main responsibilities or duties of caring for a child.

Perceptive measure: This refers to the measures based on the evaluators' perceived opinions and observations. For the doctoral analyses, the interview responses from the participants in the PIF Study are regarded as perceptive measures unless those responses were the results from standardised tests or from other forms of direct measures (see the definition of *direct measure* above).

Respondent: This refers to the participants in the interviews conducted as part of the PIF Study.

School: In the analyses sections, unless otherwise stated, a *school* is an institute of a child's primary education. If a particular meaning is intended, for example, *te reo* or foreign language-immersion schools, this will be stated clearly or evident from the context.

Teacher: In the analyses sections, unless otherwise stated, *teachers* refer to participating children's school teachers when the children were aged 6 years.

Glossary of te Reo Māori o Aotearoa

This glossary provides the intended meaning of *te reo Māori o Aotearoa* used in this thesis. It does not purport to be a stand-alone glossary for these terminologies and may not capture the whole meaning, sense and essence of the words.

Aotearoa: Long white cloud, Māori name for New Zealand.

Aroha: Love, respect, compassion, care, concern.

Eke Pānui, Ake Tamaiti: Bring forth and uplift the child, a project title within *A Better Start: E Tipu e Rea* National Science Challenge.

E Tipu e Rea: Grow and branch forth, the project title for *A Better Start: E Tipu e Rea* National Science Challenge.

Hauora: Health and wellbeing.

He Awa Whiria: Braided Rivers, a framework for studying multiple streams of knowledge and science.

Hinengaro: Mental, cognitive and emotional wellbeing.

Iwi: Tribe, extended kinship, nation, people, race.

Kapa haka: Māori performance art.

Kaupapa Māori: The philosophy and practice of being Māori.

Korero: Discussion, conversation.

Mana: Prestige, power, authority, control, status or spiritual authority.

Manaakitanga: Care and respect.

Mana Motuhake: Self-concept, one's own sense of cultural identity and belonging.

Pākehā: European descent New Zealanders.

Tangata Whenua: People of the land, local people, hosts, indigenous people.

Te Kohanga Reo: Māori language immersion early childhood programme.

Te Reo: Māori language.

Te Tiriti o Waitangi: The Treaty of Waitangi, the founding document of New Zealand.

Te Whāriki: The New Zealand Ministry of Education guidance document for early childhood education.

Tikanga: Knowledge of Māori protocol and processes.

Tino Rangatiratanga: Autonomy, self-determination, sovereignty.

Wairuatanga: Spiritual connectedness.

Whakawhānaungātanga: The process of building relationships.

Whānau: Extended family.

Glossary of Pacific Terminologies

This glossary provides the intended meaning of Pacific terminologies used in this thesis. It does not purport to be a stand-alone glossary for these terms and may not capture the whole meaning, sense and essence of the words.

A’oga àmata: Samoan language immersion early childhood programmes in New Zealand.

Duavata: Inclusion.

Fa’a Pasifika: Pacific way of life.

Fa’a Samoa: Samoan way of life.

Faka’alofa: Love, compassion.

Fakalaumalie: Spirituality.

’Fakalilifu: Respect.

Fakataki: Leadership.

Fale Fa’afaletui o Ao’a’oga: A holistic framework for supporting Pacific students’ education based on Pacific cultural values.

Fetausia’i: Pacific value of reciprocity.

Fia palagi: ‘Wanting to be like a European’ in Samoan language.

Fonofale: A holistic model of health service provision based on Samoan cultural values.

Ipukarea: Sense of belonging.

Kava: A crop in the Pacific Islands, which can be used to produce a type of drink.

Mala: A curse or illness that results from breaking cultural customs and values.

Palagi: Foreigners, in particular, European Westerners.

Pasifika: Pacific.

Talanoa: Pacific way of having open discussion, conversation, forum.

Tapu: Taboo.

Tautua fakamaoni: Samoan value of providing service to others.

Turanga tau: Integrity.

Va fealoa'i: Strong respectful relationships.

Vuvalé: Family.

Chapter 1

Introduction

1.1 Research Motivation

‘*E Tipu e Rea: A Better Start*’ National Science Challenge, an initiative of the New Zealand Ministry of Business, Innovation and Employment, has a stated objective of giving every child the best possible start in life (<https://www.abetterstart.nz>). This doctoral research sits within Study One, ‘Predicting Early Literacy Success’ of that Challenge. The overarching aim of Study One is to improve the integration of information on health and education services provided to children in order to mitigate important negative educational outcomes. Underlying this approach of analysing inter-service coordination is the view that children’s health and educational development are inextricably interconnected. This view further promotes the endeavour to define children’s health as encompassing physical, mental, emotional, cultural, and social aspects – the theme that parallels the holistic view of education. Using large, contemporary and comprehensive datasets, the aim is to construct statistical prediction models that incorporate health and educational outcomes and thus identify the most relevant information in analysing children’s educational success.

The goal of giving every New Zealand child the best start in life motivates this research. The positive impact of starting well in early education on later achievement in life is recognised internationally (Allen, 2011; Cunningham & Stanovich, 1997, 1998; Fryer, 2010; Merry, 2013; Rose, 2006; Schweinhart, 2005). The adverse consequences of not starting well in early learning were noted by the Organisation for Economic Co-operation and Development (OECD) in their 2012 report on equity and quality in education. The report admonishes that a difficult start in early education will continue to influence children’s later lives through obstacles to learning, limited career aspirations, and adverse social and health consequences (OECD, 2012). The strain of inequity on individuals will aggregate to impose costs on society in terms of lost economic productivity, financial costs of providing social services, and the general lack of social cohesion. Early intervention can help mitigate the

risks of high initial barriers to learning and alleviate the burden on children before negative outcomes can accumulate (Allen, 2011; Catts, 2017; OECD, 2012). Such intervention programmes can also make economic sense by preventing costs incurred through later interventions and reduced reliance on public services (Allen, 2011; OECD, 2012).

The primary aim of this doctoral study was to construct prediction models that can be used to identify Pacific children who would benefit the most from early intervention strategies. It was therefore intended to inform possible ways of ameliorating punitive consequences of inequity in education. The study also aimed to study features associated with successful Pacific children in an attempt to understand whether modifiable protective factors can be established and perhaps form part of an intervention for success. In addressing these aims, it is important to acknowledge that perceptions of ‘*educational success*’ are likely to differ between cultures and people within those cultures. Hence, this study attempted to understand how these perceptions may differ and from whose perceptions of ‘*success*’ this research should be based on.

To address these goals, the doctoral project was structured in three separate phases with each phase laying the foundation for the next. In Phase One, the study analysed the perceptions of school work success among Pacific children aged 6 years from the perspectives of the students, their mothers and teachers and investigated the level of agreement between them. These perceptions were then compared to a direct measure of English receptive vocabulary skills at age 6 years. In the subsequent Phase Two study, Pacific children’s English receptive vocabulary at age 6 years was predicted using a comprehensive set of variables that reflect the multifaceted factors that underpin children’s early learning. Phase Three then attempted to investigate the relationship between learning success and Pacific children’s cultural and ethnic diversity by conducting ethnic-specific analyses of children’s English receptive vocabulary at age 6 years.

The research focused on age 6 years as it is the age at which all New Zealand children are legally required to have enrolled in school and the results of formal teacher assessments are usually available. It is also a critical period for studying children’s academic progress and environmental factors associated with successful transition to school (Crosnoe & Ansari, 2016). The results found in studies that involve children at this age can also be used to inform early intervention strategies. The statistical analyses in each phase allowed the possibility of identifying factors that influence educational success in a holistic sense by incorporating various sociodemographic factors along with variables that are related to children’s health and general wellbeing. The models were used to analyse the common traits of strong Pacific learners and to identify children who would benefit the most from early, targeted interventions.

1.2 Background

Children in New Zealand grow up in an ethnically, linguistically and culturally diverse environment. More than a quarter of the New Zealand population were born outside the country according to the 2013 New Zealand Census (Statistics New Zealand (SNZ), 2013). Pacific people, who are the main focus of this study, are a relatively youthful population with their median age of 22 years being almost half the median age of 41 years for the dominant Pākehā/European ethnic group (SNZ, 2013). What educational success means to Pacific children is studied in the context of this multicultural environment where the majority of children are taught in English at school, but many grow up in bilingual or multilingual homes (Taylor, 2011). In particular, this research looks at educational success as encompassing physical, mental, spiritual, and social aspects set within the web of cultural, geographical, environmental, economic, and social domains.

Most of the learning that occurs in the current school environment involves using language and literacy skills such as reading, listening, speaking, and writing (Rose, 2006). As observed by the New Zealand Ministry of Education (MoE), literacy is ‘*an enabler for all learning*’ (MoE, 2016a) and attaining adequate literacy skills prior to school entry or during early years at school is important for children’s later education. Understandably, the first few years of school for New Zealand children are centred around developing fundamental skills in literacy and numeracy. In English-medium schools, which comprise the majority in New Zealand, it is the students’ command of language and literacy skills in the English language that is essential for achieving academic mastery (Denston, 2016; Samu, Barnes, Asiasiga & McCreanor, 2019). Successful development of these skills is also crucial to the holistic wellbeing of an individual and society as it significantly impacts on one’s achievement of educational and vocational goals, social and cultural enjoyment, mental health, and general wellbeing (OECD, 2012). The process behind how individuals learn to read and write is complex but there is a general consensus on the connection between early language skills and later reading-related abilities (Rose, 2006; Snow, 2016). As demonstrated by Hart and Risley’s (1999) study, being exposed to a rich language environment in early childhood through abundant dialogues with mothers or primary caregivers can be conducive to children’s development of nascent language abilities. Early experiences are thus important in giving children a good start.

In order to ensure that all children are gaining these important early language and literacy skills, which underpin much of the current academic skills, there needs to be an effective mechanism with which to measure children’s progress in the attainment of these skills. From 2010 until it was abolished in 2017, all New Zealand children were regularly assessed against the age-specific National Standards set for literacy and numeracy skills

(Crooks et al., 2009). Established under the Education Amendment Act (2008), the standards were intended to provide parents, educators and the ministries with a clear picture of children's progress in academic endeavours. The overarching aim was to mandate the informing process whereby parents were regularly made aware of their children's assessment results and to instigate proper mitigating actions if the standards were not being met (Crooks et al., 2009). The aggregate student results, however, shed light on a concerning trend of disparity across the student population based on their socioeconomic and ethnic backgrounds. Disproportionately high numbers of Māori and Pacific students were seen to achieve below National Standards in all levels of the standard school curriculum. In 2015, 31% of Māori and 34% of Pacific students were assessed below National Standards for Year 1 to Year 8 in reading. Similarly, 35% of Māori and 47% of Pacific students were assessed below National Standards for Year 1 to Year 8 in mathematics (MoE, 2016c). The trends observed in National Standards data were replicated in studies using other achievement results including the Progress in International Reading Literacy (PIRLS), Programme for International Student Assessment (PISA) and, National Certificate of Educational Achievement (NCEA) (MoE, 2016c, 2016e, 2016f). Despite these tools being narrow and highly externalised measures and unlikely to have reflected the children's cultural funds of knowledge, the standards serve as a painful reminder that some groups of children are being left behind in the current Western style educational system.

It is important to understand how to best serve these groups of students. The impact of educational success transcends the outcome of individuals' attainment of qualifications and has far reaching influences on people's income earning opportunities and health outcomes (Low, Low, Baumler & Huynh, 2005). In his 2010 State of the Union Address, the former president of the United States (US) Barack Obama noted that '*In the 21st Century, the best anti-poverty program around is a world-class education.*' (as quoted in Fryer, 2010, p.2). Educational disparity should also concern health researchers as the deepest and the most persistent divides in health outcomes are rooted in unequal income opportunities and unequal education (Harvard Gazette, 2016). In fact, reducing the inequity in educational attainment is seen as one of the most important ways to tackle disparities in health outcomes (Johnston, Lea & Carapetis, 2009; Low et al., 2005). A recent editorial in the Lancet emphasised the importance of understanding the social, behavioural and environmental determinants of health to better serve people's health and wellbeing (Lancet Editors, 2018). Low et al. (2005) asked whether an education policy can also be a health policy. Their call for a conjoint effort across all social sectors is best summarised here. '*All agencies, from education, health, and finance to social welfare will have to agree on common objectives and create integrated policies to promote and support the new programs. Most important, all must understand that education affects far more than an individual's*

employability and economic prospects and that promoting good health cannot be the sole purview of the health care system.' (p.17). In the United Kingdom (UK), literacy is seen as a fundamental component in realising the agenda for Every Child Matters, which promotes children being healthy, staying safe, achieving economic wellbeing and making positive contributions (Rose, 2006). The current doctoral research posits that these domains are interconnected. The study is aimed at identifying risk and protective factors for early educational outcomes and hence allowing the possibility of implementing early intervention. It therefore hopes to contribute to alleviating the risks of Pacific children being left behind in the current educational programmes.

Underlying this research is the view that educational success should be defined in a cultural context. Hence, this project looked at different perceptions of Pacific children's school performance in the first year of school and analysed the extent of agreement between mothers, teachers, and children. Further, these perceptions were compared to the outcomes from a direct measure of children's English receptive vocabulary skills. This was conducted to gain insight into how Pacific children, and their mothers and teachers define and perceive Pacific children's educational success in New Zealand. A prediction model for Pacific children's early language outcome was constructed to help identify environmental factors that contribute to Pacific children's language and literacy success at age 6 years in New Zealand. These analyses were further extended to investigate the relevance of these factors for each distinct Pacific ethnic group using ethnic-specific analyses. This approach was taken in appreciation of the cultural and linguistic diversity among Pacific ethnic groups in New Zealand (Borrows, Williams, Schluter, Paterson & Helu, 2011). In recognition that reading and academic success depend crucially on well-developed language comprehension in the language of instruction, the analyses in this research have focused on Pacific children's early development in the English receptive vocabulary skills as the outcome of interest. These analyses were conducted using data from the Pacific Islands Families (PIF) Study.

The PIF Study is a longitudinal study that combines information on 1,398 Pacific children growing up in New Zealand. Initiated at the Centre for Pacific Health and Development Research at the Auckland University of Technology, the study has been following a cohort of Pacific children since their birth in 2000. The PIF Study's collection of data includes interviews with parents, teachers and children, health information, and educational test results and encompasses subject areas that provide a holistic view of children's development. Apposite datasets from the PIF Study were accessed and used to investigate the degree of agreement between teachers, mothers, and children on Pacific children's school performance and to construct a statistical model for predicting English receptive vocabulary for Pacific children growing up in New Zealand.

The questions included in the PIF Study's 6-years measurement wave for the primary caregivers, teachers, and children directly addressed the data requirements of current study's research aims. The study focused on the children aged 6 years as it is the age when all children would have started their formal education (after a year of schooling if the children started their primary school at age 5 years) and when a teacher's overall assessment of children's literacy and numeracy skills would be first available. This age thus represents the earliest opportunity for instigating primary school-based intervention strategies. The information collected at this time of their development can also be used to identify factors that influence their transition to school and their academic performance in the first year of school. Responses to other questions contained in the 6-years measurement wave and information captured over the duration of the PIF Study also provided important background information with which to construct predictive models of children's receptive vocabulary. In particular, the information from the 6-years measurement wave was augmented with responses to earlier measurement wave protocols, including maternal interviews at 6-weeks, 1-year, 2-years, and 4-years. Of particular interest was the rich set of information on children's and their parents' health. The information regarding families' socioeconomic backgrounds, their behavioural patterns and involvement in Pacific communities was also of interest. The PIF Study's comprehensive coverage of these issues and its focus on Pacific population made its dataset uniquely valuable to this project.

As a direct consequence of using large, contemporary and comprehensive datasets, the variables that are related to multiple domains of children's early development were incorporated into statistical models thus providing holistic frameworks to analyse Pacific children's early language development. In particular, Pacific children's birth conditions, behavioural and emotional functioning, early childhood development, parenting, linguistic and cultural environments and socioeconomic backgrounds were integrated into the model framework. These elements were often interconnected and revealed some important insight into how Pacific children thrive or falter in their pursuit of language and learning success. The results of these analyses were used to discern common characteristics among successful Pacific learners and to also identify children who are most likely to be experiencing difficulty in the current New Zealand educational system. It is hoped that this research could be used to help mitigate the risks of these children not reaching their full academic potential.

1.3 Thesis Structure and Content

The overall structure for this thesis is guided by the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines (von Elm et al., 2008). Thus

it begins with a general introduction chapter (the current chapter and Chapter Two) followed by the overview of methods chapter, results chapters, and then the overall discussion chapter.

Chapter One, the Introduction, described the motivation behind this research and positioned the study within the holistic tenet of health and wellbeing research. The chapter also briefly introduced the PIF Study, the main data source for this research. It concludes with the current section which lays out the structure of the thesis.

Chapter Two begins with some background information on Pacific children growing up in New Zealand. This was followed by a brief discussion on the current educational landscape in New Zealand and where Pacific children sit within that scheme. This chapter is intended to provide the reader with some general background information on what it means to succeed in education for Māori, Pacific and other students receiving Western style education in New Zealand. More detailed literature reviews pertaining to the specific issues addressed in each phase are contained within those separate results chapters. The chapter concludes with a section describing the research objectives for this thesis.

Chapter Three outlines the methodology and methods used in this thesis. More detailed descriptions of methods used in each phase are provided in the results chapters for these studies. Chapter Three, as a stand-alone piece, can be referred to as a brief summary of the datasets, measures and analyses used in each phase. As this research used secondary data obtained from an external source, efforts have been made to adhere to the protocols and guidelines on data access, security and confidentiality provided by the governing body for the data source. This chapter also contains information on the processes behind data access, use and management. The ensuing sections briefly discuss the ethical considerations for the research and the broad limitations of the study.

The results of the study are presented over three chapters, each corresponding to one of the aims, and each forming the basis for a journal publication. In each of the three results chapters, namely Chapter Four, Five and Six, the IMRaD format was employed and presentation was informed by the STROBE guidelines.

Chapter Seven contains the overall Discussion for the thesis. It begins with a brief introduction which recapitulates the main research objectives for each phase. It is then followed by an overview of findings and the interpretations and implications of these results. The limitations of the research and potential avenues that could be taken to remedy those limitations are explored. The strengths of this research are also discussed and some considerations are given to future research directions. The chapter finishes with a summary of recommendations and the final concluding remarks.

The thesis contains four separate Appendices chapters. Appendix A contains the Ethics Approval Letter signed and obtained from the PIF Study team. Appendix B

is a manuscript of Phase One study submitted for paper publication. Appendix C is a compilation of doctoral candidate's notes on the classification tree method (Breiman, Friedman, Olshen & Stone, 1984) and the implementation of `rpart` package (Therneau, Atkinson & Ripley, 2018) in the R programming language (R Development Core Team, 2017). Appendix D presents the journal publication of the Phase Two study.

Chapter 2

Pacific People in New Zealand and the Context for This Research

Pacific people in New Zealand originate from the neighbouring Pacific Islands nations and they typically identify with the languages, customs and cultures of those countries. In the 2013 New Zealand Census, they made up 7.0% of the total New Zealand population (SNZ, 2013) and their numbers are growing faster than the rate of general population growth. Although they share some common cultural values and in some cases genealogical ties, they represent a diverse group of people with different languages, cultures, histories, traditions and customs (Borrows et al., 2011; Paterson et al., 2006). In New Zealand, Samoans comprised the greatest proportion (48.7%) of Pacific community, followed by the Cook Islands Māori and Tongans, who accounted for 20.6% and 20.4% respectively. Other ethnic groups represented in smaller proportions such as Niueans, Fijians, Tokelauans, Tuvaluans, together made up 10.3% of the total Pacific populations in New Zealand (SNZ, 2013).

Some common Pacific cultural values include importance of family, holism, reciprocity and collectivism (Pacific Health Research Council (HRC) Guidelines, 2014). Many of these values are similar to those of Māori, the indigenous people of New Zealand, who descended from the earliest settlers from the Pacific Islands around 1200-1300 AD (Borrows et al., 2011; Fraenkel, 2012). The second large-scale Polynesian migration to New Zealand began around the post-war 1950s largely driven by the economic imperatives and the shortage of labour in manufacturing, agricultural and forestry sectors (Borrows et al., 2011; Kokaua, Schaaf, Wells, & Foliaki, 2009; Kokaua & Wells, 2009; Starks, 2005). Following the economic downturn in the late 1970s and throughout the 1980s and 1990s, many Pacific people, who were predominantly engaged in agricultural and industrial sectors, were afflicted by decreases in wages and employment opportunities (Fraenkel, 2012; Kokaua et al., 2009; Kokaua & Wells, 2009). The relations between New Zealand and the Pacific Islands

further soured during these periods when Pacific immigrants were specifically targeted for random checks for their residency permits (e.g. Dawn Raids) and were deported in often humiliating circumstances (Fraenkel, 2012). These negative socio-political and economic events have continued to impose burden on their welfare and social outcomes and many Pacific people still reside in lower socioeconomic neighbourhoods in New Zealand (Kokaua et al., 2009; Paterson et al., 2006). The Pacific migration to New Zealand continues today, albeit through different avenues for different jurisdictions. The Cook Island Māori and Niueans are granted automatic New Zealand citizenship under free association agreements, – Tokelau remained a non-self-governing New Zealand territory – while Samoans and Tongans undergo the usual residency test (Fraenkel, 2012). These circumstances may contribute to different adaptation strategies and outcomes across Pacific ethnic groups. However, as a group, Pacific people in New Zealand are disproportionately represented in adverse health, educational and social outcomes (Kokaua et al., 2009; Paterson et al., 2006).

In particular, the disparity in educational outcomes between Pacific students and the general student population is considered a crisis (Talení, 2017) and an urgent action is called to reduce the burden on Pacific students and their families. The MoE has committed to the goal of lifting the achievement levels of Pacific students and has made consistent efforts over the years as indicated by the implementation of a series of Pasifika Education Plans since 2001 (www.education.govt.nz). A number of research and technical reports were commissioned to elucidate ways to improve the educational outcomes of Pacific students (Chu, Glasgow, Rimoni, Hodis & Meyer, 2013; Gorinski 2005; Gorinski & Fraser, 2006; MoE, 2009). These reports emphasised the importance of reflecting Pacific cultural values and making curriculum relevant for Pacific students. Qualitative studies, such as Fletcher, Parkhill, Fa’afai, Talení and O’Regan (2009) and Talení (2017), also explored ways to better support Pacific students’ learning experiences based on their interviews with Pacific students, families and teachers. These studies suggest that Pacific perspectives need to be taken into account when investigating what it means for Pacific students to succeed in education and how their cultural values and adherence to those values influence their learning outcomes in New Zealand. This doctoral research is aimed at analysing various factors that are relevant to Pacific students’ early learning success and in particular, incorporating their cultural and ethnic backgrounds into a quantitative research framework.

2.1 Defining Educational Success

The highest performing educational system can be thought of as one that provides all students with equal opportunities to succeed in their educational endeavour and thus being one that ‘*combines equity with quality*’ (OECD, 2012, p.3). New Zealand, like many other OECD member countries, is experiencing an increased degree of diversity in its educational system (OECD, 2010). This diversity requires schools to cater for students from differing backgrounds and provide an educational system that is culturally caring and supportive so that every child feels safe to be themselves and to learn and succeed (Macfarlane, Glynn, Cavanagh, & Bateman, 2007). The key to fostering inclusive education is emphasising equity pedagogy where the focus is placed on partnership of all participants in education – parents, teachers, students, and communities (Bishop, 2003; Gorinski, 2005; Macfarlane et al., 2007). Another aspect to consider when attempting to incorporate inclusiveness and multiculturalism in education is the way in which students’ academic success is defined. Such a definition must take into account the cultural values and languages of these students. In such a diverse environment as the current New Zealand educational system, defining educational success in a single, unified approach may be a difficult, if not an impossible, task.

If we view educational success to mean academic success, the literature often defines the term as one that is of the outcome construct (see Kuh, Kinzie, Buckley, Bridges, & Hayek (2006); and York, Gibson, & Rankin (2015) for extensive literature review on the definition of academic success for higher education). York et al. (2015, p.1) notes that the term currently functions as ‘*an amorphous construct that broadly incorporates a broad range of educational outcomes from degree attainment to moral development*’. It is necessarily amorphous because it depends on the perspective of the person defining it or using the term. Yet, the bulk of the literature reviewed by York et al. (2015) focused on the ‘*academic achievement*’ when defining or measuring academic success. Additionally, such academic achievement was often measured using a quantifiable set of results such as grades or scores from standardised tests.

The current English-medium educational system in New Zealand largely defines students’ educational success by measuring the attainment of highly externalised and codified knowledge. Until recently (2017), National Standards were used as a benchmark to assess whether a student was academically performing at the age-appropriate level from Year 1 to 8. Under the National Standards assessment, a student was considered ‘*above*’ National Standards if the student’s current level of achievement was at a standard above their year group (MoE, 2016b). Students were evaluated by teachers who based their judgement on evidence from various aspects of learning. The standard curricula for students in Year 1

to Year 8 at school (usually 5 to 12 years of age) typically cover broad areas of learning. However, the achievement expectations under National Standards were largely focused around the attainment of literacy and numeracy skills.

This emphasis on demonstrating externalised skills and knowledge within an Anglo-dominant educational system, at times, conflicts with the more culture-connected learning style of New Zealand's indigenous Māori students (Whitinui, 2010). The partnership and power-sharing principle in education is fundamental to culturally responsive education guided by the theoretical framework of *Kaupapa Māori*, 'the philosophy and practice of being Māori' (Bishop & Glynn, 1999; Macfarlane et al., 2007; Smith, 1992). The basis of *Kaupapa Māori* theory is the recognition of Māori as *tangata whenua*, the indigenous people of *Aotearoa* (New Zealand). It reinforces *tino rangatiratanga*, Māori rights to self-determine their educational objectives and drive their own learning initiatives and further, rejects the 'deficit' theorising of Māori language, culture and customs in an Anglo-dominant educational system (Bishop, 2003; Bishop and Glynn, 1999; Macfarlane et al., 2007; Smith, 1992; Whitinui, 2010). The Māori ways of learning is often internalised as intuition and cultural wisdom (Royal, 2009), the assessment of which is often difficult in an educational system which is characterised by the demonstration of externalised knowledge.

However, the recognition of *kapa haka* (Māori performance art) as a credited academic subject in the national curriculum was seen as a change in direction towards providing a culturally safe and supportive environment for Māori students (Whitinui, 2010). The students taking part in *kapa haka* showed better engagement in other classes, stayed on longer to progress onto higher levels and tended to have less issues with truancy (Whitinui, 2010). This renders support to the view that there is a genuine need for schools to draw on Māori knowledge to develop learning strategies that best support Māori students (Macfarlane et al., 2007; Whitinui, 2010). Māori pedagogy emphasises the embodiment of values such as *whakawhānaungātanga* (the process of building relationship), *manaakitanga* (care and respect), *tikanga* (knowing Māori protocol and processes), *aroha* (love and respect), *hinengaro* (mental and emotional wellbeing), *hauora* (health and wellbeing), *whānau* (inclusion of family), and *wairuatanga* (spiritual connectedness) (Bishop and Glynn, 1999; Macfarlane et al., 2007; Whitinui, 2010). This holistic view of Māori pedagogy was further promulgated with *He awa whiria*, a multicultural, inclusive approach which weaves Māori wisdom and knowledge with those of other cultures such as Western science (Macfarlane, 2009; Macfarlane, Macfarlane, & Gillon, 2015; Social Policy Evaluation and Research Unit (Superu), 2018). Macfarlane et al. (2007, p.74) recounted a story about a student who was considered to be successful by the administrators at her school but when asked what it is like to be a Māori student in senior school responded 'most of the time the lights are turned off. The light comes on Tuesday afternoon at kapahaka'. Macfarlane et al. (2007)

saw this as an indication that the definition of educational success need not necessarily be purely based on the externalised assessments of knowledge and behaviours.

Defining educational success as encompassing one's cultural identity was also evident in the studies of Pacific families and their perceptions of New Zealand schools. In particular, the studies on the expectations of Pacific students, their parents and teachers revealed different values and perspectives on educational success held by each group. Fletcher et al. (2009) found that Pacific students valued parental support, cultural identity, the importance of home-school relationships, high expectations from school staff and parents for Pacific students' educational success, the central role of church, and the information and communication technology-supported learning environment. The value of Pacific students' cultural identity was a recurring theme in the studies of Pacific students' perspectives on educational achievement (Coxon, Anae, Mara, Wendt-Samu & Finau, 2002; Fletcher et al., 2009; Nakhid, 2003). This view was echoed by Pacific parents who considered the knowledge of their first language and culture to be an important educational goal for their children (Fletcher et al., 2009; Podmore & Sauvao, 2000; Podmore, Sauvao & Mapa, 2003).

The MoE's guidance for language planning and policy documents such as the '*New Zealand Curriculum Framework*' (MoE, 2016d) allows schools to tailor their instructional materials to suit their local needs in achieving linguistic, gender and cultural inclusiveness (Barkhuizen & Starks, 2006). This view was supported by MacGibbon et al.'s (2008) study where it had been observed that the reading texts provided by the MoE included those about the different ethnic groups within Pacific region and their unique language and culture (MacGibbon et al. (2008) as cited in Fletcher et al. (2009)). As early as 1997, the MoE advocated the use of reading materials written by Pacific writers in instructing Pacific children (Fletcher, Parkhill, Taleni & Fa'aoi, 2006).

Despite this ministerial endorsement, there is contentious evidence around the actual use of instructional materials that reflect Pacific culture. The earlier findings of Caddick (1992) where only tokenistic use of Pacific contents were observed in teaching materials were later supported by Podmore and Sauvao's (2000) research on the transition experiences of students from the Pacific Islands early childhood services to schools. They noted that under-resourced schools, where most Māori and Pacific children were enrolled, were more likely to experience difficulty providing ethnic language continuity for their Pacific children. Fletcher et al. (2006, p.117) told a story about a 13-year-old boy who complained that '*all the reading books were about white people*'. Despite uneven evidence of the dominance of Anglo-European culture in teaching and learning resources in use in English-medium classrooms, the importance of incorporating Māori and Pacific ethnic values and cultures into educational programmes is seldom disputed (Airini, 1998a, 1998b;

Bishop, 2003; Gorinski, 2005; Harker & McConnochie, 1985; Nakhid, 2003; Podmore & Sauvao, 2000; Tuafuti & McCaffery, 2005).

These results are still relevant today as, despite the efforts made by the MoE to specifically target the achievement levels of Māori and Pacific students, many were still assessed as not meeting the required level of performance measured against National Standards for their age group. A number of studies identified the need for more concerted efforts to involve parents and communities in Pacific students' education to lift the achievement levels of these students (Fairbairn-Dunlop, 1981; Fletcher et al., 2009; Podmore & Sauvao, 2000; Podmore et al., 2003; Spiller, 2012). Within the context of the standards used in the English-medium educational system, the persistence of the achievement gap between Māori and Pacific students and the rest of their cohort group seems to render some evidence to the '*Matthew Effect*'¹ discussed in much cited Stanovich (1986). The achievement gap between the students from indigenous or ethnic minority groups and the rest of their cohort groups is well documented in studies where efforts made to elicit the potential causes of low levels of achievement all too often point in the direction of the negative impact of low socioeconomic status and the lack of engagement from the students and their parents (Nash, 2000; Nicholson, 1999, 2000, 2002; Snow, Burns & Griffin, 1998).

Within the New Zealand context, other studies have challenged this view with a shift of onus from the students to pedagogic style and a long history of mono-culturalism that underpinned the acculturation and cultural mismatch in our English-medium education (Caddick, 1992; Bishop, 2003; Harker & McConnochie, 1985; Nakhid, 2003; Tuafuti & McCaffery, 2005; Wilkinson, 1998). This view is supported by the studies that incorporated intervention programmes for teachers, which have been shown to be effective in improving the performances of Māori and Pacific students to near National Standards levels (McNaughton, Phillips, & MacDonald, 2003; Phillips, McNaughton, & MacDonald, 2004; Timperley, Robinson, & Bullard, 1999). These findings suggest that although many Pacific students evidently start school with lower levels of general literacy knowledge in the English language (McNaughton et al., 2003; Nicholson, 2002), effective early instruction focused on key areas such as word recognition, reading, and writing can significantly mitigate the risks of low levels of English literacy and language skills attainment and later academic achievement.

The historic '*deficit*' theorising of Pacific students' achievement levels by the teachers of English-medium educational system was evident in the literature studying teachers' perceptions of Pacific students' and their parents' expectations and attitudes towards New

¹This biblical reference of 'the rich get richer and the poor get poorer' was used to refer to the phenomenon of a widening achievement gap between the more skilled students and their less skilled counterparts.

Zealand education (Coxon et al., 2002; Spiller, 2012; Timperley et al., 1999; Tuafuti & McCaffery, 2005). Spiller (2012) documented teachers' interpretations of Pacific students' behaviours as being the Pacific way and as an impediment to Pacific students' academic achievement. Some of the behaviours highlighted were Pacific students' needs for perfection, thought to have originated from home where the recitations of the Bible without making mistakes were highly regarded, and the value of humility due to which students did not wish to look clever in front of others in class. The teachers in the study often mistook Pacific parents' absence at school events as a lack of interest in children's education and Pacific parents often expressed discomfort or feeling unwelcome at English-medium schools (Coxon et al., 2002; Fletcher et al., 2009). Pacific parents in these studies also felt that they should not challenge teachers as a show of respect even when they disagreed with instructional approach, but this was perceived as being in agreement by the teachers and the schools (Tuafuti & McCaffery, 2005). Nakhid (2003) found that teachers were often unaware of Pacific parents' role and their interest in their children's education.

Spiller (2012) observed that the Pacific students themselves were aware of their teachers' low expectations of them. Fletcher et al. (2009) reported that Pacific students found noisy classrooms and disruptive behaviours of other students as impediments to their performance and that their teachers were not adequately managing the classroom atmosphere. These studies and others (Coxon et al., 2002; Nakhid, 2003; Podmore & Sauvao, 2000; Podmore et al., 2003; Spiller, 2012; Tuafuti & McCaffery, 2005) provided supporting evidence of what Fairbairn-Dunlop (1981) and Harker and McConnochie (1985) found in their earlier studies, that there is a need for greater communication and understanding between home and school.

Many of the studies discussed above (Fairbairn-Dunlop, 1981; Fletcher et al., 2009; Nakhid, 2003; Podmore & Sauvao, 2000; Spiller, 2012) are qualitative interpretive studies performed through unconstrained, *talanoa* or dialogue based interviews with Pacific students, their parents, and teachers². Despite the evidence from these interviews suggesting different perceptions of educational success held between Pacific students, parents, and teachers, no studies have been conducted to specifically elicit the similarities and differences between these perceptions using a contemporary, large-scale and quantitative data. The aim of this doctoral study is to address that gap in literature and complement the body of qualitative research on the perceptions of Pacific children's academic performance by analysing the data on over 1,000 Pacific students living mainly in the Manukau district of South Auckland. The dataset comes from the PIF Study, the description of which is

²This interview style is preferred by many researchers of Pacific people as it is thought to be a more culturally responsible and appropriate way to interact with Pacific people and hence results in more effective engagement from the study participants.

discussed in more detail in Chapter 3.

The key consequence of building a prediction model is the possibility of identifying children who are most likely to struggle in the current educational and health systems so that they may benefit from early intervention strategies. The statistical prediction models outlined in Chapter 3 have made use of comprehensive data available from the PIF Study. The models were constructed by incorporating variables that are associated with the holistic development of children and hence encompass various domains such as health, education, family/whānau, cultural and social context, and neighbourhood environment. This approach was taken in order to identify risk and protective factors for Pacific children's early learning outcomes and to reflect the same holistic and multifaceted perspectives on children's development as those reflected in the underlying data.

2.2 Predicting Educational Success

Children growing up in New Zealand are heterogenous in terms of their ethnic, cultural, and social backgrounds, and these differences add to the complexity of identifying the predominant factors that influence early educational achievement. Indeed, New Zealand has been regarded as being '*super-diverse*' with more than 200 ethnic categories recorded in the 2006 census and more than 120 distinct languages (Callister, 2011, p.123). Moreover, many children identify with more than one ethnicities (Callister, 2011). The heterogeneity inherent in children who come from diverse ethnic backgrounds can also present additional challenges to researchers engaged in studying early language and literacy outcomes. For example, Paradis (2005) noted that most of the tools used to assess language skills are designed for a monolingual population and hence could provide inaccurate results when used to detect language impairments in English as an additional language (EAL) learners. Many immigrant children in New Zealand come from countries where English is not their first language and like most other member countries of the OECD, the immigrant children of New Zealand perform less well in reading than their native peers (OECD, 2012). As the main educational goals at ages 5 and 6 years are those associated with the attainment of language and literacy skills (MoE, 2016a), the risk and protective factors for literacy are also likely to be associated with the factors that affect the overall educational achievement. The importance of attaining these emergent literacy skills on children's later reading outcomes and hence educational success cannot be understated (Cunningham & Stanovich, 1997, 1998; Rose, 2006; Snow, 2016). Facilitating children's language and literacy development is important in achieving equitable educational outcomes.

The Simple View of Reading, attributed to Gough and Tunmer (1986), posits that reading comprehension is a product of decoding skills and linguistic comprehension. The

simple view of literacy acquisition, according to Juel, Griffith and Gough (1986), centres on factors such as ethnicity, intelligence, and oral language skills initially influencing the development of phonemic awareness. The phonemic knowledge then combined with exposure to print lead to cipher knowledge and lexical knowledge. Further, this knowledge should develop into word recognition, reading comprehension then writing (Juel, 1993; Nicholson, 1999).

Using a longitudinal study following a sample of American children from the first grade to the tenth grade (ages 6 to 16 years), Sparks, Patton, and Murdoch (2014) showed that exposure to print in the first grade predicted the students' reading outcomes 10 years later. Further, the study showed that exposure to print and reading skills were highly reciprocal as print exposure enhanced reading skills and skilled readers developed more interest in reading and hence tended to read more. Through more frequent reading, these students developed other related skills such as vocabulary and reading comprehension, thus widening the gap between themselves and their less skilled peers. This evidence of '*Matthew Effect*' (Stanovich, 1986) is a concerning phenomenon as the equity in educational achievement among students is considered the fundamental element of a highly performing educational system (OECD, 2012).

Studying factors that either exacerbate or ameliorate the achievement gap in the context of a broader definition of educational success is one of the aims of this study. A holistic definition of educational success implies that many of the factors that influence educational outcomes are interconnected. For example, physical health is one that is closely related to educational achievement. Sharma, Purdy, and Kelly (2009) showed that the comorbidity of auditory processing disorder with language and reading disorders was common among a sample of children aged between 7 and 12 years. Such language impairments were found to significantly influence the development of literacy skills (Snow et al., 1998, Washington & Craig, 2004). The recent emergence of life course epidemiology, a study of factors early in life impacting the life long health and wellbeing (Gilman, 2012), provides an interesting angle to explore in analysing the interaction between health and education. The availability of perinatal information on Pacific children growing up in New Zealand (PIF, 2000) allows the possibility of analysing the the association between children's development very early in their lives and their later educational achievement levels at school. Guthridge et al. (2015) is a publication example using the Northern Territory Australian population. They found factors such as maternal smoking during pregnancy, higher birth order, and being a boy as having an impact on the risks of falling below the national minimum standards in literacy and numeracy in the third year of schooling.

In a similar way to the impact of physical health on educational outcomes, the studies on social and emotional responsiveness found a close association between these skills and

early educational success. Applying a person-centred approach in their study of early school success, Denham et al. (2012) found social emotional learning to be crucial to children's early educational success and later wellbeing and mental health. Importantly, preschool emotion knowledge - such as self-regulation, emotional expressiveness, and social skills - was found to predict teachers' overall evaluations of children's literacy and numeracy skills and general knowledge. The association between children's ability to regulate their emotions and their early educational achievement was also evident in Graziano, Reavis, Keane, and Calkins (2007), where these skills were found to uniquely predict academic outcomes even after controlling for children's cognitive abilities. Emotion regulation skills were thought to facilitate children's development of positive student-teacher relationships, which in turn, was important for fostering children's academic motivation. Given the importance of social and emotional factors in predicting educational success, it is not surprising that Pacific students who feel out of place in an Anglo-dominant English-medium educational system should suffer in terms of academic outcomes. As explored in the previous section, the teachers in English-medium schools at times perceived Pacific values and customs as a hindrance to Pacific students' educational attainment (Spiller, 2012).

Many of the factors known to predict early educational success put doubts into one's mind about the equitable nature of the current educational system. Factors such as gender, ethnicity, and socioeconomic background are some of the examples. Gender was often shown to have a significant impact on early educational achievement (Brinkman et al., 2012; Guthridge et al., 2015). In Wilkinson (1998), 9 year-old New Zealand girls and boys exhibited different patterns in their use of reading materials which contributed to the reading achievement gap between those students within class. The differing achievement levels by gender were also evidenced in the OECD study comparing students' achievement levels in reading, mathematics, and science literacy across different countries (Easton, 2013). Among the New Zealand students aged 15 years, female students achieved higher levels in reading compared to male students, a result that was generally replicated in other OECD countries. Ethnicity and socioeconomic backgrounds were also shown to be closely associated with educational achievement. The result that students from higher socioeconomic backgrounds achieve at higher levels compared to those from more disadvantaged backgrounds is one that is typically accepted among policy makers and educators (The New Zealand House of Representatives' Education and Science Committee (ESC), 2003; The New Zealand Post Primary Teachers' Association (PPTA), 2013; Tunmer & Chapman, 2015). The analyses of OECD data on student achievement in Easton (2013) showed that socioeconomic backgrounds affected student's educational achievement levels even after adjusting for ethnicity and gender. Pacific students from this study deserve particular attention as only they achieved at levels lower than the OECD average even after adjust-

ing for socioeconomic backgrounds. This indicates a need to look beyond socioeconomic explanations and focus on the factors that are specific to Pacific students. This may entail reflecting on Pacific perspectives and unlocking their cultural funds of knowledge.

In New Zealand, differential funding for schools to address barriers to learning from socioeconomic disadvantage was introduced in 1995 in the form of a decile system. A decile is a census-based measure of socioeconomic status that uses five indicators: household income, household crowding, parental occupation, parental education, and beneficiary status (MoE, 2014). An inquiry report (2003) by the New Zealand ESC noted the decile mechanism as one that is more transparent and objective than the previous system and that there is an ‘overwhelming evidence’ (p.8) which suggests that the students from low socioeconomic backgrounds do not achieve at the same level as those from higher socioeconomic backgrounds. The evidence of this can still be found 20 years on in the achievement statistics of students leaving school. In 2015, 92% of students from the highest two decile (decile 9 and decile 10) schools left with at least one level 2 NCEA compared to 65% of students from the lowest two decile (decile 1 and decile 2) schools (MoE, 2015). Concerningly this affected some ethnic groups more than others. In 2016, 90% of the students in the lowest decile, decile 1, schools were Māori and Pacific students. Similarly, 72% of the students in decile 2 schools were Māori and Pacific students (MoE, 2016c).

Previous studies on the educational outcomes of Pacific students have mainly focused on identifying factors that were associated with low levels of educational achievement. In language and literacy studies, these factors often included low socioeconomic backgrounds of the students’ families (McNaughton et al., 2003; Nash, 2000; Nicholson, 1999, 2000, 2002; Tunmer, Chapman, & Prochnow, 2006). This may be the result of applying much cited international studies that focused on the interaction between poor educational outcomes of pockets of groups, often ethnic minority groups, indigenous populations or other groups marginalised within the society, and their socioeconomic status (Bourdieu, 1984, Juel et al., 1986, Snow et al., 1998). The variables related to home literacy environment and socioeconomic status are often correlated with each other and in prediction models often produce statistically insignificant coefficient estimates. For example, a number of studies aimed at predicting prevalence of dyslexia found home literacy environment, socioeconomic status, and familial risk of dyslexia not having much impact over and above each variable when included together (Dilnot, Hamilton, Maughan, & Snowling, 2016; Puolakanaho et al., 2008). Snowling and Merby-Leråg (2016) referred to these variables collectively as the ‘*gene-environmental factors*’. Similarly, in the literacy literature aimed at predicting literacy skills attainment, the influence of home literacy environment on early literacy achievement was often combined with that of family’s socioeconomic status in a term defined as the ‘*cultural capital*’. Tunmer et al. (2006, p.187) defined ‘*literate*

cultural capital' as 'a generic term referring to reading-related variables at school entry that are strongly linked to activities in the home environment that support early literacy development'. Other studies used the term, '*cultural capital*' in the context that was used by Bourdieu (1984) and to refer to the varied influences of socioeconomic status on factors that give rise to the reproduction of social classes (Gorinski, 2005; Nash, 2000; Nicholson, 2002).

In Snow et al.(1998), American children from ethnic and linguistic minority backgrounds who lived in communities with lower levels of resources than the dominant culture were found to achieve lower levels of literacy skills. According to Nicholson (2002), this is also the case in New Zealand where 75% of the children from low decile schools were found to be reading at levels below their age agroup after two years of schooling compared to that of 14% of children from high decile schools. Despite this evidence of an achievement gap between students from different socioeconomic backgrounds, Nicholson (2002) noted that children getting a good start in attaining language and literacy skills was more crucial to children's educational success. This view was confirmed in Sparks et al. (2014), where early exposure to print predicted later reading success. They replicated the earlier results of Cunningham and Stanovich (1997) that providing children with a strong start in reading produces '*powerful, and long-term benefits*' (Sparks et al., 2014, p.189) and even went on to state that '*the reading-related differences can start early and help or hinder a child's entire academic career*' (Sparks et al., 2014, p.190). The persistent impact of starting well on students' later achievement suggests that the measure of educational effectiveness should take into account the incremental value created by education rather than the outcomes measured at the end of children's school-life.

This is especially relevant since, as demonstrated in Phillips et al. (2004), effective intervention programmes can help close the gap between struggling students and the more accomplished. Moreover, their results provided a strong argument against the '*deficit*' theorising of Pacific students as their intervention programmes were targeted at the teachers of the struggling Pacific students and not the students. The need for teachers to take an active role in dismantling the school culture that externalises the causes of poor academic performance was identified in Timperley and Robinson (2001)'s study of low decile schools in New Zealand. Timperley and Robinson (2001) showed that teachers' own perceptions of external factors for academic performance of students in low decile schools were challenged and changed over the course of their study. They recognised internal factors such as their own teaching practices as the key determinants of children's educational outcomes. These findings support the conclusions of an earlier international study from Wang, Haertel, and Walberg (1993) that have identified the direct influences such as teachers' social interactions with students and the time spent on instruction as having a greater impact on

students' learning than the indirect influences such as school policies and the district-level policies. The importance of the quality of student-teacher relationship was later confirmed in Graziano et al. (2007) where a supportive and caring relationship was shown to predict greater academic productivity in class and higher scores in the standardised tests of reading and mathematics. These findings reinforce the view that pedagogic style and the children being of the indigenous or minority status while learning in an educational framework defined for the dominant culture can have a significant impact on the academic achievement of Pacific students (Caddick, 1992; Bishop, 2003; Harker & McConnochie, 1985; Nakhid, 2003; Tuafuti & McCaffery, 2005; Wilkinson, 1998).

This study is uniquely positioned to investigate the factors that characterise high-performing Pacific students by analysing comprehensive sets of information that reflect the holistic view of educational success. This information comes from large, contemporary datasets that provide the results of children's health checks, educational assessments and families' economic, social, and cultural backgrounds. Through the analysis of these wide-ranging indicators, the study attempted to identify strong predictors of Pacific children's educational outcomes and the associated risk and resilience factors for achieving educational success. These can then be used to inform strategies for early intervention.

The endeavour to reduce early achievement gap among students within New Zealand schools is very relevant and paramount to achieving highly performing educational system and society. There is a growing body of evidence of early reading success predicting later literacy and educational success and the corollary findings of widening achievement gap over the course of children's academic lives (Cunningham & Stanovich, 1997; Sparks et al., 2014; Stanovich, 1986). Instigating early interventions to ensure all children have equal access to opportunities, resources, and the environment necessary to succeed in education can reduce or even prevent the achievement gap (Allen, 2011; Catts, 2017). As a result of such intervention programmes, children will benefit early in terms of developing the skills necessary for their secondary education, staying on school longer, and completing their education with sufficient skills to succeed in later endeavours such as higher education and career (OECD, 2012). Such intervention to strengthen equity in education was found to especially impact the socially disadvantaged children (OECD, 2012, p.26). Hence, identifying the children who are most likely to be left behind in our current educational system is crucial to ameliorating the impact of educational disparity. A goal that is equally important to identifying struggling students is one that attempts to establish the common traits among successful learners and apply that knowledge to lift the outcomes of other students. By being able to identify these groups of children, early and targeted intervention programmes that focus on the strength of these students can be instigated. Educational success can importantly mitigate health and social risks, and within the social

determinants of health framework, can form integral part of intervention to support better health and general wellbeing (Low et al., 2005).

2.3 Research Objectives

Language is the major tool for communication, learning, relating to others, and interpreting world experiences (Chomsky, 2007; Kohnert, Yim, Nett, Kan & Duran, 2005). Early language skills also build the foundation for later literacy acquisition and educational attainment (Catts, 2017; Rose, 2006; Snow, 2016). A strong start in these essential skills is important as an early gap in reading achievement levels can broaden with age (Cunningham & Stanovich, 1997; Sparks et al., 2014). For those who face higher barriers to learning, early identification and intervention is key to mitigating the risks of these children not fulfilling their academic potential (Catts, 2017; Rose, 2006).

To this end, this doctoral study aimed to identify Pacific children who would benefit the most from early, targeted interventions by analysing large, contemporary and comprehensive datasets on children growing up in New Zealand. The study takes the view of defining educational success as one that encompasses physical, mental, emotional, cultural, and social aspects. This broader definition is one that parallels the holistic view of health and one that emphasises the balance in all these aspects. To reflect this holism, the research aimed to identify various factors that are relevant to Pacific students' early learning success and in particular, incorporating their cultural and ethnic backgrounds into the quantitative research framework.

To address these goals, the doctoral study was structured in three phases with each phase laying the foundation for the next. In each phase, the statistical analysis incorporated various sociodemographic factors along with variables that are related to children's health and general wellbeing and thus help determine factors that influence educational success in a holistic sense. The models were used to identify children who would benefit the most from early, targeted interventions to lift the educational achievement levels of these children. Common traits that characterise successful Pacific learners were also analysed and discussed.

In Phase One, Pacific children's early academic performance was investigated from the perspectives of the children, their mothers and teachers. These perceptions were then compared to the children's performances in a traditional language assessment tool. Differing perspectives on educational outcomes are expected among culturally diverse students and their parents and teachers (Lynch, 2011). Immigration history and cultural environment can also influence one's views on educational goals and expectations (Lea, 2012; Spring, 2009). Presently, the literature on agreement among Pacific students, their parents and

teachers on their perceptions of educational outcomes is relatively scant and none investigates its association with cultural orientation in any rigorous fashion. Using data on a large birth cohort of Pacific children, augmented with information provided by their mothers and teachers, this study explicitly investigated such associations. Thus the results in this study are nationally novel, and adds to the relatively limited international evidence-base.

The Phase Two study was conducted to understand environmental factors behind Pacific children's English receptive vocabulary development, an important component of early language and literacy attainment. There is an identified need for research which includes achievement related measures of learning outcomes for Pacific children (Chu et al., 2013). This task is especially urgent for Pacific students and studying early learning outcomes is important in tackling later achievement disparity (Schluter et al., 2018b; Taleni, 2017). A classification tree method was used to construct a prediction model which incorporates health, perinatal, socioeconomic, and cultural elements into analysing Pacific children's vocabulary development. The prediction model was used to identify and analyse common characteristics among Pacific children with strong English receptive vocabulary skills and those who are at risk of being left behind in the current educational system.

In Phase Three, ethnic-specific analyses were performed to identify environmental elements that serve as risk or protective factors for Pacific children's English receptive vocabulary development at age 6 years. This was intended to address the lack of research recognising the ethnic diversity among Pacific students and their families and to add to the body of literature that report high quality ethnic-specific data and analysis (Chu et al., 2013). The ethnic differences across Pacific communities are analysed in relation to how maternal cultural orientation and other key variables identified in Phase Two influence children's English receptive vocabulary at age 6 years. The study also investigated whether the cultural connectedness with both the dominant European New Zealand culture and the Pacific community culture can enhance Pacific children's English receptive vocabulary skills.

These research objectives were deliberately interconnected and designed to complement one another. They reflected a clear intention to analyse Pacific children's early learning success from a holistic perspective and to reflect their cultural and ethnic diversity in a quantitative research framework. By addressing these separate but interwoven research questions, the common attributes that characterise high achieving Pacific children were analysed and the children who deserve additional support in order to reach their educational goals were also identified.

Chapter 3

Methodology and Methods

3.1 Methodology and Overview of Methods

This doctoral research applied quantitative methods in a holistic framework informed by the World Health Organisation (WHO)'s *Social Determinants of Health (SDH)* conceptualisation (Solar & Irwin, 2010). Under the SDH framework, health is viewed as a social phenomenon, and education as a structural determinant of health inequity, based on the consideration that health, education and socioeconomic factors are closely interconnected.

The SDH framework posits that social and political context plays an integral role in determining a person's socioeconomic position which then influences their ability to achieve good health and wellbeing. The structural determinants in the SDH model comprise factors at the governance level, macroeconomic, social and public policies, and cultural and societal values (Solar & Irwin, 2010). Within New Zealand and the specific contexts of Pacific immigrants, these determinants interact with Pacific people's socioeconomic positions indexed by their level of education, type of occupation, and income. Despite the social insurance policies aimed at protecting the general population (that is, those with citizenship and residency permits), New Zealand is a small, open economy subject to international market fluctuations, and both public policies and private sector performances are influenced by these external factors. There are calls for actions targeted at improving the health outcomes of the most disadvantaged groups in New Zealand, which include Māori and Pacific people and hence would require understanding of their views of health and wellbeing (Safarti et al., 2019). Yet the underlying cultural and societal values in New Zealand are predominantly dictated by Western norms (Safarti et al., 2019; Samu et al., 2019; Solar & Irwin, 2010). Pacific people in New Zealand are, therefore, cultural, linguistic and ethnic minorities whose values are often in conflict with the dominant norms and who continue to be positioned in lower socioeconomic classes and over-represented in adverse health, social and educational statistics (Borrows et al., 2011; Paterson et al.,

2006, 2008; Schluter et al., 2018b).

Based on this social context and the underlying thesis of this research, which was framed using the SDH model, the holistic domains of child development were considered and included in the analyses. This approach has been applied throughout the doctoral research, which is organised in the following three phases:

- Phase One: The literature is reviewed on self-assessment practices and how immigration and cultural differences may impact on one's perceptions of their school work performance. The PIF Study data are used to analyse perceptions of children's school work performance at age 6 years from the perspectives of children, mothers, and teachers. These perceptions are then compared to the results from a standardised language assessment tool.
- Phase Two: A prediction model of Pacific children's English receptive vocabulary at age 6 years is constructed using the PIF Study data. The model performance is analysed and the variables that are important for accurate construction of model are identified.
- Phase Three: Using the variables identified in Phase Two, ethnic-specific analyses are performed to determine factors that could hinder or support Pacific children's English receptive vocabulary development at age 6 years.

The study focused on the children aged 6 years because it is the age at which all children are legally required to have started their formal education in New Zealand. Since most children start their primary education on their 5th birthday, they would have had a year of formal instruction by the age 6 years. This is when a teacher's overall assessment of children's literacy and numeracy skills would be available. Attainment of literacy and numeracy skills is the key objective of education for children aged 6 years in New Zealand. This view is supported by the '*New Zealand Curriculum Framework*' document published by the MoE (2016d). The information collected at this time of their development is crucial in identifying factors that influence their transition to school and their academic performance in the first year of school.

3.2 Phase One: Respondent Agreement Study

3.2.1 Research Objectives

The aim of this phase was to study differing perspectives on educational success and investigate how the perceptions of Pacific children's school work performance at age 6 years may differ between the children, and their mothers and teachers. These perceptions were then compared with children's performance in a standardised test. Teachers' assessments of children's oral language skills were validated using the results from a direct measure of children's English receptive vocabulary skills. The overall levels of concordance and agreement between assessments made by the children, mothers and teachers were analysed. The sociodemographic information on the concordant groups of children, mothers and teachers was compared with those of the discordant groups to analyse the factors that may be associated with the patterns of concordance. The objective of the research was to gain insight into what Pacific children and their families perceive as educational success and how these may differ from the perspectives of the teachers. Further, the study of relationship between participants' sociodemographic information and concordance patterns could reveal what factors were relevant to the participants' assessments of children's school performance in the first year of formal schooling. The analyses and the results of Phase One are presented in Chapter 4 of this thesis. The manuscript submitted to a journal for publication is included to this thesis as Appendix B.

3.2.2 Data

This study was conducted using datasets from the PIF Study. In particular, the interview responses from the primary caregivers, teachers, and children when the children were aged 6 years were accessed and analysed. The interviews conducted as part of the 6-years measurement wave included questions relating to children's progress at school. Information on 1,001 participating children was obtained for this part of the 6-years measurement wave. The following questions were put to each respondent group:

- Primary caregiver: 'Based on your knowledge of your child's school work, how is he/she doing in school this year?'
- Teachers: 'Evaluate the child's performance in: Reading, Oral language, Written language and Maths.'
- Children: The children were asked about their own school work performance with responses to the statement 'I'm good at school work'.

- In addition, the children's English receptive vocabulary skills were tested using the British Picture Vocabulary Scale (BPVS) (Dunn, Dunn, Whetton, & Burley, 1997).

3.2.3 Statistical Analysis

The responses to interview questions were based on each respondent's perception of how the child was performing at school. To analyse the level of agreement between respondents in their perceptions of the children's performance at school, pairwise relationships between the responses were analysed, that is, the agreement between the mother-teacher, teacher-child, and mother-child pairs. The questions put to the respondents and the response types available for each respondent were not matched exactly between different respondent groups. This limitation was taken into account in interpreting the results and its implication was considered in the discussion section of the chapter.

The pairwise agreement was analysed using descriptive methods such as count tables and barplots and agreement statistics such as Cohen's kappa measures (Cohen, 1968). The concordant groups of children, mothers, and teachers were compared to the discordant groups by analysing the differences in the population proportions of various sociodemographic variables. Fisher's exact test (Fisher, 1934) was performed to test the homogeneity of proportions between the concordant and discordant groups.

The perceptive measures (the interview responses) were then compared to the direct measure of children's receptive vocabulary skills tested using the BPVS. The BPVS is a one-to-one test measuring children's receptive vocabulary skills and is suitable for pre-school to secondary school students (ages 3 to 16 years). The test comprises 14 sets, with each set containing 12 vocabulary entries. The entries cover a broad range of language proficiency as well as word classes and are allocated to different semantic and/or grammatical groupings (e.g. actions, adjectives, animals and parts, books, human body parts, buildings, emotions and social expression, food). The test was conducted by an interviewer who held up a series of pages consisting of four black and white pictures. For each page, the children were asked to select the picture that they thought best represented the word read out to them. Derived from the Peabody Picture Vocabulary Test, the test is normed for the British population. Children usually start at the age appropriate set and work down until a basal set (a set for which a maximum of 2 errors are permitted) is established. From this basal set, they work upwards until they reach their ceiling set, a set where 8 or more errors are made. Raw scores obtained from the test can be translated into population standardised scores and compared to the age-equivalents (Atkinson, 1991; Gathercole, Willis, Baddeley, & Emslie, 1994; Mahon and Crutchley, 2006; Thornley, 2010). Standardised scores are useful when a comparison needs to be made to a large, nationally representative sample that have previously taken the test (Thornley, 2010).

Standardised scores between 85 and 115 indicate the ‘*age-expected*’ range. Based on split-half reliability tests, Gathercole et al. (1994) reported a median reliability coefficient of 0.80 for 3 to 7 year olds and 0.81 for 4 to 9 year olds.

For the PIF Study, the participating children were tested using the BPVS as part of the 6-years measurement wave. The raw test scores and the standardised scores for the age group are both available from the PIF Study. Since this study focuses on the comparison within the current cohort of children, the raw scores were considered more appropriate for the most part of the analyses. Comparisons were made between the BPVS raw scores and the interview responses from the respondents using count tables and plots. An ordinal logistic regression modelling using proportional odds was performed to analyse the association between the children’s performance in the BPVS and the ratings they received from their teachers.

All analyses and graphics were performed using R version 3.4.0 (R Development Core Team, 2017). Statistical significance in all tests performed was defined by $\alpha = 0.05$. Reporting of materials and presentation of analyses was informed by the STROBE guidelines (von Elm et al., 2008).

3.3 Phase Two: PIF Prediction Model

3.3.1 Research Objectives

The main research objective of Phase Two was to determine important environmental markers that influence Pacific children's early learning success. To this end, a statistical model that incorporates variables that reflect children's health, cultural environment, behavioural and emotional functioning and family background was constructed. The data from the 6-years measurement wave of the PIF Study were used for this analysis. The results of this phase is presented in Chapter 5 of this thesis and the paper publication that has resulted from this study is included as Appendix D.

3.3.2 Data

This study builds on the Phase One research where the variables that predict a direct measure of early learning success had been identified. As in Phase One, the variables for the prediction model were obtained from the PIF Study. The questionnaires for the 6-years measurement wave contained information on (but is not limited to) children's health, behaviour, education, and home environment. In addition, interviews were conducted with various groups associated with children's development such as the primary caregivers, fathers, teachers, and even the children themselves. As a result, the information from these interviews provides a holistic perspective on children's development at age 6 years. In Phase One, the results of the analyses suggested a strong correspondence between children's English receptive vocabulary and the teacher assessments of children's oral language skills and the overall school work performances. Children's strong English receptive vocabulary skills were also relevant for concordant child-teacher pairwise assessments of children's school work performance. Hence, a direct measure of children's English receptive vocabulary was used as the outcome variable in the prediction model. The literature review on predictors for educational outcomes informed the selection of variables for inclusion in model construction. The variables that were found relevant in distinguishing the concordant groups from discordant groups in Phase One were also considered as strong candidates. Exploratory analyses of data such as correlation matrices, pairs plots, and box plots were used to determine the relationships between the candidate predictors. The variables relating to early childhood development at age 4 years and the home literacy environment were considered. The associations between the outcome variable and various socioeconomic data, home environment, and health information were analysed to determine the potential confounding factors for the prediction model. These included socioeconomic variables such as the household income, dwelling situation, and

parental educational qualifications; the home environment variables such as the number of people living together, time spent with parents, disciplinary methods used by parents, parents' marital and social relationships, and cultural orientation; health variables such as any serious health issues or injuries at age 6 years or younger and parents' health. When one confounding factor is included in the model, other variables in the same category are often not all required. However, if some related variables were considered integral to predicting Pacific children's early learning and language (often informed by the literature), these variables were included in the model despite their association. The social and health determinants of children's early educational outcomes are often interconnected. Such considerations guided the selection of method for constructing the prediction model.

3.3.3 Statistical Analysis

The analyses performed for the Phase Two study included both the descriptive and analytical methods. The descriptive analyses included exploratory data analyses of composite variables. For numerical variables, analyses of correlation matrix and pairwise scatter plots were performed. Most variables included as predictors were categorical variables. These were summarised in count tables and bar graphs. The exploratory data analyses and the literature review suggested that most candidate predictors were related. Hence, the classification tree method was selected as the most appropriate method for constructing the prediction model. The application of the method was guided by Breiman et al. (1986) and the compilation of notes based on their book is included to this thesis as Appendix C. The outcome variable was dichotomised and the prediction model was constructed using the 10-fold cross validation. An *a priori* value for the tree complexity parameter was used for initial model building, which was then varied to analyse its impact on the misclassification rates. The performance of this model was separately tested using the Leave-One-Out cross validation method. The predictors that resulted in the most accurate classification of the outcome variable were identified using the variable importance score measure (Breiman et al., 1986). The `rpart` implementation of the classification tree method in R incorporates the misclassification rates when computing variable importance score measure. These scores were plotted against the predictors using a dot plot.

All analyses and graphics were performed using R version 3.4.066 (R Development Core Team, 2017). Statistical significance in all tests performed were defined by $\alpha = 0.05$. Reporting of materials and presentation of analyses were informed by the STROBE guidelines (von Elm et al., 2008).

3.4 Phase Three: Ethnic-Specific Analyses

3.4.1 Research Objectives

The main research objective of this phase was to analyse the risk and protective factors for Pacific children's English receptive vocabulary at age 6 years. The variables of interest were chosen based on the results from the Phase Two study. The whole cohort group in the 6-years measurement wave of the PIF Study was analysed first. Then ethnic-specific analyses were performed to study how these factors influence each Pacific ethnic group differently. The results of these analyses are contained in Chapter 6 of this thesis.

3.4.2 Data

As in Phase Two, children's performance in the BPVS, a direct measure of English receptive vocabulary, was used as the outcome variable. The predictor variables were chosen based on the variable importance scores computed in the Phase Two prediction model. The cohort was categorised into Samoan, Tongan, the Cook Islands, and Other Pacific groups for ethnic-specific models. These categories were constructed based on maternal ethnicity(ies) identification. The predictors chosen were maternal cultural orientation, length of stay in New Zealand, disciplinary parenting behaviour, children's birthweight and early childhood development.

3.4.3 Statistical Analysis

A series of proportional odds ordinal logistic regression models were constructed using the above outcome and predictor variables. The missing observations were first imputed using multiple imputation methods (Rubin, 1987, 1996). In total, 1,001 cohort children were included in the analyses after the multiple imputation. A whole cohort analysis was performed to analyse the impact of selected predictors on children's English receptive vocabulary performance at age 6 years. Ethnic-specific models were constructed, and the results were presented and interpreted separately for each ethnic group. Both the crude and multivariable adjusted odds ratios were computed and tabulated for each analysis.

All analyses and graphics were performed using R version 3.4.066 (R Development Core Team, 2017). Statistical significance in all tests performed were defined by $\alpha = 0.05$. Reporting of materials and presentation of analyses was informed by the STROBE guidelines (von Elm et al., 2008).

3.5 Data and Data Management

For this doctoral research, secondary data available from the PIF longitudinal study were accessed and analysed. This section outlines the main principles governing the process of accessing data for the PIF Study and the measures that were taken to safeguard the datasets obtained from the study.

The PIF Study is an ongoing longitudinal birth cohort study of 1,398 Pacific children born at Middlemore Hospital in South Auckland in the year 2000 and their parents (PIF, 2000). The Study is based within the Centre for Pacific Health and Development Research and the National Institute for Public and Mental Health Research at the Auckland University of Technology. The PIF Study's broad aims are '*to determine optimum pathways for Pacific children and families during critical developmental periods by identifying risk and resilience factors that influence positive and negative outcomes; and to provide Pacific-specific evidence and make empirically-based strategic recommendations to improve the health and wellbeing of Pacific children and families and address the social disparities they face in New Zealand*' (PIF, 2000). The focus of the PIF Study to this point has been on studying the health outcomes, and this is the first project within the PIF Study to analyse educational success.

3.5.1 Data Identification

The relevant data for the purposes of this research were identified through the PIF data dictionary and consultation with the PIF Data Access Committee. A subset of data was accessed first to perform preliminary analyses to ascertain the appropriateness of the data and the feasibility of the research. The full datasets were subsequently requested and obtained.

3.5.2 Data Access

Once the appropriate data for the doctoral research had been identified, the application process for accessing the data was initiated. The senior supervisor for the doctoral research is an accredited researcher for the PIF Study, and hence the abridged version of data access protocol was followed. The doctoral candidate had the main responsibility of following through the application process and requesting access to the PIF external working data set. All co-researchers were informed of and have agreed to abide by the terms, conditions and the guiding principles set out in the PIF Data Access Protocol. The research team received consultation from the principal members of the PIF Study team, including the Study Director and Data Manager, in regards to the doctoral research plan, project title,

research problem and its significance, research methodology and expected outcomes, the anticipated date of completion, and the proposed dissemination plan.

3.5.3 Data Storage

The datasets thus obtained were stored securely on the researchers' devices. The doctoral candidate was responsible for creating and maintaining copies for back-up purposes and adequate documentation to accompany the datasets.

3.5.4 Data Security and Confidentiality

Only the doctoral researcher and the senior supervisor had access to the datasets stored on the University of Canterbury computer system and the individual devices. The research team has taken all reasonable steps to prevent unauthorised, either deliberate or unintentional, access to the copies of datasets. The research team has adhered to the industry best practice regarding security of datasets and procedures to safeguard the privacy of study participants and their families. The research team complied with all applicable law, regulations, and ethical approvals when using the data.

The doctoral researcher and the co-researchers have made all possible efforts to assure that the data obtained from the PIF Study were only used for the purposes of approved research. The research team has also endeavoured to ensure that no process was conducted that would generate and(or) disclose any identifying information about the study participants and(or) no report or published outcomes based on the dataset would directly or indirectly disclose identifying information related to the study participants.

3.5.5 Dissemination of Research Output

All manuscripts and other outputs of research using the PIF datasets intended for a public domain were submitted to the PIF Study team for approval prior to the publication to ensure that the publication is consistent with the aims and guiding principles of the PIF Study. The doctoral research team has made all reasonable efforts to ensure that all manuscripts or other outputs that include ethnic-specific analyses and findings comply with the privacy and data security principles of the PIF Study. When submitting an article for publication or presenting a paper, the research team made appropriate acknowledgements that the dataset had been sourced from the '*Pacific Islands Families Study, Centre for Pacific Health and Development Research, Auckland University of Technology*' and any other organisations or individuals as approved by the PIF Data Access Committee. The contribution of the PIF Study families is also stated in the acknowledgements section of this thesis.

3.6 Ethical Considerations

This doctoral research analysed secondary data from the PIF Study, a contemporary New Zealand longitudinal study. The PIF Study, which is maintained by the Centre for Pacific Health and Development Research of the Auckland University of Technology, has been studying various human health and wellbeing related issues of Pacific families living in New Zealand since 2000. As such, the PIF Study adheres to the guidance stipulated under the Helsinki Declaration for human experimentation (Paterson et al., 2006). Ethical approvals for the PIF Study were obtained from the Auckland Branch of the National Ethics Committee and the Health and Disability Ethics Committee. In addition, all measures included in the PIF Study have been piloted and approved by the Pacific Advisory Group, an independent body of Pacific community leaders who advise on the cultural and scientific directions of the study. Both the PIF Study and this doctoral team are assisted on a regular basis by Pacific advisors on ethical issues pertaining to this study.

This doctoral research is part of the multi-institutional and multi-disciplinary research efforts of the National Science Challenge titled ‘A Better Start - *E Tipu e Rea*’. In particular, it sits within the project titled ‘*Eke Pānui, Ake Tamaiti*: Bring Forth and Uplift the Child’ conducted by the College of Education, Health and Human Development of the University of Canterbury – *Te Whare Wānanga o Waitaha*. At the time of doctoral confirmation, the Chair of the Human Ethics Committee at the University of Canterbury was consulted as to the requirements of ethics approval for this research. A separate ethics approval for the use of secondary data for this doctoral research was not deemed necessary given that the ethics approval had been obtained for the National Science Challenge - and for the PIF Study. It was recommended, however, to obtain a signed letter from the study team governing the longitudinal study acknowledging the use of their data for the doctoral research.

We proceeded to communicate with the PIF Study team regarding the use of their data for the purposes of this doctoral research. As a result of this communication, a copy of the signed letter acknowledging the use of the PIF data was obtained from the PIF Study Director, Dr. el-Shadan Tautolo. A copy of this letter is included as Appendix A of this thesis.

3.7 Limitations for the Analyses

The analyses planned for addressing the research questions were contingent on the availability of apposite data from the PIF Study and elsewhere. The measure of children's English receptive vocabulary, the BPVS, was normed using a British monolingual population due to the lack of corresponding population assessment data on New Zealand children. This would likely to have introduced some cultural bias in measuring Pacific children's English receptive vocabulary skills. The BPVS was also the only outcome used as a measure of children's early language development. A more comprehensive suite of measures would have been ideal had they been available to gain more accurate indication of how the children were developing in their early language skills.

The PIF Study is Auckland-centred with most of the children deliberately recruited from the wider Auckland region. However, Pacific children in other geographical locations may have different explanatory drivers or the same drivers but of different relevance. Hence, the results from the analyses may not easily be extended to infer educational and health outcomes for Pacific children growing up in other regions in New Zealand.

Education, health, and other social systems evolve continuously. Unless the constructed models reflect this dynamic nature of the environment, or updated continuously to incorporate the changes, the outcomes derived from these models could become less precise and efficient. Despite the availability of large databases and the best use of contemporary epidemiological and biostatistical techniques, there is still a chance that even the optimally chosen statistical models could perform relatively poorly in terms of goodness of fit, precision and efficiency. This was indeed the case for the prediction model constructed. The variability inherent in the educational data meant that the model produced lower performances in the test data limiting its utility as a prediction model for children's early receptive vocabulary skills. Some important sub-Pacific ethnic groups had less strong representations in the database. The analyses were limited to including only a small number of predictors to compensate for the loss in power for these ethnic groups.

This PhD is funded by the National Science Challenge and has a time constraint of three years of funding. The time limit was taken into account when planning analyses for this thesis during the proposal stages.

Chapter 4

Phase One: Perceptions of Pacific Children's Academic Performance at Age 6 Years: a Multi-informant Agreement Study

4.1 Introduction

Culture plays an important role in shaping one's views towards education (Lynch, 2011; Nasir & Hand, 2006). It is of relevance to educators to analyse how differing cultural backgrounds influence students' learning and how teachers can interact with them given those differences. The New Zealand classrooms and schools today cater for a large number of migrant students who bring with them their unique cultural heritage and languages. Within this culturally rich and diverse environment, teachers are challenged with meeting the needs of students and their families whose expectations and perspectives around education may differ from their own due to cultural differences (Lea, 2012; Lynch, 2011; Spring, 2009). This is especially relevant for primary school teachers who are predominantly Pākehā but have students whose ethnic composition is much more diverse than their own (MoE, 2016c).

For those students whose families have recently migrated to New Zealand, their immigration history and acculturation can importantly shape their views on educational expectations and achievement. This also appears to be true for Pacific students. Pacific students and their parents have voiced the importance of incorporating their cultural identity in education (Fletcher et al., 2009). In turn, their traditions and cultural heritage have been found to influence their expectations and attitudes towards education (Fairbairn-Dunlop, 1981). Their immigration history also manifests in their language profiles. Most Pacific

children were emerging bilinguals as evidenced from a large birth cohort study (Taylor, 2011) and their English receptive vocabulary skills measured using a direct measure were significantly influenced by the language spoken at home. Further, significantly differential acculturation and the English language fluency were found between the New Zealand-born and Pacific born mothers (Schluter, Tautolo & Paterson, 2011).

Based on this intrinsic connection between immigration and acculturation, differing perceptions of Pacific children's early academic performance held among students, their mothers, and teachers are investigated in this study. Such multiple perspectives are studied in recognition that children's early academic development depends not just on the pedagogic relationships between teachers and children, but also on the holistic growth of children with the involvement of parents and the wider community. Various sociodemographic factors surrounding the children, their mothers, and the teachers are also analysed to study the impact of differing backgrounds on the children's academic performance.

4.1.1 Culture and Perceptions of Academic Performance

In a child's education, both parents and teachers are recognised as the key contributors to the process of learning at home, at school, and in the community (Ankrum, 2016; Epstein, 1985; Epstein et al., 2002). Under the communitarian school of thought, engaging parents and facilitating parent-teacher relationships are important aspects of fostering shared responsibility and commitment to children's education (Epstein et al., 2002). In this paradigm, the emphasis is placed on demonstrating care and understanding within parent-child and teacher-child relationships rather than on a one-directional didactic style where teachers and parents impart their knowledge to their children. This approach necessarily recognises students' perspectives as important elements in defining educational success, setting educational objectives and measuring student performances against those objectives.

Within the current New Zealand educational system, teachers are often responsible for making the overall judgement of children's academic performance in the first few years of school (MoE, 2016a, 2016b). This may create tensions between parents, teachers and children if they do not share the same views on children's educational goals and assessments (Lasater, 2016). Studies on the impact of culture on education have noted that there are significant intercultural differences in thinking patterns and that these are influenced by students' cultural backgrounds and languages of those cultures (Davies, 2007; Lynch, 2011). The multicultural environment of classrooms and schools today thus presents additional complexities in interpreting differing views and perceptions of academic success held by students, parents, and teachers. A study of migrant parents and teachers found that cultural conflicts between home and school could have a negative impact on

migrant children's motivations for studying (Lea, 2012). However, cultural coherence in education can act as a protective factor and lacking this coherence and understanding about different perspectives of learning held between home and school could hinder the academic progress of those children (Lea, 2012). The impact of these differing perspectives on children's academic performance needs investigating.

Concordances between the parent-child, parent-teacher and teacher-child perceptions of academic performance within the general population, however, has not received much research attention. Most of the literature has focused on the concordance in perceptions of academic success among children with known learning difficulties (LDs) and their parents and teachers. For example, Montgomery (1994) studied the perceptions of academic self-concept of students with LDs aged 11 to 16 years and found slight to moderate agreements between the parent-child, child-teacher, and parent-teacher dyads. A recent paper on the level of agreement between mothers', fathers' and teachers' ratings of behavioural and emotional problems in 4,469 children aged between 3 and 5 years also reported poor agreement between the parent and teacher ratings (Fält, Wallby, Sarkadi, Salari & Fabian, 2018). The inter-rater agreement on the responses to the Strengths and Difficulties Questionnaire was analysed using both Pearson's correlation and intraclass correlations. The analyses revealed poor agreement in both mother-teacher and father-teacher ratings indicating the need for incorporating both parents' and teachers' judgements on children's behavioural and emotional functioning.

Although some attributed the lack of concordance between different informants to signal unreliability in one or more of the informants, others have argued that they reflect valid contributions of different information (Achenbach, McConaughy & Howell, 1987; Jensen et al., 1999). Indeed, pooling information from multiple informants and analysing differences can help researchers to obtain a more comprehensive picture with which to predict children's behaviours or diagnose LDs (Azad, Reisinger, Xie & Mandell, 2016; Jensen et al., 1999; Sointu, Savolainen, Lappalainen & Epstein, 2012).

Murray, Murray and Waas (2008) noted that the primary basis often cited by researchers for not including children's perspectives in their studies is the lack of reliability and validity in children's self-reported measures. However, this stance conflicts with the peer- and self-assessment (PASA) strategies promoted by those who support using learning assessments primarily for formative purposes (Andrade & Valtcheva, 2009; Black, Harrison, Lee, Marshall & Wiliam, 2003; Harris & Brown, 2013). The proponents of formative learning practices emphasise the benefits of PASA in empowering students, developing students' self-regulation, and communication skills and improving student engagement (Andrade, 2010; Brown, Andrade & Chen, 2015; Harris, Brown & Harnett, 2015). Harris and Brown's (2013) synthesis of students' and teachers' perspectives on PASA practices

observed in New Zealand classrooms revealed that students and teachers placed different emphases across the main conceptions of assessment. This may explain the low to moderate concordances between students' self-assessment and teachers' evaluations or test performances found in studies reviewed by Brown et al.(2015). However, the relationship between differing perceptions arising from cultural differences and the impact on children's academic performance remains largely unknown.

4.1.2 Pacific Children within a Multicultural Educational Setting

Educational migration and the generally increased mobility of the global population are relatively recent phenomena that influence many Western societies (Spring, 2009). As a result, educators and educational systems have to meet the needs of culturally and ethnically diverse student compositions (Lea, 2012). New Zealand is at the forefront of this with half (50%) of the children aged between 5 and 10 years in 2016 identified as Pākehā or New Zealand European, 26% of the children identified as Māori or New Zealand's indigenous people, 11% identified as Asian, and 10% identified as Pacific (MoE, 2016c). This ethnic diversity makes it necessary to incorporate the different cultural knowledge and identity of students into teaching and is likely to impact on the agreement between parents, teachers, and children on their perceptions of children's academic performance. The extent of this impact, however, has not received much research attention.

As discussed in Chapter 1, there are historical and well-known disparities in achievement outcomes within primary and secondary education across ethnic groups in New Zealand (MoE, 2016c). The disparities affect Pacific student outcomes more acutely than the general population of students (MoE, 2016c, 2016e, 2016f). Pacific people are one of the fastest growing subpopulations in New Zealand and are a relatively youthful population (Rush, Oliver & Plank, 2016; SNZ, 2013). This creates a need to understand educational achievement from Pacific perspectives and to design and implement plans to help realise the educational aspirations for this group. The New Zealand Government's latest Pacific Education Programme (MoE, 2017a) demonstrates their intention to address this need and is aimed at raising Pacific educational participation and achievement through improved cultural responsiveness and greater involvement of Pacific perspectives in both the curriculum and governance.

4.1.3 Analysing Different Perceptions of Academic Performance

Pacific peoples in New Zealand, who are the focus of this work, are typically from immigrant backgrounds and identify with the cultures of neighbouring Pacific countries. Despite the geographic proximity of Pacific countries to New Zealand, those from the Pacific immigrant backgrounds are often faced with more adverse health, economic, educational,

and social outcomes in New Zealand compared to the general populations (Paterson et al., 2006, 2008; Rush et al., 2016; Sundborn et al., 2011). Improving Pacific people's educational outcomes and providing supportive educational environments are seen as some of the ways to mitigate these adverse outcomes. However, it is important to reflect their perspectives and be responsive to their cultural values and traditions when designing strategies to positively intervene in Pacific students' educational enterprise. Being in different generations of immigration and experiencing varying degrees of acculturation are also likely to impact on Pacific students' educational expectations and outcomes (Borrows et al., 2011). The disparate views on educational goals and success held by Pacific students and their teachers motivate further investigation into this phenomenon using larger and more general populations (Fletcher et al., 2009).

One such dataset is the PIF Study, an on-going birth cohort study of 1,398 Pacific children growing up in New Zealand (PIF, 2000). The PIF Study has been following a cohort of Pacific children since their birth in 2000. The study's collection of data includes interviews with parents, teachers and children, demographic and health information, and educational and behavioural test results. The datasets encompass domains that provide a holistic view of Pacific children's development. The PIF data were used in this study to analyse different perceptions of Pacific children's early academic performance held by Pacific children, and their parents and teachers.

All children in New Zealand are legally required to have started their formal education by age 6 years. However, most start their primary school education on their 5th birthday, which means that they would have had approximately one year of formal instruction by the age 6 years. The availability of teacher's overall assessment of children's literacy and numeracy skills at this age allows the researchers to study the outcomes of children's early instruction. Therefore, Pacific children's self-reported academic performance at this age can be obtained from the 6-years measurement wave of the PIF Study and contrasted with the responses from the children's mothers and teachers.

Analyses of self-reported measures can help elicit differing perceptions of what educational success means to different respondents. It has also been suggested that the self-reported information on individuals' perceptions of availability of support is related to their overall psychological wellbeing and resilience against stress and life transitions (Cohen & Wills, 1985; Wethington & Kessler, 1986). Further, comparisons of self-reports with standardised tests can be informative about the mismatch between self-perceptions and directly measured outcomes. Here, comparisons are made between the teacher judgement on students' oral language skills and the students' performances in the BPVS, a direct measure of children's receptive vocabulary skills (Dunn et al., 1997). The analyses were used as a way to validate teachers' assessments of children's oral language skills.

In the absence of receptive vocabulary assessments that have been designed and normed for the New Zealand population, the BPVS is one of the tools available to language and learning specialists (New Zealand Council for Educational Research (NZCER), 2018). All measures contained in the PIF Study have been reviewed by the Pacific Advisory Group and all instruments have been piloted prior to being implemented across the whole cohort. As a result, whilst these instruments may not have been designed or normed for Pacific people, they still retained some face-validity for their use for this cohort.

Cultural values and traditions held by Pacific families were found to influence their views on educational objectives and outcomes (Fairbairn-Dunlop, 1981; Fletcher et al., 2009; Podmore et al., 2003; Spiller, 2012; Taleni, 2017). In this research, the effects of maternal cultural orientation on concordances between mother-teacher and child-teacher perceptions of children's academic performance were analysed. The immigration history of Pacific families also manifests in the families' language profiles. Taylor (2011) found that 46% of the PIF households exclusively spoke Pacific language(s) at home despite the majority of cohort mothers reporting proficiency in the English language. The proportion of parents reporting fluency in English increased with the years lived in New Zealand (Schluter, Tautolo & Paterson, 2011). Further, the language spoken at home significantly influenced the cohort children's performances in the BPVS. The PIF mothers' proficiency in the English language was analysed in connection with the concordances between the participants on their perceptions of children's academic performance. The differences between concordant and discordant groups in terms of their sociodemographic profiles were also analysed.

4.1.4 Research Objectives

In this chapter, Pacific children's early school work success is investigated from the perspectives of the children, their mothers and teachers. The perceptions of children's school work performance in the first year of school held by the children, mothers and teachers were compared using concordance and agreement statistics. The sociodemographic factors that characterise the most concordant and discordant groups of mother-teacher and child-teacher pairs were then analysed. The teacher assessment of children's oral language skills was also compared to the children's performance in the direct measure of receptive vocabulary skills to analyse the validity of teacher assessments.

4.2 Methods

4.2.1 Study Design

Data from the 6-years measurement wave of the PIF Study, which included both maternal and child interviews, augmented with teachers' assessments and the BPVS test results were analysed.

4.2.2 Subject Population

The subject population were Pacific children and their mothers and teachers who participated in the PIF Study at the 6-years measurement wave. The eligible children were born at Middlemore Hospital in South Auckland, New Zealand, between 15 March and 17 December 2000. Additional inclusion criteria included one of the child's parents being Pacific and one being a New Zealand permanent resident. The participating families were recruited through the Birthing Unit, in conjunction with the Pacific Islands Cultural Resource Unit. Consents were sought from the mothers to make home visitations within 6 weeks of the children's births. At approximately 6-weeks postpartum, potential participants were visited at home by female Pacific interviewers fluent in both English and Pacific language(s). Once eligibility was confirmed and written informed consent obtained, mothers participated in one-hour interviews concerning family functioning and the child's health and development. These home visits were repeated at approximately 1-year, 2-years, 4-years, and 6-years postpartum.

The children were independently interviewed for the first time at the 6-years measurement wave. Most of these interviews were conducted within the children's school settings. This was also the first time the teachers were approached to take part in the study. The teachers who gave their consents were given a questionnaire and asked to send the completed forms back to the study team. Full information on the recruitment and retention of the PIF participants are available in cohort profile publications (Paterson et al., 2006, 2008).

4.2.3 Rater Population

Three population groups – children, mothers and teachers – were analysed in this phase. Each group were asked to rate the children's school work performance in the first year of school. All responses were self-reported and revealed each participant's perceptions of the child's school work performance. These perceptions were then analysed in pairs: child-mother, child-teacher and mother-teacher groups.

4.2.4 Direct Measure

The children were tested using the BPVS to measure their English receptive vocabulary skills as part of the 6-years measurement wave assessment. A more detailed account of derivation of the BPVS scores is provided in Section 3.2.

4.2.5 Self-reported Measures

The participating children, mothers, and teachers were asked to evaluate the children's academic performance using Likert-type scale responses.

The children provided self-reported academic performance on a 5-point Likert-type scale. They were asked to respond to the statement, 'I am good at school work' using the responses: 'Yes always (AY)'; 'Yes sometimes (SY)'; 'Child understands the sentence but does not state yes or no (N)'; 'No sometimes (SN)'; and 'No always (AN)'. The response types were tailored so that they were suitable for young children.

The mothers provided responses on a 5-point Likert-type scale to the question, 'Based on your knowledge of your child's school work, how is he/she doing in school this year?' Responses were made in the scale of 'Very well (VW)'; 'Well (W)'; 'Average (A)'; 'Poorly (P)'; and 'Very poorly (VP)'.

The teachers were asked to evaluate the children's performances in reading, oral language, written language, and mathematics. Their responses were made in the scale of a 5-point Likert-type scale of: 'Excellent (E)'; 'Very good (VG)'; 'Satisfactory (S)'; 'Needs improvement (NI)'; and 'Very poor (VP)'. To form a global score for the overall teacher assessment of children's academic performance at age 6 years, the scores for individual academic areas were added then categorised into the following five levels using the mean (\bar{x}) and the standard deviation (SD) of the summed scores: $[0, \bar{x} - 1.5SD)$; $[\bar{x} - 1.5SD, \bar{x} - 0.5SD)$; $[\bar{x} - 0.5SD, \bar{x} + 0.5SD)$; $[\bar{x} + 0.5SD, \mu + 1.5SD)$; and $[\bar{x} + 1.5SD, 20)$. These five levels corresponded to the ordered scale of a Likert-type response. The overall teacher assessment scores were then compared with the children's and their mothers' responses.

4.2.6 Demographic Information

Sociodemographic Information on Mothers

Self-reported sociodemographic information was obtained through maternal interviews at 6-weeks postpartum (baseline) and at the 6-years measurement wave. Given maternal consent, information from Middlemore Hospital and Plunket records at birth and the baseline were obtained to corroborate the responses. The sociodemographic information collected at the baseline included age, ethnicity, the highest level of educational qualification, marital status, the household income, English language fluency, and maternal

acculturation/cultural orientation types.

Maternal age was determined from the date of birth and the date of interviews at the baseline. The number of years thus obtained was then categorised into: <20 years; 20–24 years; 25–29 years; 30–34 years; 35–39 years; and ≥ 40 years. Mothers could select an ethnic group that they identified themselves most with from the following options: Samoan; Cook Islands Māori; Niuean; Tongan; Fijian; Fijian Indian; Tokelauan; Tuvaluan; Māori; New Zealand European/Pākehā; and Other. These responses were further collapsed into Samoan; Cook Islands Māori; Tongan; Other Pacific - to include the Pacific ethnicities other than the previous three and also to group those who identified with more than one major ethnicities - and Non-Pacific - to include those mothers who were eligible because of their Pacific partners.

Maternal education was elicited from several questions. At the baseline, they were asked about their 1) highest school qualification¹ and the 2) highest post-school qualification². The responses to the above questions were recoded into three categories: No formal qualification; Secondary; Post-secondary qualification.

The social marital status was categorised into the following three types: Partnered, legally married; Partnered, in de facto relationships; and Non-partnered. These responses were obtained from several questions relating to the marital and relationship status of mothers.

Numeric responses to annual household income question at the baseline were recoded into a categorical variable with the following levels: $\$0 \leq \$20,000$; $\$20,000 - \$40,000$; $> \$40,000$; and 'Unknown, declined to respond' – which included mothers with missing observations or who declined to respond to this question. To put these categories into perspective, the median weekly New Zealand household income from all sources was \$1,129 in the June quarter of 2006 (www.stats.govt.nz). This converts to the median annual household income of \$58,708.

To elicit maternal language proficiency, the mothers were asked about their fluency in the following languages: Samoan; Cook Islands Māori; Niuean; Tongan; Fijian; Hindu; Tokelauan; Māori; English; Other; Don't know, decline; Not Applicable; and Missing. The responses to the above question were dichotomised into 'Yes' or 'No' responses.

¹Responses could take the form of the following: No formal qualification; New Zealand School Certificate in 1 or more subjects; New Zealand 6th Form Certificate in 1 or more subjects; New Zealand University Entrance (pre 1986) in 1 or more subjects; New Zealand Higher School Certificate or Higher Leaving Certificate; New Zealand University Bursary or Scholarship; Other New Zealand secondary school qualification; Overseas secondary school qualification; Don't know, decline; and Missing.

²Responses could take the form of the following: No other qualification; Trade Certificate; Advanced Trade Certificate; New Zealand Certificate or Diploma; Technicians Certificate; Polytechnic Certificate or Diploma; Teachers Certificate or Diploma; Other; Don't know, decline; and Missing.

Maternal acculturation profile or cultural orientation was conceived using Berry's bi-directional framework (Berry, 2003, 2006), which measures a group's adoption and maintenance strategies for culture from a bi-dimensional perspective. The framework is bi-directional or reciprocal in a sense that cultural changes can occur for either or both of the migrating and host societies. The bi-dimensional framework is based on the conjecture that an ethnic minority residing in multi-cultural societies should confront two essential questions: whether to maintain their ethnic identities from the culture of origin and whether to be actively involved in the majority host culture (Borrows et al., 2011). The result is a position on a spectrum largely categorised into four cultural orientation groups: integration, assimilation, separation and marginalisation (Berry, 2003).

Integration represents people who have adopted the attitudes and behaviours of the host culture but who have also maintained those of their culture of origin. Assimilation represents the group who have largely adopted the attitudes and behaviours of the host culture without retaining those of their original culture. Separation refers to the group who have failed to adopt attitudes or behaviours of the host culture or engage with the majority society but relies on maintaining their own cultural behaviours and connections. Marginalisation occurs when a person fails to recognise or engage with the host culture and is also disconnected from the society and the culture of their origin.

The acculturation instrument used for the PIF Study was an adaptation of the General Ethnicity Questionnaire (GEQ) (Tsai, Ying and Lee, 2000). The scale was shortened to reduce burden on interviewees and to only focus on activities and behaviours that are relevant for the New Zealand context. The original 38-item GEQ scale was reduced to 11 items but included key items relating to five of the six specific cultural dimensions identified in Tsai et al. (2000) and reflected the two fundamental issues of interest: (a) maintaining one's heritage, culture and identity; and (b) relative preference for having contact with and engaging in the larger society. The questions thus included reflected specific cultural dimensions of language, social affiliation, activities, exposure in daily living and food (Borrows et al., 2011). Table 4.1 contains these 11 questions. The adapted acculturation measure received positive feedback from pre-participant focus group and the Pacific Advisory Group, an independent body of community representatives who advise on the cultural and scientific directions of the study (Borrows et al., 2011). See Borrows et al. (2011) for more in-depth discussion of the adaptation and modification of the GEQ for the New Zealand context and the resulting validity and reliability.

Demographic Information on Children

Demographic information on the children included age, sex, ethnicity, birth order, and internalising/externalising problem behavioural scores. The age of the children was mea-

Table 4.1: Pacific and (New Zealand) Cultural Orientation Scales

Cultural Orientation Items
[a] I was brought up the Pasifika (New Zealand) way.
[b] I am familiar with Pasifika (New Zealand) practices and customs.
[c] I can understand a Pasifika language (English) well.
[d] I have several Pasifika (non-Pasifika) friends.
[e] Most of my friends speak a Pasifika language (English).
[f] I participate in Pasifika (New Zealand) sports and recreation.
[g] I speak a Pasifika language (English).
[h] I have contact with Pasifika (non-Pasifika) families and relatives.
[i] I eat Pasifika (non-Pasifika) food.
[j] I visit a traditional Pasifika healer (Western-trained doctors) when I have an illness.
[k] I go to a church that is mostly attended by Pasifika (non-Pasifika) people.

sured using the difference between the date of birth and the date of interviews. The children's biological sex was identified at the baseline and categorised into Female; Male; Don't know, decline; Missing. The last two response types were set to missing. Maternal parity was used as a proxy for the children's birth order. Parity was measured as any number of births that extended beyond 24 weeks of gestational period.

The children's ethnic identities were elicited from the mother and recorded at the baseline. The ethnicities were categorised into either: Samoan; Cook Islands Māori; Niuean; Tongan; Fijian; Fijian Indian; Tokelauan; Tuvaluan; Māori; New Zealand European/Pākehā; Other; and Missing. These types were further collapsed into Samoan; Tongan; Cook Islands Māori; and Other Pacific.

The mothers were asked to complete the Child Behaviour Checklist 6-18 (CBCL) for their children (Achenbach, McConaughy, Ivanova, & Rescorla, 2011). The CBCL broadly looks at internalising (depressed/withdrawn) and externalising (aggressive/disruptive) problem behaviours and can be standardised using the age and gender norms (Paterson, Taylor, Schluter & Iusitini, 2013; also see Achenbach, 2010). The norms are separated into 6–10 and 11–18 years age groups and the score of 50 is set to be the average with standard deviations of 10. The scores below 93rd percentile (standardised scores of 65) are considered a normal range, the scores between 93rd and 97th percentiles are considered borderline and the scores above 97th percentile are considered clinical internalising or externalising behaviours (Achenbach et al., 2011).

Demographic Information on Teachers

The teachers self-reported their sex as either male or female. The teachers were asked to disclose all ethnicities that they identified with among the following groups: New Zealand Pākehā; Māori; Samoan; Cook Islands Māori; Tongan; Niuean; and Other. When multiple ethnicities were declared, the groups that they identified with most strongly were used in the analyses. The teachers who identified with multiple ethnic groups equally strongly were left as a separate category. Years of teaching experience were provided as numeric responses which were then coded into a categorical variable with three levels: ≤ 5 years; 6–10 years; and >10 years.

4.2.7 Measurement Procedure and Rating Process

Interviews with all participants were conducted after written consents were obtained from the mothers. Only interviews conducted at the baseline and at the 6-years measurement wave were used in the analyses. The interviews were conducted with female Pacific interviewers who were fluent in both English and Pacific language(s). At the baseline, the mothers were consulted whether they wanted the interviews conducted in English or their Pacific language. The interviews with mothers usually lasted around one hour and were conducted at their family home. The children were mostly interviewed at school and only after written consents were obtained from their mothers and the children assented to being interviewed. The participating teachers were provided with a questionnaire and asked to return the completed forms.

4.2.8 Ethics

Ethical approvals obtained by the PIF Study and the considerations given to this research are discussed in Section 3.6. The approval letter for this research from the PIF Study is included in the Appendix A.

4.2.9 Statistical Analysis

All analyses and graphics were performed using R version 3.4.0 (R Development Core Team, 2017), and $\alpha = 0.05$ defined statistical significance. The reporting of the material and the analyses presented in this study were informed by the STROBE guidelines (von Elm et al., 2008).

Definitions of Concordance and Discordance

To analyse the relationships between perceptions of academic performance held by each participant group (mothers, teachers, and children), the following terminologies were de-

fined. The term *complete concordance* refers to those pairs who provided the ratings at the same level of scales, that is, the pairs who are on the diagonal axis of the pairwise count tables in Tables 4.7 to 4.9. The term *partial concordance* is used for those pairs who are close to the complete concordance but not exact. To be precise, they are those pairs for which one of the pairs lies off the diagonal by one level above or below. An example of a completely concordant pair is mother-teacher ratings of (VP, VP). An example of a partially concordant pair is mother-teacher ratings of (P, VP). All remaining pairs are defined as being *discordant*. Here, we defined the *extremely discordant* pairs as those whose ratings are on the extreme bottom left triangle of the pairwise count tables. More precisely, for mother-teacher pairs, these were (VW, VP), (VW, NI) and (W, VP); for child-teacher pairs, (AY, VP), (AY, NI) and (SY, VP); and for child-mother pairs, (AY, VP), (AY, P) and (SY, VP). The extreme discordance was only defined for those pairs in which the teacher ratings were considerably lower than the child or mother ratings. This enabled the analysis of relative optimism often shown in children's and mothers' evaluations compared to the teacher assessments (Miller & Davis, 1992).

Testing the Independence of Concordant and Discordant Groups

The proportions of completely concordant (CC) pairs, completely and partially concordant (CPC) pairs and extremely discordant (ED) pairs out of the total numbers of pairs for mother-teacher, child-teacher and child-mother groups were calculated to analyse the overall extent of concordance. The proportions of CPC pairs were compared to the proportions of ED pairs for various sociodemographic variables to study how these factors differ between the two groups. The analysis was extended to infer the concordance patterns for a more general population of Pacific children aged 6 years in New Zealand. In particular, the conditional independence between the proportions of the CPC pairs from those of the ED pairs was tested using Fisher's exact test (Fisher, 1934; McDonald, 2014). In a contingency table with fixed row and column marginal totals, the probability of observing a particular arrangement of counts can be obtained using the hypergeometric distribution. Like many other tests of independence, Fisher's exact test assumes that the individual observations are independent from one another. Among other alternative tests of independence for counts from contingency tables, McDonald (2014) recommends using Fisher's exact test for any sample size less than 1,000. For the current dataset, both Fisher's exact test using exact hypergeometric probabilities and χ^2 test using asymptotic χ^2 probabilities yielded essentially the same results. These tests were performed using the built-in base R function `fisher.test`.

Agreement in Pairwise Evaluations

Pairwise inter-rater agreement was then analysed using Cohen's weighted kappa (κ) statistics (Cohen, 1968). Cohen's κ and weighted κ statistics are often used to provide quantitative measures of agreement between observers (inter-observer agreement) and are not dependent on the assumptions of symmetry in distributions (White & van den Broek, 2004). For the dataset in question, the weighted κ statistics were considered more appropriate since it allows one to penalise more extreme disagreement such as (VP, VW) more severely than the slight disagreement such as (W, VW). The penalty function used for the analysis was a square function. Thus, a penalty of the squared distance of a ratings pair from perfect agreement (or CC) was used as the weights for computing κ .

The computed κ statistics were then interpreted using Landis and Koch (1977)'s approach. Landis and Koch (1977, p.165) suggested the guideline listed in Table 4.2 for interpreting κ statistics.

Table 4.2: The Landis and Koch approach (1977)

κ Statistics	Strength of Agreement
< 0.00	Poor
0.00 - 0.20	Slight
0.21 - 0.40	Fair
0.41 - 0.60	Moderate
0.61 - 0.80	Substantial
0.81 - 1.00	Almost perfect

For the computation of κ and its p-values from the test of null hypothesis of chance agreement ($\kappa = 0$), `irr` package version 0.84 (Gamer, Lemon, Fellows & Singh, 2012) for R was used.

Analysis of Teachers' Evaluations and the BPVS Scores

The teachers' assessments of children's oral language skills were compared to the BPVS raw scores. A box-and-whisker plot (Tukey, 1977) was used to depict the distribution of BPVS raw scores for each score given by the teachers and the median values of BPVS scores were compared. An ordinal logistic regression was fitted using proportional odds (Chuang-Stein & Agresti, 1997) to model a monotonely increasing relationship between the teachers' evaluations and the BPVS raw scores. The teachers in the study evaluated the children's oral language skills using a 5-point Likert-type scale. The counts from these

evaluations were used as the ordered response variable in an ordinal logistic regression model. The children’s English receptive vocabulary skills tested using the BPVS were used as the explanatory variable along with other covariates. The model was specified using a cumulative logit link function of the form:

$$\begin{aligned} \text{logit}[P(Y_i \leq j)] &= \alpha_j + \beta_1 x_{1i} + \dots + \beta_K x_{Ki}, \\ \text{where,} & & i &= 1, \dots, I, \\ & & k &= 1, \dots, K, \\ \text{and} & & j &= 1, \dots, J - 1. \end{aligned}$$

where β_k indicates the constant and linear effect of the explanatory variables (x_k) on the logit of cumulative probability of a teacher’s rating, j . The number of levels in the teacher assessment is denoted by J . Each predictor variable included is indexed by k and the total number of predictors is denoted using K . There are $J - 1$ or 4 non-redundant levels for teacher’s rating variable, Y . The model was fitted using the R function `polr` in MASS package version 7.3-47 (Ripley et al., 2017).

4.3 Results

4.3.1 Data Description

At the baseline (6-weeks postpartum), 1,376 mothers and 1,398 children (22 twins) participated in the PIF Study. The mean maternal age at childbirth was 27.9 years (range: 14, 57 years), with 8% younger than 20 years. Overall, 1,107 (81%) mothers were living together in married or de facto partnerships, 454 (33%) were New Zealand-born, and 535 (39%) had no formal educational qualifications. At the 6-years measurement wave, the questionnaires for 1,001 maternal and 1,019 child interviews were completed (retention rate of 73% for each group). Infants from multiple births tend to share many of the biological characteristics and including all could bias the between subject variability. Hence, only one child from multiple births (there were 18 twins remaining in the study at the 6-years measurement wave) has been randomly selected leaving data on 1,001 children and their mothers to be analysed. Teachers’ information on 548 of these children was available along with their evaluations for children’s performances in at least one of the four academic areas: reading, writing, oral language, and mathematics. The scores for each academic area were summed to create a global score resulting in the overall scores for 545 children after removing those who had missing scores for one or more of the four academic areas.

In total, 870 children provided self-assessment of their own school work. These re-

sponses were analysed in conjunction with 998 responses from their mothers, and teachers' assessments for 545 children. The BPVS raw scores were available for 877 participating children. Demographic information for 1,001 children and their mothers, and teachers of 548 children, are presented in Tables 4.3 to 4.5. The demographic representation in the dataset is discussed below.

Table 4.3: Children's Sociodemographic Profiles ($n = 1,001$)

Child Characteristics	n (%)
<i>Sex</i>	
Female	485 (48)
Male	516 (52)
<i>Ethnicity^a</i>	
Samoan	463 (51)
Tongan	174 (19)
Cook Islands Māori	47 (5)
Other Pacific	218 (24)
<i>Birth order^{b†}</i>	
1	251 (26)
2–4	561 (57)
5+	172 (17)
<i>CBCL 6-18 (6 years)</i>	
Internalising behaviour ^c	
Normal range	841 (84)
Borderline	75 (8)
Clinical	84 (8)
Externalising behaviour ^c	
Normal range	709 (71)
Borderline	145 (14)
Clinical	146 (15)

^a 99 (10%) values missing/unknown/declined to respond.

^b 17 (2%) values missing/unknown/declined to respond.

[†] Birth order proxied by maternal parity.

^c 1 (<1%) value missing/unknown/declined to respond.

Children's Demographic Profile

Demographic information on the children is summarised in Table 4.3. 516 male children (52%) had slightly higher representation in the dataset than 485 female children (48%). Samoan ethnicity was the predominant ethnic group represented among the children, and Tongan and the Cook Islands Māori were the next major ethnic groups identified.

Mothers' Demographic Profile

Table 4.4 presents the participating mothers' demographic characteristics. The majority of mothers (592, 59%) were under 30 years of age at the time of childbirths. Most were married or in de facto relationships (814 mothers, 81%) and the majority (626 mothers, 63%) were fluent speakers of English. The mothers self-identified their ethnicities and these were categorised according to the 1996 New Zealand Census (SNZ, 1996) sub-groupings.

The largest proportion of the cohort mothers identified themselves with Samoan ethnicity (463 mothers, 46%). There were 68 (7%) non-Pacific mothers who were eligible due to their partners' Pacific heritage. Maternal cultural orientation was also elicited in relation to the New Zealand and Pacific cultures. The proportion of 314 mothers who were characterised as separated (32%) from the New Zealand culture was similar to the proportion of 316 mothers who were characterised as largely assimilated (32%) into the New Zealand society. Smaller proportions of mothers were characterised as either integrated (183 mothers, 18%) from the New Zealand society and marginalised (178 mothers, 18%) from both cultures.

Teachers' Demographic Profile

Demographic information on the teachers was available for 548 cohort children. These results are presented in Table 4.5. Female teachers taught the great majority of children leaving only 5% of the students being taught by males. The biggest proportion of children were taught by Pākehā teachers, while 95 children (18%) were taught by Pacific teachers, 27 (5%) by Māori and 143 (27%) by teachers of other ethnicities such as Asian and other Europeans. Years of teaching experience ranged from less than 1 year to 43 years, while the highest proportion of children (256, 48%) were taught by teachers who had less than 6 years of teaching experience.

Table 4.4: Maternal Sociodemographic Profiles at the Baseline ($n = 1,001$)

Maternal Characteristics	n (%)
<i>Age at childbirth (years)^a</i>	
< 20	73 (7)
20 – 24	241 (24)
25 – 29	278 (28)
30 – 34	229 (23)
35 – 39	143 (14)
≥ 40	36 (4)
<i>Ethnicity</i>	
Samoan	463 (46)
Tongan	218 (22)
Cook Islands Māori	174 (17)
Other Pacific	78 (8)
Non-Pacific	68 (7)
<i>Highest educational qualification</i>	
No formal qualification	371 (37)
Secondary	358 (36)
Post-secondary	272 (27)
<i>Marital status</i>	
Married/de facto	814 (81)
Single	187 (19)
<i>Household income^b</i>	
\leq \$20,000	331 (34)
\$20,001 – \$40,000	511 (53)
$>$ \$40,000	120 (13)
<i>English fluency</i>	
Fluent	626 (63)
Not fluent	375 (38)
<i>Acculturation^c</i>	
Separation	314 (32)
Assimilation	316 (32)
Integration	183 (18)
Marginalisation	178 (18)

^a 1 (<1%) value missing/unknown/declined to respond.^b 39 (4%) values missing/unknown/declined to respond.^c 10 (1%) values missing/unknown/declined to respond.

Table 4.5: Teachers' Demographic Profiles at 6-Years ($n = 548$)

Teachers' Characteristics	n (%)
<i>Sex^a</i>	
Female	515 (95)
Male	29 (5)
<i>Ethnicity^b</i>	
Pākehā / New Zealand European	262 (48)
Māori	27 (5)
Pacific Islands	95 (18)
Other	143 (26)
Multiple [†]	15 (3)
<i>Years of teaching experience^c</i>	
≤ 5	256 (48)
6 – 10	126 (24)
> 10	153 (29)

^a 4 (<1%) values missing/unknown/declined to respond.

^b 6 (1%) values missing/unknown/declined to respond.

^c 13 (2%) values missing/unknown/declined to respond.

[†]Multiple ethnicities, equally identified.

4.3.2 Assessments of Pacific Children's Academic Performance

Table 4.6 summarises the counts (%) of responses for each rater. The children generally rated themselves as performing well. The majority of children assessed their own performance highly with 496 (57%) responding that they were always good at school work. Only 10 (1%) responded that they were never good at school work. Similarly, 482 (48%) mothers thought that their children were doing well at school work and 359 (36%) mothers thought that the children were performing very well. Only 2 (<1%) mothers responded that their children were doing very poorly. The teachers' evaluations painted a very different picture with 169 (31%) children being evaluated as performing either very poorly or needing improvement. Only 39 (7%) children were given the highest performance rating by the teachers and the largest proportion of them, 205 (38%), were reported to be performing at a satisfactory level.

The children's self-assessments of their own academic performance at 6-years are pre-

Table 4.6: Perceptions of Pacific Students' School Performance at Age 6 Years - n (%)

Performance	Rater		
	Child	Mother	Teacher
0 (low performance)	10 (1)	2 (0)	49 (9)
1	44 (5)	7 (1)	120 (22)
2 (neutral/average)	1 (0)	148 (15)	205 (38)
3	319 (37)	482 (48)	132 (24)
4 (high performance)	496 (57)	359 (36)	39 (7)

sented in Figure 4.1 along with the assessments made by their mothers and teachers. Also presented is the histogram of the BPVS raw scores at this measurement wave. At 6-years, the PIF children's raw test scores in the BPVS ranged 18 and 104. The mean raw score was 49.4 with the standard deviation (SD) of 11.4. The bar graphs for each group exhibit different marginal distributions. The children's and mothers' evaluations are highly concentrated around the higher ratings. By contrast, the teachers' evaluations are almost symmetrical, as is the histogram for the BPVS raw scores.

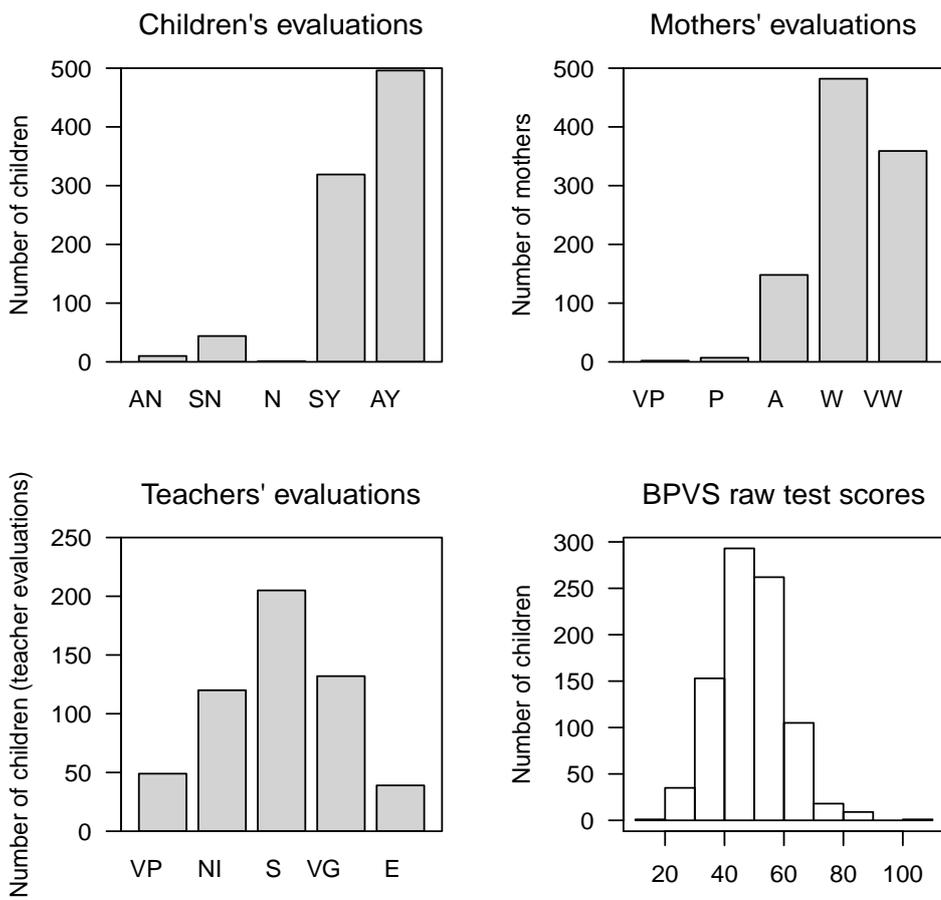


Figure 4.1: Perceptions of Pacific Students' School Performance at Age 6 Years

4.3.3 Pairwise Relationships of Pacific Children's Academic Assessments

Children's and Mothers' Assessments

The pairwise relationships between child-mother evaluations are summarised in Table 4.7. The diagonal entries (in bold text) represent the CC pairs. The CPC pairs are represented by the cells in darker shade. The ED pairs are the cells in lighter shade.

Table 4.7: Child-Mother Pairwise Count Table - n (%)

Child	Mother				
	VP	P	A	W	VW
AN	0 (0)	0 (0)	2 (0)	5 (1)	3 (0)
SN	0 (0)	0 (0)	9 (1)	18 (2)	17 (2)
N	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
SY	1 (0)	3 (0)	55 (6)	143 (16)	117 (13)
AY	0 (0)	3 (0)	68 (8)	243 (28)	182 (21)

The counts in the table show that out of 870 total number of pairs, 182 (21%) pairs gave the children the highest ratings. Overall, there were 325 (37%) CC child-mother pairs, increasing to 749 (86%) CPC pairs when the criterion is relaxed to include partially concordant pairs. Correspondingly, there were 121 (14%) discordant pairs but only 4 (<1%) of which were ED. A high concentration of counts on the bottom right corner (that is, in (SY, W), (SY, VW), (AY, W), and (AY, VW)) shows both the children and their mothers generally rated the children's performances in school work highly. The discordance occurred most frequently (243, 28%) for the child-mother assessment pairs of (AY, W). The counts in the top right corner of (AN, W), (AN, VW), (SN, W), and (SN, VW) show that there were some discordance between the children who self-assessed themselves as performing below average and the mothers who assessed the same children above average. The pairwise agreement analysed using Cohen's weighted κ statistics, however, was 0.03 (standard error (SE) of 0.032) representing negligible agreement beyond chance between the children and their mothers.

Children's and Teachers' Assessments

The pairwise relationships between child-teacher assessments are shown in Table 4.8. Of the 531 total number of pairs, 74 (14%) were CC pairs, increasing to 261 (49%) CPC pairs if partially concordant pairs are included. There were 270 (51%) discordant pairs among

whom 107 (21% of 531) were ED pairs. Among those discordant pairs, 92 children (18% of 531) responded that they were always good at school work, while the teachers rated them as performing below the satisfactory level. The above shows a high concentration of observations in the bottom two rows of the table (at children's self-ratings of SY and AY) indicating a large number of children evaluating themselves highly in school work. The most frequently observed pair of ratings were children's self-ratings of AY (the response of a child being always good at school work) and teachers' ratings of S, a satisfactory performance. The weighted κ statistics for child-teacher pairs was 0.04 (SE = 0.018) indicating a negligible level of agreement beyond chance.

Table 4.8: Child-Teacher Pairwise Count Table - n (%)

Child	Teacher				
	VP	NI	S	VG	E
AN	0 (0)	3 (1)	1 (0)	0 (0)	0 (0)
SN	5 (1)	4 (1)	10 (2)	4 (1)	1 (0)
N	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)
SY	15 (3)	42 (8)	75 (14)	44 (8)	11 (2)
AY	24 (5)	68 (13)	115 (22)	82 (15)	26 (5)

Mothers' and Teachers' Assessments

The pairwise relationships between assessments made by the mothers and teachers are presented in Table 4.9. Out of 545 total number of mother-teacher pairs, 109 (20%) were CC pairs, increasing to 335 (61%) CPC pairs if include partially concordant pairs. There were 210 (39%) discordant pairs and among those, 77 (14% of 545) were ED pairs. The observations are predominantly placed around the lower left-half of the diagonal axis in the count table. A large number of mothers gave their children positive ratings of W or VW when the teachers considered the same children as performing at a satisfactory level (S). Similar to the child-teacher pairwise relationship, there is a dearth of observations at the upper right triangle of the table. Among the discordant pairs, there were 130 (24% of 545) pairs of whom the mothers rated their children above average at school work, while the teachers rated the same children as performing below the satisfactory level. The weighted κ statistics for the mother-teacher pairs was 0.11 (SE = 0.021) indicating slight level of agreement beyond chance.

Table 4.9: Mother-Teacher Pairwise Count Table - n (%)

Mother	Teacher				
	VP	NI	S	VG	E
VP	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)
P	0 (0)	0 (0)	2 (0)	1 (0)	0 (0)
A	9 (2)	30 (6)	28 (5)	13 (2)	0 (0)
W	34 (6)	53 (10)	106 (19)	55 (10)	13 (2)
VW	6 (1)	37 (7)	69 (13)	62 (11)	26 (5)

4.3.4 Sociodemographic Differences between Concordant and Discordant Assessment Pairs

Comparisons were made between concordant and discordant pairs by analysing the differences in various sociodemographic variables between the proportions of ED pairs and those of the CPC pairs. The results from these analyses are discussed below.

Children's and Mothers' Assessments

As there were only 4 (<1%) ED pairs, further analyses of pairwise assessments and sociodemographic variables were not pursued.

Children's and Teachers' Assessments

The sociodemographic differences between the ED and CPC pairs among child-teacher assessment pairs were analysed and presented in Tables 4.10 – 4.12. These tables show the population percentages of ED and CPC pairs in each category of the variables analysed. Table 4.10 presents the results from analysing the differences in the proportions of ED and CPC pairs in children's demographic profiles for child-teacher assessment pairs. The p-values computed from the test of independence between the proportions of ED and CPC pairs are also indicated alongside the variable names. Comparing the two groups, a significantly higher proportion of children in the CPC pairs were expected to score above the age-expected level at the BPVS test ($p < 0.001$) in a more general population of Pacific children aged 6 years. Although there were slightly higher proportions of children presenting clinical internalising or externalising problem behaviours among the CPC pairs in the PIF cohort, they were not expected to differ significantly in the general 6-year-old Pacific population. Table 4.11 presents the results from analysing the differences in the

proportions of ED and CPC pairs using maternal demographic profiles for child-teacher assessment pairs. The household income proportions in the PIF cohort population were very similar between the ED and CPC pairs. There seemed to be some differences in the proportions of mothers in each age group but these differences were not expected to be significant in the general Pacific population. The results from the test of independence indicate that significantly higher proportions of children in the CPC group had mothers with post-secondary educational qualifications ($p = 0.004$), proficiency in English ($p < 0.001$), and assimilated or integrated acculturation characterisations ($p = 0.04$) compared to the children in the ED group. The same type of analyses was performed using the teachers' demographic information. These results are summarised in Table 4.12. The results show no or negligible difference in the representation of male and female teachers between the ED and CPC pairs. However, there were higher proportions of Pacific or Other ethnic group teachers among the CPC pairs than the ED pairs. In addition, more teachers in the CPC pairs had teaching experiences between 6–10 years. These differences were also expected to be significant in the general population.

Table 4.10: Children's Demographic Profiles and Concordance between Child-Teacher Pairs

Child Characteristics, % (Fisher's Exact Test)				
<i>Sex</i> (p = 0.82)				
	Female	Male		
ED	50	50		
CPC	48	52		
<i>Birth order</i> [†] (p = 0.07)				
	1	2-4	5+	
ED	21	56	23	
CPC	25	62	13	
<i>Ethnicity</i> (p = 0.58)				
	Samoan	Tongan	Cook Islands	Other Pacific
ED	53	12	5	30
CPC	50	18	6	27
<i>CBCL 6-18 (6 years) Internalising behaviour</i> (p = 0.19)				
	Normal	Borderline	Clinical	
ED	86	8	6	
CPC	79	10	11	
<i>CBCL 6-18 (6 years) Externalising behaviour</i> (p = 0.33)				
	Normal	Borderline	Clinical	
ED	74	14	12	
CPC	67	15	18	
<i>BPVS standard score (6 years)</i> (p < 0.001)				
	Below norm	Age expected	Above norm	
ED	16	82	2	
CPC	3	81	16	

[†] Birth order proxied by maternal parity.

P-values obtained from Fisher's exact test.

Table 4.11: Mothers' Demographic Profiles and Concordance between Child-Teacher Pairs

Maternal Characteristics at Baseline, % (Fisher's Exact Test)						
<i>Age at childbirth (years)</i> (p = 0.12)						
	< 20	20 – 40	25 – 29	30 – 34	35 – 39	40+
ED	9	22	22	27	11	7
CPC	7	21	31	25	14	2
<i>Ethnicity</i> (p = 0.21)						
	Samoaan	Cook Islands	Tongan	Other Pacific	Non Pacific	
ED	50	11	28	7	4	
CPC	45	16	24	5	10	
<i>Highest educational qualification</i> (p = 0.004)						
	None	Secondary	Post-secondary			
ED	38	43	19			
CPC	26	39	35			
<i>Marital status</i> (p = 0.46)						
	Married	De facto	Not partnered			
ED	64	20	16			
CPC	58	23	20			
<i>Household income</i> (p = 0.78)						
	< \$20k	\$20k – \$40k	\$40k+			
ED	34	52	14			
CPC	32	54	14			
<i>English fluency</i> (p < 0.001)						
	Fluent	Not fluent				
ED	51	49				
CPC	70	30				
<i>Acculturation</i> (p = 0.04)						
	Assimilation	Separation	Integrator	Marginal		
ED	27	38	19	16		
CPC	39	24	22	14		

P-values obtained from Fisher's exact test.

Table 4.12: Teachers' Demographic Profiles and Concordance between Child-Teacher Pairs

Teacher Characteristics at 6 Years, % (Fisher's Exact Test)					
<i>Sex</i> ($p = 0.99$)					
	Female	Male			
ED	93	7			
CPC	93	7			
<i>Ethnicity</i> ($p = 0.01$)					
	NZ Pākehā	Māori	Pacific	Other	Multiple [†]
ED	48	9	17	24	2
CPC	46	2	21	29	3
<i>Years of teaching experience</i> ($p = 0.03$)					
	≤ 5 years	6–10 years	> 10 years		
ED	47	17	36		
CPC	46	28	26		

[†]Multiple ethnicities, equally identified.

P-values obtained from Fisher's exact test.

Mothers' and Teachers' Assessments

The sociodemographic differences between the ED and CPC mother-teacher assessment pairs were analysed and presented in Tables 4.13 – 4.15. Table 4.13 summarises the results for children's demographic information. Unlike the child-teacher pairs, where there were a smaller proportion of children in Other Pacific group, a larger proportion of Other Pacific children were present in the CPC mother-teacher assessment pairs. Similar to the child-teacher analyses, a significantly higher proportion of mothers in the CPC pairs were expected to have children who perform above the age-expected level in the BPVS ($p < 0.001$) than those in the ED pairs. Table 4.14 summarises the results of analyses using maternal demographic information. There was a higher proportion of married mothers among the ED pairs but the marital statuses across mothers were not expected to differ in the more general Pacific population. Comparing the two groups, significantly higher proportions of mothers in the CPC pairs were expected to have post-secondary educational qualifications ($p < 0.001$) and be proficient in English ($p = 0.03$). Table 4.15 summarises the results from the teachers' demographic information. In the cohort, slightly higher proportions of teachers who had 6–10 years of experience or female were represented among the CPC pairs. However, these differences were not expected to be significant among the general Pacific population. A significantly higher proportion of teachers in the CPC pairs, however, were expected to be of Pacific ethnicity ($p = 0.03$) compared to those in the ED pairs. The differences in the proportions between those of the CPC and the ED pairs being due to chance could not be rejected for other demographic variables.

Table 4.13: Children's Demographic Profiles and Concordance between Mother-Teacher Pairs

Child Characteristics, % (Fisher's Exact Test)				
<i>Sex</i> (p = 0.70)				
	Female	Male		
ED	49	51		
CPC	46	54		
<i>Birth order</i> [†] (p = 0.27)				
	1	2-4	5+	
ED	21	58	21	
CPC	23	64	14	
<i>Ethnicity</i> (p = 0.25)				
	Samoan	Tongan	Cook Islands	Other Pacific
ED	59	18	4	19
CPC	47	19	6	28
<i>CBCL 6-18 (6 years)</i>				
<i>Internalising behaviour</i> (p = 0.39)				
	Normal	Borderline	Clinical	
ED	79	13	8	
CPC	81	8	10	
<i>Externalising behaviour</i> (p = 0.10)				
	Normal	Borderline	Clinical	
ED	75	16	9	
CPC	65	16	19	
<i>BPVS standard score (6 years)</i> (p < 0.001)				
	Below norm	Age expected	Above norm	
ED	12	88	0	
CPC	3	85	12	

[†] Birth order proxied by maternal parity.

P-values obtained from Fisher's exact test.

Table 4.14: Mothers' Demographic Profiles and Concordance between Mother-Teacher Pairs

Maternal Characteristics at Baseline, % (Fisher's Exact Test)						
<i>Age at childbirth (years)</i> (p = 0.15)						
	< 20	20 – 40	25 – 29	30 – 34	35 – 39	40+
ED	9	26	17	30	14	4
CPC	7	21	32	24	13	4
<i>Ethnicity</i> (p = 0.16)						
	Samoaan	Cook Islands	Tongan	Other Pacific	Non Pacific	
ED	57	17	18	4	4	
CPC	42	17	25	7	9	
<i>Highest educational qualification</i> (p < 0.001)						
	None	Secondary	Post-secondary			
ED	43	44	13			
CPC	29	38	33			
<i>Marital status</i> (p = 0.99)						
	Married	De facto	Not partnered			
ED	71	12	17			
CPC	60	22	17			
<i>Household income</i> (p = 0.54)						
	< \$20k	\$20k – \$40k	\$40k+			
ED	32	60	8			
CPC	32	55	13			
<i>English fluency</i> (p = 0.03)						
	Fluent	Not fluent				
ED	53	47				
CPC	67	33				
<i>Acculturation</i> (p = 0.11)						
	Assimilation	Separation	Integrator	Marginal		
ED	23	35	25	17		
CPC	36	28	18	17		

P-values obtained from Fisher's exact test.

Table 4.15: Teachers' Demographic Profiles and Concordance between Mother-Teacher Pairs

Teacher Characteristics at 6 Years, % (Fisher's Exact Test)					
<i>Sex</i> (p = 0.57)					
	Female	Male			
ED	93	7			
CPC	95	5			
<i>Ethnicity</i> (p = 0.03)					
	NZ Pākehā	Māori	Pacific	Other	Multiple [†]
ED	49	10	11	27	3
CPC	49	3	20	26	2
<i>Years of teaching experience</i> (p = 0.05)					
	≤ 5 years	6–10 years	> 10 years		
ED	49	15	36		
CPC	48	27	26		

[†]Multiple ethnicities, equally identified.

P-values obtained from Fisher's exact test.

4.3.5 Teachers' Assessments and the Direct Measure

The teachers' assessments of children's oral language skills at 6-years were plotted against the children's raw test scores from the BPVS (see Figure 4.2). A dotted line in the plot indicates the median BPVS raw scores (49) for all children, which is within the 95% CI (49, 51) of the median (50) of the children who received the satisfactory performance rating.

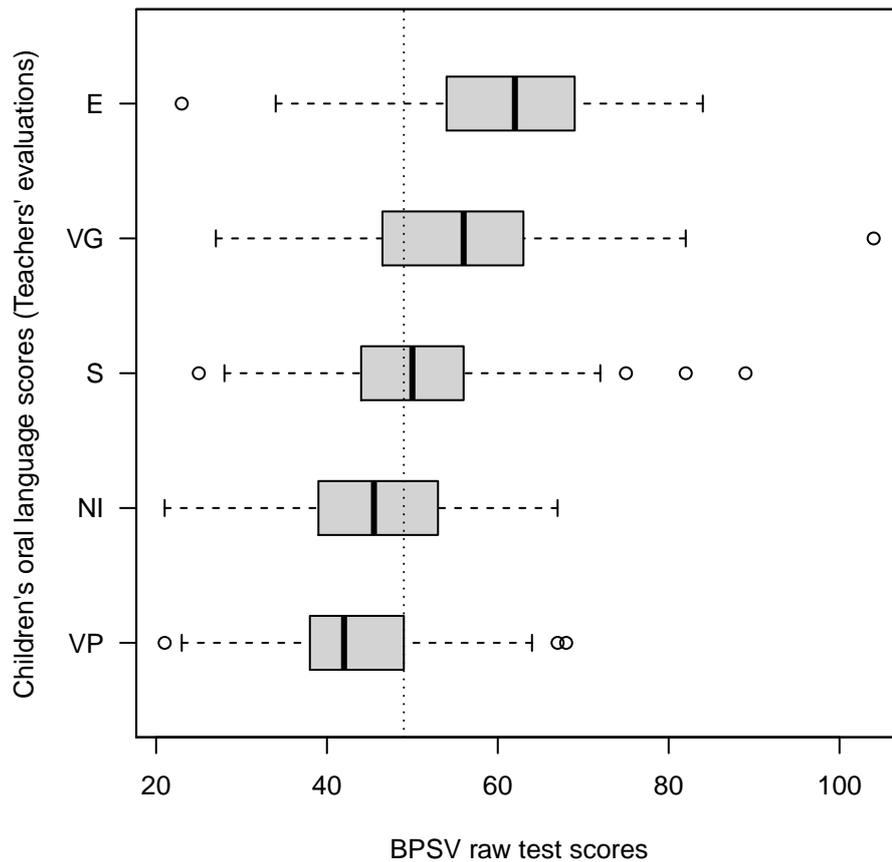


Figure 4.2: Teachers' Assessments of Children's Oral Language Skills and the BPVS Raw Test Scores

With each higher teacher rating, the median values of BPVS scores increased. This gives an indication that the children's performance in the BPVS may be positively correlated with the teachers' evaluations of children's oral language skills. The median values for each level of teachers' evaluations are summarised in Table 4.16. The median BPVS scores increased monotonely with each increase in the teacher evaluations. The estimate for intraclass correlations coefficient, however, was low at 0.22 (95% CI: 0.08, 0.70), indicating the estimate may have been influenced by unusual observations.

The monotonely increasing relationships between the teacher's evaluations of children's oral language skills and the children's performance in the BPVS observed in Figure 4.2 and

Table 4.16: Median (95% CI) BPVS Scores for Each Level of Teacher Rating

BPVS	Teacher's Evaluation				
	VP	NI	S	VG	E
Raw	42 (40, 44)	46 (44, 47)	50 (49, 51)	56 (53, 59)	62 (58, 66)
Standard	92 (90, 94)	96 (94, 98)	101 (99, 103)	108 (105, 110)	113 (109, 117)

Table 4.16 are further analysed using an ordinal logistic regression model with proportional odds as specified in Section 4.2.9. The odds of receiving a higher teacher rating increased by 1.08 (95% CI: 1.06, 1.10) for each unit increase in the BPVS raw test scores after adjusting for the household income, child's sex, ethnicity, and teacher's sex, ethnicity, and years of experience. Table 4.17 presents these results.

Table 4.17: Odds Ratios (OR) for Teacher's Evaluations (95% CI)

Variable	OR	Adjusted OR
BPVS raw scores	1.08 (1.06, 1.09)	1.08 (1.06, 1.10)

4.4 Discussion

In this study, the cohort children expressed generally positive self-perceptions of their school work performance in the first year of school. The children's self-perceptions were to some extent validated by a large number of mothers who also perceived their children's school work performance in a positive light. The teacher assessments of children's overall academic performance were characterised by a strong tendency to be centred around Satisfactory or Average performances. The level of agreement in the children's school work performance at age 6 years across the participant groups was further analysed using the weighted κ statistic. When compared across the participant groups, the assessments of cohort children's academic performance at age 6 years provided by the children, their mothers and teachers indicated negligible to slight pairwise agreements between each pair of raters. The levels of agreement among child-mother and child-teacher pairs observed in this study have not been previously investigated in the study population. The discordance between home and school found in this study is an important factor to consider when applying PASA strategies as the assessment of children's academic performance may differ importantly between teachers and students. The discrepancy between the mothers' perspectives and that of the teachers evidenced in this study is also worthy of consideration when making efforts to facilitate home-school continuity for migrant children.

Despite the lack of agreement among each pairwise relationship studied, there were some similarities between the findings from the mother-teacher and child-teacher concordance patterns which suggest that there are some important common influences to the patterns of concordance. A significantly higher proportion of mothers with proficiency in the English language were found among the concordant mother-teacher pairs. The mothers with higher educational qualifications were also more strongly represented among the group of mothers who agreed with the teachers compared to those who disagreed. The analogous study of child-teacher pairs also found similar patterns. Among the concordant child-teacher pairs, higher proportions of children had mothers who were proficient in the English language, had higher educational qualifications and enjoyed stronger connections to both the New Zealand and Pacific cultures and societies. The connection between maternal cultural orientation types and the concordance between the perceptions held by students and teachers in the general populations, to our knowledge, has not been explored previously. This study made an attempt at investigating such association.

The results, however, also point to some areas that could be improved to enhance the home-school communication and understanding, and hence the home-school continuity in the conceptions and perceptions held about the school work performance in the first year of school. For example, among the most discordant child-teacher pairs, a dis-

proportionately higher number of children had mothers who were largely separated from the New Zealand culture. The association between the English language proficiency and concordance patterns suggests that this group of mothers, largely separated from the Anglo-dominant New Zealand culture and society, may have experienced difficulty obtaining adequate information with which to assess their children's academic performance against more standardised and Western measures. Most Pacific cultures emphasise the importance of deference towards authority figures, the teachers in this instance, which may result in Pacific students and their parents not questioning teachers' views or teaching methods employed (Fairbairn-Dunlop, 1981; Fletcher et al., 2009). The above patterns of discordance suggest that Pacific mothers who are not fluent in the English language and separated from the New Zealand culture may experience cultural and language barriers to understanding their children's progress at school. The separation from the New Zealand culture may thus include disconnection from their children's schools. The home-school connection and parental involvement at schools are influenced by the interactions between students, family, school and communities and the cultural values and philosophies held by each group (Epstein, 1985; Epstein et al., 2002). Having shared goals and common practices between home and school can develop into more collaborations and hence create a more coherent learning environment for children (Epstein, 1985; Epstein et al., 2002; Patel & Stevens, 2010). The results found in the current study emphasise the need to enhance communication between Pacific homes and schools, and encourage Pacific parents' involvement at schools by fostering inclusiveness and expressing cultural responsiveness towards Pacific families (MoE, 2009; Taleni, 2017).

Even with the practice of benchmarking each student against predetermined achievement standards, there is still a potential for bias in teachers' assessments. For example, in a study involving 519 American fifth and sixth graders, Mowrey and Farran (2016) found that the teachers in the study tended to recalibrate their students' performances in mathematics based on the students within their school rather than to the national norms. This had the effect of inflated ratings for culturally diverse students from lower socio-economic backgrounds. An attempt has been made in this study to gain insight into this phenomenon by comparing teachers' assessments with the BPVS scores. The results from the ordinal logistic regression showed that the teachers in this study provided evaluations that tended to increase monotonely as the children's BPVS raw test scores increased. This result validated the teacher assessment of children's oral language development in a sense that the teacher assessments resembled the distribution of a language assessment tool that is based on externalised and directly measurable standards. However, the coefficient estimate for intraclass correlation in the BPVS raw scores within each grade showed relatively poor agreement. The presence of unusual observations could have influenced the analyses

of squared deviations in the computation of intraclass correlation coefficients. The estimated confidence interval was indeed wide in the current result. The analyses of median and the interquartile ranges were reported to supplement the result of the correlation estimate. The median scores, which are not affected by the unusual observations, show a more clear trend of monotone increases in the raw scores for each increase in the grades given by the teachers.

Data on children's behaviours obtained from multiple informant sources may show discrepancies for various reasons. Miller and Davis (1992) noted that one of the general findings from studies that compared mothers' assessments of their children's performances with those of the teachers' or the results from standardised tests among children with LDs was the tendency of mothers to overestimate their children's performances. Their own study of 60 American second and fifth graders without LDs indicated that, although both mothers and teachers tended to overestimate children's cognitive abilities, the teachers tended to be more accurate in terms of students' relative standing within their class. Patel and Stevens (2010), in their study of 179 American sixth to eighth graders (aged 11 to 14 years), also found discrepancies in the perceptions of children's academic abilities between parents, teachers, and students. Children's self-perceptions of general scholastic abilities were compared to their parents' perceptions of their children's abilities in mathematics and English/language arts subjects and the actual grades given by the teachers. The results of bivariate linear regressions revealed that in general, as parent-student or parent-teacher discrepancies in perceptions of students' academic abilities increased, the parents tended to get less involved in school activities and the schools facilitated less opportunities for parents to get involved. These results support the argument that the family-school interactions are importantly shaped by the ideas and perceptions held by students, parents and teachers (Epstein, 1985; Epstein et al., 2002). Establishing joint understanding of perceptions of children's scholastic abilities could be an important step toward enhanced home-school collaborations and parental involvement in children's education.

Some commonly believed reasons for discrepancies in multi-informant responses are relatively strong within-observer effects that are often stronger than the inter-observer effects (Demaray, Malecki, Secord & Lyell, 2013; Jensen et al., 1999; Mitsis, McKay, Schulz, Newcorn & Halperin, 2000) and children's behaviours being situation-specific (Achenbach et al., 1987; Malhi, Singh & Sidhu, 2008; Sointu et al., 2012). Of these, the relatively strong within-observer associations have been observed in studies across various domains of children's behavioural studies. For example, it has been noted that the lack of agreement between parent and teacher dyads on their observations of children's behaviours may be due to dealing with children within disparate settings and environments (Achenbach et al., 1987; Malhi et al., 2008; Mitsis et al., 2000). Children are thought to display a

different range of emotions and behaviours depending on the situation and the setting, hence allowing parents and teachers to observe children's behaviours within the context of home and school (Malhi et al., 2008; Mitsis et al., 2000; Sointu et al., 2012). It is also noted that parents and teachers may exhibit systematic discrepancies in their observations as they may have different benchmarks to compare a child to (for example, a sibling at home or other students in class), and also have varying degrees of tolerance if a child displays any problematic behaviours (Azad et al., 2016; Orylska, Brzezicka, Racicka-Pawlukiewicz, Albinski & Sedek, 2016).

The primary basis often cited by researchers for excluding children's perspectives in their studies is the lack of reliability and validity in children's self-reported measures (Murray et al., 2008). However, Murray et al.'s (2008) study of child-teacher relationships among minority children in urban kindergarten classrooms indicated meaningful differences between perceptions held by the children and their teachers. They demonstrated that these differences enhance the understanding of child-teacher relationships and, more importantly, help to identify problems with over-relying on teachers' reports alone. For instance, teachers' perceptions were more positive for students from the same ethnic backgrounds as their own, whereas the students did not perceive their relationship quality or school adjustment status differently based on their teachers' ethnicity.

The analyses of patterns of concordance and teachers' ethnicities showed that there were higher proportions of Pacific teachers among both the child-teacher and mother-teacher concordant pairs compared to the discordant pairs. These results indicate that the ethnic match could impact on the concordance or discordance between Pacific children and their mothers and teachers. However, further investigation into the direction of discordance is required to confirm the asymmetric relationships between the students and teachers that depended on the ethnic matching found in Murray et al. (2008). These results, in addition to very disparate perceptions of their own academic performance held by the children compared to those of their mothers and teachers, warrant further research into aligning and explaining the differences in PASA and teachers' assessments or results from standardised tests.

This study had a number of strengths, including the large data size compared to most studies reviewed in this chapter, the measurement wave timing at 6 years, the availability of variables that reveal a multifaceted view of children's development, and the use of psychometrically strong measures. To the candidate's knowledge, and also evidenced by the lack of relevant search results in major literature databases, this is likely to be the first study to look at the child, parent and teacher concordances in perceptions held about educational outcomes among Pacific population in New Zealand. An attempt has been made in this study to apply a nonparametric measure of agreement that applies greater

penalties to extreme disagreement than those for the slight disagreement. The datasets from the PIF Study contained a comprehensive set of sociodemographic and acculturation information on the participating Pacific families. Such information was used in this study to analyse the effect of respondents' sociodemographic backgrounds on the presence of any patterns in concordance.

Despite these strengths, the study is not without its limitations. The cohort of Pacific children were deliberately recruited from the wider Auckland region, New Zealand's most populous city, where almost two thirds of Pacific people resided (SNZ, 2013). As such caution should be exercised when generalising to Pacific communities elsewhere. Our respondents had differently worded response types available to them to evaluate cohort children's academic performances, which weakens some of the analyses presented here. The primary reason for this was to aid the participants' understanding of what they were asked to do. This was particularly important for the cohort children who were aged 6 years at the time of interviews. The overall impact of the trade-off between the improved reliability resulting from the participants' enhanced understanding of the questions and the difficulty in interpreting the differently worded response types are unknown. However, the clear differences in self-reported assessments shown in Table 4.6 are worthy of further consideration. As with all studies using self-reported measures, various sources of bias may impact on the findings. The presence of teacher-specific effects, which could not be investigated in this study (as these data were not collected), may have also affected the results. Not all eligible PIF children had complete information from their teachers and parents. Such missing observations could compromise internal validity if the missing information importantly differs from those of the observed. The BPVS test, like most other direct measures designed for a monolingual population, could suffer from cultural bias if tested on an EAL population (Carter et al., 2005) or in other geographic locations. The current study was not immune to this as evidenced from an account by an investigator who administered the test to the cohort children. For example, when a child was asked to point to the picture of a lorry, confusion ensued since it was a terminology seldom used in New Zealand and Pacific Islands (personal communication, June 14, 2017).

4.4.1 Conclusion

A recent study found that parent-teacher conflicts can result from disagreement on the perceptions of children's ability and many of these disputes could remain unresolved (Lasater, 2016). When there were discrepancies between parents' and teachers' or between parents' and students' perceptions of students' academic abilities, parents tended to become less involved at their children's schools and teachers tended to facilitate fewer programmes involving parents (Patel & Stevens, 2010). The findings in the current study provide an

important motivation for working towards resolving these conflicts and provide a holistic interpretation using children's family circumstances and their cultural associations. The results from this chapter also emphasise the importance of factors such as the mothers' familiarity with the New Zealand culture (which may support understanding of the teachers' perspectives), as well as the benefits of better education and higher socioeconomic status in general. These results help motivate future research and warrant further study of the above factors as elements in predicting children's early educational outcomes. Such study should help confirm whether the above findings are specific to Pacific immigrants or can be attributed to factors that are more ubiquitous and affect other immigrant communities as well as the general population.

For the educators, the main findings reaffirm the importance of teachers demonstrating cultural responsiveness towards Pacific students and their families and enhancing communication between home and school (Lea, 2012). Dismantling cultural barriers experienced by Pacific mothers largely separated from the New Zealand culture could encourage them to initiate conversations with teachers on their children's academic progress and be more involved at school. To this end, the initial teacher education should equip teachers with the knowledge of Pacific perspectives and values by incorporating them into teacher preparation programmes and materials (Hogg, 2016; MoE, 2017). Such demonstration of Pacific cultural values by teachers and schools could help improve home-school continuity for migrant Pacific children and enhance their educational experience. Providing support for those families at risk of cultural separation and marginalisation, empowering them to achieve higher socioeconomic circumstances, and preparing teachers to be culturally responsive are important policy implications from this study.

In Phase Two, the impact of cultural mismatch between home-school, proxied by the early cultural environment to which Pacific children were exposed is explicitly analysed in relation to the children's English receptive vocabulary development. This was achieved by constructing a prediction model which incorporates various elements of Pacific children's early development. The findings from the Phase Two study are then used to provide further evidence of the importance of cultural, linguistic and socioeconomic continuity on children's language development.

Chapter 5

Phase Two: Integrating Health, Education, and Cultural Factors in Predicting Pacific Children's Receptive Vocabulary at 6 Years

5.1 Introduction

Educational success, for most, can be an important foundation on which one can build their career aspirations and other important life goals. However, not all children are equally placed in achieving this crucial platform. Disparities in educational achievement levels across countries and societies are evident in the 2015 PISA results for the OECD members (OECD, 2016). Furthermore, there is a concerning trend of achievement gaps between different ethnic groups within those OECD countries. For example, in New Zealand, a developed and ethnically diverse country, a wider gap between the top and the bottom ten percent of students was recorded than for most other OECD countries indicating relatively low equity in learning outcomes (MoE, 2016f).

Although the PISA measures the learning outcomes in students at ages 15–16 years, the importance of early language skills in predicting those later results cannot be overstated. A study using large scale, nation-wide longitudinal studies in the US and Canada analysed the impact of early receptive vocabulary skills on PISA reading scores and demonstrated that the difference in the results between the two cohorts existed at ages 4–5 years and remained 11 years later at ages 15–16 years (Merry, 2013). Similarly, the evidence of disparity among New Zealand students in their attainment of literacy skills appears much earlier. The 2016 PIRLS which assessed the reading skills at age 10 years showed similar patterns of ethnic disparity in reading outcomes in New Zealand (MoE, 2016e). Pacific

children, on average, start their secondary education at a lower level of literacy skills compared to the European children and the gap persists throughout the school years (New Zealand Qualifications Authority (NZQA), 2016). Here, it is important to point out that these standardised measures are highly externalised and have predominantly Western cultural underpinnings for conceptualising educational success. As such, they are unlikely to reflect the holistic concept of educational success often expressed by Pacific learners, families and communities (Fletcher et al., 2009, Podmore et al., 2003; Taleni, 2017). However, the Pacific communities have also expressed their yearning for an integrated membership within the New Zealand society, and succeeding in the Pākehā/*Palagi* sense as well as in the Pacific cultural sense (Podmore et al., 2003). Academic mastery in the Western style New Zealand educational system is considered an essential part of achieving this success (Lianza, 2017). The current situation of Pacific students' documented outcomes is alarming for the Pacific community and educators, and highlights the need for early intervention (Taleni, 2017; Schluter et al., 2018). Tackling disparity in learning outcomes within New Zealand is a priority for the MoE, as it is for the OECD across its member countries (MoE, 2010; OECD, 2016).

In New Zealand, many who have attempted to investigate the educational achievement gap have encountered methodological restrictions such as small and non-representative samples and a relatively scant collection of potential predictors. In their survey of empirical research on Pacific children's educational outcomes, Chu et al. (2013) noted an urgent need for research which includes achievement-related measures of educational outcomes, guidance about effective mechanisms for teachers and parents to work together and factors that influence successful transition from early childhood centres to primary schools. In particular, there has been *'little systematic and reliable information regarding student achievement until late in (Pacific) young people's school careers – their senior secondary years, thus severely limiting potential for improving educational outcomes and limiting the usability of research findings to inform policy and practice to this end'* (p.4).

However, educational researchers are currently in a unique situation where an unprecedented amount of information is collected and available on children growing up in New Zealand through both contemporary longitudinal studies and routinely collected administrative data. The PIF Study and the Growing Up in New Zealand Study are examples of depositories for comprehensive information on contemporary New Zealand birth cohorts and their welfare and wellbeing outcomes. Government ministries and organisations such as the MoE, the Ministry of Health (MoH) and SNZ routinely collect administrative data on individuals and these can now be linked across different agencies and accessed through the Integrated Data Infrastructure (IDI) maintained by the SNZ. Ethnic-specific, population-based data is also available to researchers to study factors that influence early

learning success among Pacific children aged 6 years. By age 6 years, all children have started their formal education in New Zealand, thus enabling the analysis of their educational outcomes. This also makes possible the identification of children who are struggling to meet the level of early language and literacy skills expected of their age, and enables early, targeted interventions to help them develop those skills. Although there are many components to early language and literacy skills, the measures of those individual areas are highly correlated (Sparks et al., 2014). In particular, oral vocabulary is related to phonemic awareness, decoding and reading comprehension (Cassano & Schickedanz, 2015; Dahlgren, 2008). Further, predictive relationships between oral vocabulary size and future reading achievement have been repeatedly observed (Juel et al., 1986; Morgan, Farkas, Hillemeier, Hammer, & Maczuga, 2015; NICHD, 2005; Suggate, Schaughency & Reese, 2005). Prediction models can be useful in understanding the drivers of educational success and what explains differences in student achievement results (Campbell, De Blois & Oblinger, 2007; Porter & Balu, 2016). Once identified, such factors can then be used to implement an intervention for success and thereby potentially contribute to reducing the documented disparities in the achievement results.

5.1.1 Predictors Associated with Early Language Development and Academic Achievement

Multiple individual and environmental factors are thought to influence children's early language and literacy development. This section briefly discusses some of the potential predictors for early language skills and educational outcomes grouped in their broader domains. The domains explored are prenatal and birth related factors, early home environment including parenting practice, socioeconomic factors, early childhood development and cultural environment.

Prenatal and Birth Outcomes

With the emergence of life course epidemiology, more research efforts have been made to analyse early life origins of long term health and social outcomes (Gilman, 2012). Guthridge et al. (2015) investigated the association between early life risk factors and school achievement results among 7,601 Australian children by incorporating perinatal and birth outcomes into regression models for reading and numeracy at age 8 years. The study showed that the children born to older mothers (above the age of 35 years at child-birth) were relatively advantaged at reading and numeracy compared to other children. On the other hand, the younger children in families with more than one child performed poorly in both skills when compared to the skills of the first born children. Additionally lower birthweight (less than 2500 grams) was associated with children's lower numeracy

outcomes among Australian indigenous children. Concerningly, the indigenous children were at higher risk of achieving below the minimum national standards in reading and numeracy compared to the non-indigenous cohort. Fergusson, Horwood & Boden (2006) found a significant association between being later born and a lower likelihood of obtaining educational qualifications among a birth cohort of 1,256 New Zealand young adults. Although similar influences of birth order on literacy skills were found by Malacova et al. (2009), the association was moderated by socioeconomic conditions at birth. Malacova et al.'s study has also demonstrated that higher percentages of optimal head circumference and term birth were positively and independently associated with literacy scores. Similarly, in a study of large scale linked data of over 128,000 children aged 8 years from routinely collected administrative database in a large US city, gestational age and term births were found to be positively related to reading and mathematics scores independently of birthweight and socioeconomic factors (Noble, Fifer, Rauh, Nomura, & Andrews, 2012). Again, higher risk of first year failure in mathematics and reading were associated with preterm birth in a population based study in the state of Georgia, US. (Williams, Lang Dunlop, Kramer, Dever, Hogue, & Jain, 2012).

Maternal behaviours during pregnancy such as tobacco smoking and alcohol consumption have been linked to later academic outcomes for children. Older maternal age and not smoking during pregnancy were associated with higher achievement levels in literacy and numeracy among Australian birth cohort children at kindergarten (ages 5–7 years) and middle childhood (ages 8–11 years) (Moore et al., 2014). The negative impact of prenatal smoking on cognitive and behavioural functions among children aged 5–11 years was evident in a Dutch birth cohort study (Batstra, Hadders-Algra, & Neeleman, 2003). Children exposed to heavy prenatal alcohol levels during the first trimester were twice more likely to not achieve the benchmark scores for reading (O'Leary, Taylor, Zubrick, Kurinczuk, & Bower, 2013). The same applied for children's writing skills when they were prenatally exposed to the mothers' occasional binge drinking in late pregnancy. However, low to moderate prenatal alcohol exposure was not associated with academic underachievement indicating the relevance of dose, pattern, and timing of prenatal alcohol exposure (O'Leary et al., 2013).

These results suggest prenatal conditions and birth outcomes should be considered as potential predictors when attempting to construct prediction models for children's language and literacy development. Malacova et al. (2009) goes even further to posit that optimising maternal health in pregnancy (pre- and post-natal care) should be both health and educational policy.

Parenting Practice and Early Home Environment

The home literacy environment, parental behaviours and expectations, and maternal health could foster or impede children's early language development. Using data from a population-based, longitudinal study of 8,650 US children, Morgan et al. (2015) analysed the relationship between children's oral vocabulary at age 24 months and their later academic and behavioural functioning when aged 60 months. Along with other confounding factors, the model incorporated a number of variables related to the home environment and parenting behaviours. The parenting quality of children, the mother being socially isolated and suffering from health problems were all contemporaneously associated with children's oral vocabulary size at 24 months. However, the effects of these variables on academic and behavioural functioning when children were aged 60 months were mediated by the children's oral vocabulary size at age 24 months suggesting the importance of nurturing children's language development in early childhood.

Parents can play a vital role in promoting their children's early oral language development. Hart and Risley (1999) analysed the every-day interactions between 42 US mothers and infants over a three-year period. Their studies demonstrated the benefits of rich language discourses between mothers and their young children in children's oral vocabulary and language development. They also reported differences in the amount of mother-child language interactions depending on the families' socioeconomic circumstances. However, the impact of these differences on the children's oral language skills was mitigated by the high quality and volume of language experiences provided by some of the mothers from low socioeconomic backgrounds. The positive impact of rich mother-child linguistic interactions on the children's oral language skills reported in Hart and Risley (1999) deserves further consideration when considering Morgan et al.'s (2015) findings of strong early language development influencing later academic and behavioural functioning. These results emphasise the importance of parental involvement in their children's language development, and demonstrate the connection between parenting behaviours and their children's early language skills.

Parental behaviours and expectations regarding their children's education could also predict children's learning outcomes. Davis-Kean (2005) explored the pathways through which parental education and income influence children's academic achievement at ages 8–12 years using a cross-sectional data on 868 US European American and African American children. The study demonstrated that parental education influenced the children's achievement indirectly through two paths: its impact on the parental beliefs held about children's academic achievement; and the capacity to provide stimulating home environment for their children. The results of path analyses revealed ethnic differences in the direct

and indirect influences of parental education. Overall, the theory of indirect influences of parental education and income through parental expectations and behaviours were better explained among African American sample compared to the European Americans. The ethnic difference in the pathways from parental education to children's academic performance was further investigated in Davis-Kean and Sexton (2009) using a larger sample and more diverse ethnic representation that included European, African, Asian and Hispanic American children. For all ethnic groups, parental education had both direct and indirect effects (through parenting beliefs and behaviours) on children's 3rd grade (typically 8 to 9 year-olds) outcomes. Some ethnic differences in the pathways from parent education to parent expectations and behaviours and then to outcomes were observed. For example, parental expectations were important predictors of the outcomes for all ethnic groups except the Hispanic Americans. The home environment had a small and non-significant effect on outcomes for African American families, a result that is inconsistent with the earlier analysis in Davis-Kean (2005). Missing pathways from neighbourhood or schooling variables that have not been captured in the model were suggested as potential culprits. Davis-Kean and Sexton's study importantly identified some ethnic differences in the pathways, through which parenting behaviours and expectations could influence children's learning outcomes, and hence highlighted the importance of acknowledging and incorporating the ethnic and cultural diversity in the prediction studies of educational outcomes.

The weight of evidence provided by the research in this area indicates that home literacy and parenting environment is an important consideration in modeling children's early educational outcomes. However, the results vary in their statistical significance and across different population groups as evidenced above. From a national longitudinal study of over 2,000 kindergarteners, Janus and Duku (2010) found a bivariable association between parenting reading practice and the children's school readiness but not when adjusted for socioeconomic and health factors. This result suggests that there may be some connections between the socioeconomic variables and parenting behaviour. The socioeconomic environment has repeatedly been demonstrated to influence children's educational outcomes and hence often included in the statistical analyses of achievement outcomes. Some of these results are discussed in more detail in the following section.

Socioeconomic Environment

In most studies of educational outcomes, some consideration is given to the socioeconomic background of the subject population as either a main predictor of interest or as a confounding variable. Families with socioeconomic advantages have access to resources to provide a more stimulating home learning environment for their children. On the other

hand, poverty can affect the ways parents can manage and support their children's academic opportunities. These can include the monetary investments (such as books, learning materials, tutors and extracurricular activities) the parents make for their children's educational progress (Crosnoe & Ansari, 2016). But the opportunities can also be limited by non-monetary resources such as the time spent with children and parental involvement at school. Hence poverty can alter the general environment that children grow up in and ultimately influence their learning outcomes (Crosnoe & Ansari, 2016).

In a pathway study of close to 1,500 low income families, Mistry, Biesanz, Chien, Howes and Benner (2008) found that socioeconomic factors predicted all indicators of parental investment in children's education, greater language stimulation and supportiveness. These indicators were, in turn, associated with children's higher scores in an early childhood developmental index. However, the direct effect of socioeconomic factors on early childhood development was mediated once the pathways for these indicators were included in the model. This suggested that the interventions to enhance early developmental outcomes should be made at the child and family level by directly targeting the quality of children's home experiences. The authors further noted that across both native and immigrant families, the socioeconomic factors were important for young children's cognitive development partly through their impact on the mother's ability to provide an environment that was conducive to her child's learning. Their results reiterate the role of financial constraints in parents being able to provide educationally stimulating environments for their children, which is crucial for early language and academic development (Crosnoe & Ansari, 2016; Hart & Risley, 1999; Mistry et al., 2008).

The impact of material affluence on children's learning outcomes is not confined within families and homes. The neighbourhood deprivation levels could influence children's cognitive and behavioural development independently of the socioeconomic and home environment provided by the family. Martens et al. (2014) studied over 180,000 children from population-based, census linked data from Manitoba, Canada, to analyse the effect of neighbourhood socioeconomic status on education and health outcomes for children living in social housing. The results confirmed that the children in social housing faced significantly poorer health and educational outcomes than other children. They were also more likely to live in low socioeconomic neighbourhoods and the negative effect of neighbourhood deprivation on health and development was stronger for older children. Hence the authors emphasised the importance of targeting policies to aid the children living in social housing and placing those houses in higher socioeconomic neighbourhoods. Similarly, a graded relationship between the neighbourhood socioeconomic levels and children's anti-social behaviours at age as early as 5 years was observed among over 2,000 twins aged 5–12 years from a UK longitudinal twin study (Odgers et al., 2012). The difference in antisocial

behaviours observed between children growing up in affluent and deprived neighbourhoods broadened with age. However, nurturing parenting behaviours such as the demonstration of maternal warmth and close parental monitoring completely mediated the adverse effects of neighbourhood- and family-level deprivation on children's antisocial behaviours. To the extent the parental behaviours are modifiable factors in children's development, this result indicates that the intervention programmes centred around building and strengthening capabilities within families could potentially bring substantial benefits to the children growing up in low socioeconomic neighbourhoods.

Crosnoe and Ansari's (2016) review of empirical research on the school readiness and transition into formal schooling among low income families found that poverty has strong influence over children's academic development during their transition from early childhood education to school and beyond. The impact of low socioeconomic environment was particularly strong at early childhood and manifested over many channels. To enhance the outcomes of families with socioeconomic disadvantages, like Mistry et al. (2008) and Odgers et al. (2012), they advocated policies that involve a family-directed approach and lowering direct and indirect economic barriers to achieving. This recommendation and other policies aimed at mitigating the negative impact of socioeconomic inequity on children's educational outcomes are very relevant for Pacific families in the New Zealand context. The majority of Pacific immigrant families reside in the low socioeconomic neighbourhoods in New Zealand and hence are affected by the consequences of geographic and regional deprivation (Paterson et al., 2006). Schluter et al. (2018a, 2018b) constructed a model predicting the outcome of Pacific children receiving a reading intervention in their early primary school years using data from a nation-wide health screening for children aged 4 years. The model incorporated an index for economic deprivation levels as one of its covariates and showed that the children were more likely to receive a reading intervention in early primary school years if they were from the neighbourhoods with high deprivation index levels. Their studies, in conjunction with others reviewed above, suggest the relevance of socioeconomic factors when analysing the learning outcomes among Pacific children in New Zealand.

Children's Early Development

Increasingly more attention has been paid to implementing early, targeted literacy interventions (Catts, 2017; Gillon et al., 2019; McNaughton et al., 2003; Phillips et al., 2004). Some attributed this to the success of many of the efforts targeted at supporting behavioural and cognitive development of children before the start of their kindergarten or formal school education (Low et al., 2005). Despite many researchers acknowledging the influence of children's early development on later outcomes, to date, surprisingly little

research has been conducted with preschool-aged children (Morgan et al., 2015). However, some studies have incorporated the measures for children's school readiness in prediction models for later academic or language outcomes. For example, in a study involving 3,847 Australian children, Christensen, Zubrick, Lawrence, Mitrou and Taylor (2014) analysed the impact of various individual and environmental risk factors at age 4 years including the school readiness measure on children's receptive vocabulary at age 8 years. The children within the lowest quintile for school readiness measure were 1.7 to 3.6 times more likely to be categorised as having low receptive vocabulary skills at age 8 years after adjusting for socioeconomic, maternal behaviour and health, and home environmental factors.

Children's kindergarten ability to regulate their emotions effectively, adapt to a new environment and engage positively with other children and teachers has been shown to enhance children's school experiences and academic outcomes. Graziano et al. (2007) investigated the role of emotion regulation in children's early academic success among 325 kindergarteners. Using a mediational model, they examined whether emotion regulation continues to have a significant effect on academic outcomes after controlling for children's behavioural problems and student-teacher relationships. In the study, children's emotion regulation contributed unique variance towards the prediction of all outcome measures (academic success and productivity measure, standardised test results in mathematics and literacy) after accounting for children's intelligence, behavioural problems and student-teacher relationships. Additionally, they found that student-teacher relationships also uniquely predicted the academic outcome measures. A child's level of problem behaviours, however, did not contribute to the prediction of academic success once the quality of student-teacher relationships was accounted for nor was it a significant mediating channel in the pathway from emotion regulation to academic outcomes. The results revealed that compared to the children with emotion dysregulation, the children with better emotion regulation skills adjust to qualitative shift in the learning environment that occurs during kindergarten with more ease and are better able to independently attend to and learn new information presented by their teachers. A quality student-teacher relationship may further enhance such independent behaviour and reinforce children's positive learning experience and their motivation for learning.

Morgan et al.'s (2015) study of a predictive relationship between oral vocabulary size at age 24 months and reading at age 60 months included children's internalising and externalising problem behaviours as covariates in the model. The analyses of these problem behaviours were based on the maternal reports when children were aged 24 months. The internalising problem behaviours such as anxious and withdrawn behaviours were concurrently related to oral vocabulary size at age 24 months even after adjusting for the children's general cognitive functioning. These behaviours, however, did not predict chil-

dren's reading skills at age 60 months. This result indicated that this relationship may have been moderated by the levels of children's earlier oral vocabulary and cognitive functioning. Externalising problem behaviours such as aggression and disruptive behaviours were significantly associated with oral vocabulary at age 24 months but not after adjusting for general cognitive functioning. Although the children's behavioural profiles at age 24 months did not directly predict their reading at age 60 months, the contemporaneous relationships between the children's problem behaviours and their oral vocabulary at age 24 months could have indirectly influenced reading skills at age 60 months.

Indeed, a study involving 603 children enrolled in the Head Start programme¹ found that mathematics, reading and behavioural problem scores at ages 5–6 years were significantly associated with those outcomes at ages 11–12 years (Lee, 2010). These results suggest that children's early emotional, behavioural and cognitive developmental outcomes are important indicators of their later longterm outcomes. Similarly, Merry (2013) demonstrated that the difference between birth cohorts in the US and Canada in their PISA reading scores at ages 15–16 years could be traced back to when they were aged 4–5 years. These findings indicate that earlier cognitive, behavioural and language skills are important predictors of later language and literacy outcomes and should be accounted for in prediction models for language development.

Cultural Environment of Immigrant Families

The social and cultural contexts provided by immigrant parents can play a critical role in deciding the adaptation outcomes of the second-generation immigrant children (Portes & Rumbaut, 2005). The alternative paths in the adaptation processes can hinge on a number of factors such as the immigration histories, the acculturation outcomes of the first-generation, the socioeconomic and cultural barriers to successful integration, and the means to confront these barriers (Portes & Rumbaut, 2005). Although the relevance of acculturation in determining immigrant outcomes has been recognised, there is no widely accepted measure of acculturation or cultural integration (Borrows et al., 2011). Even when attempts have been made to apply the concept, the measures used often lacked the theoretical underpinnings or strong psychometric properties (Schluter et al., 2011). In a study of adolescent outcomes and parental involvement among Filipino American immigrants, the length of stay in the host country was used in the synonymous sense with the concept of acculturation (Ying & Han, 2008). Another study investigating the

¹Head Start programme offered by the US Department of Health and Human Services supports children and parents from low income families. The programme provides a comprehensive level of assistance to the families to improve their health, early childhood educational outcomes, and parenting behaviours and involvement.

school achievement differences among Chinese and Filipino American students used an acculturation measure derived from the language spoken at home, place of birth and the length of stay in the US (Eng et al., 2008). Similarly, in the context of predicting children's early receptive vocabulary, the measures closest to the concept of cultural orientation or acculturation were the proficiency in the languages of the host culture and whether the participants had been born in a different country from where the studies were conducted (Christensen et al., 2014; O'Callaghan et al., 1995; Taylor, Christensen, Lawrence, Mitrou & Zubrick, 2013).

In New Zealand, empirical research efforts into investigating the achievement gap between the dominant European students and Māori and Pacific students have often been restricted to studying the associations between educational outcomes and socioeconomic backgrounds of the children and their families. Less research has involved the cultural environment in studying educational outcomes and even less has investigated this among Pacific children. Several research papers using the data from the PIF longitudinal study included maternal acculturation types in predicting health outcomes in children and their parents. The acculturation types, derived from Berry (2003, 2006)'s conceptual framework and modified versions of GEQ, were used as a measure of maternal cultural orientation. Although maternal acculturation types were found to be relevant in health outcomes for children, to date, no analyses have been performed in relation to the educational outcomes. The current study makes the first attempt at incorporating this psychometrically appealing measure of acculturation into predicting early language outcomes for the PIF children.

Berry's framework for acculturation strategies adopted by migrant people upon their encounters with alternative cultural norms is appealing because it assumes a bi-directional approach wherein both migrant and host cultures interact and negotiate. The migrants are empowered within the framework to make conscious identity choices and formulate acculturation strategies. However, this very notion has been critiqued in Weinreich (2009) as being overly simplistic and failing to reflect the actuality of identifying process that is '*more nuanced and without general explicit conscious awareness*' (p.125). Although Weinreich's (2009) view of 'enculturation', where agentic individual continuously incorporates and reassesses cultural elements during socialisation, provides an insight into the socio-psychological process of cultural reformulation, it does not take into account the various and specific manifestations of culture therein defined: '*a fundamental aspect of culture is its embodiment of the societal processes of substantial groups of people who perceive themselves as belonging to a commonality of values and beliefs, moral imperatives and religious beliefs, dress and behaviour, folklore and narratives of history, and modes of living, whereby one group is culturally distinctive from another*' (p.127). Such elements of the

New Zealand European and Pacific cultures are incorporated into the modified GEQ for the PIF Study and the parsimony with which Berry's framework of acculturation characterisations is adapted in the questionnaires is a great strength for the particular analysis performed in this study.

The body of research linking acculturation of migrant families and the educational outcomes of their children is limited. However, the current study posits that the maternal acculturation strategies and the early cultural environment to which Pacific children are exposed have an impact on their language outcomes. Although there must be substantial individual and group variabilities that should not be overlooked, there is some international evidence to suggest that immigrant children lag behind their native peers in educational outcomes (OECD, 2012). In their review of empirical research in the impact of socioeconomic and immigrant statuses on children's transition into formal schooling, Crosnoe and Ansari (2016) found that in overall, Latin American immigrant children underperformed academically during the transition into formal schooling. Many of the socioeconomic disadvantages experienced by the immigrant families were compounded by lower levels of household income, rates of educational attainment, and occupational statuses. However, being an immigrant (in this particular case, being Latin Americans) presented disadvantages to the children through factors that were independent of low socioeconomic status – the language barriers and the parents' unfamiliarity with the US educational system. The authors noted that despite these vulnerabilities inherent in Latin American immigrants, their children have strengths that can be leveraged to promote more a successful transition. These included bilingualism, high levels of parental motivation and values placed on education that results in greater receptiveness towards instruction and suggestions. Such strengths led to many dual-generation initiatives in improving the outcomes for Latin American immigrant families.

Like Crosnoe and Ansari (2016), Mistry et al. (2008) observed that being a migrant is a mixed blessing for children's development that brings both advantages and disadvantages. Compared to the native mothers in their sample, the immigrant mothers had lower financial and human capital, and were more likely to be in stable marital relationships and larger families. The children from immigrant families experienced higher levels of parental stress and lower levels of literacy and cognitive stimulations at home, and scored lower in a measure of early developmental index at ages 2–3 years. However certain maternal attributes and influences were identified as protective factors. In structural equation models, maternal education was the strongest predictor for both native and immigrant mothers. Across both types of families, the authors found that socioeconomic factors were significant predictors for children's cognitive outcomes but those effects were mediated through the quality of home environment. The indicators of quality were not entirely dependent

on financial resources such as the ability to afford books, but also included assessments of mother's engagement in '*language-rich and cognitively stimulating activities*' (p.207) with their children.

In a study involving 365 Filipino American adolescents, parental acculturation, proxied by the length of stay in the US and parents' English language fluency, enhanced the parents' school, home-educational and social involvement, which in turn, led to higher self-esteem and lower rates of depressive symptoms in their children (Ying & Han, 2008). The results suggest that there may be some underlying interactions between cultural backgrounds and parents' behaviours and involvement at their children's schools. The studies of different perceptions and expectations held by Pacific parents, students and teachers have confirmed that Pacific cultural values, at times, could conflict with the Western norms and expectations held by teachers who are predominantly of European/Pākehā ethnicity in the current Western style educational system (Fletcher et al., 2009; Spiller, 2012). The demonstrated relevance of Pacific cultural values in Pacific children's education suggests that the extent of acculturation process and other cultural factors may need to be incorporated into a prediction model for Pacific children's early language development.

5.1.2 Constructing Prediction Models

There is currently no uniformly accepted formal assessment of children's literacy and numeracy skills at age 6 years in New Zealand. To remedy for the lack of apposite outcome variable, a well-recognised traditional language assessment tool was used instead to proxy children's early language development. In this study, Pacific children's English receptive vocabulary at age 6 years was used as the outcome variable in the prediction model. Receptive language ability emerges early in life and interacts strongly with other language and literacy abilities such as oral language, reading comprehension, spelling and writing (Cassano & Schickedanz, 2015; Christensen et al., 2014; Dahlgren, 2008; Taylor et al., 2013). Oral vocabulary (both receptive and expressive) is also important in building communication skills essential for academic success, in particular, understanding and following instructions at school and building relationships with peers (Juel et al., 1986; Morgan et al., 2015).

As done in Phase One, the analysis here was performed using data from the PIF Study. It included predictors that together provide a multifaceted view of children's development. These predictors included those relating to prenatal factors and birth outcomes, the home literacy environment, children's emotional and behavioural development, maternal mental health, parental behaviours, socioeconomic background, and cultural environment.

Predictive models with the breadth of predictors considered here are uncommon in the existing literature. Moreover, few international studies have employed prediction mod-

els with a particular focus on Pacific children's educational outcomes and use the data size available for this research. The use of predictors from tests that are known to have strong psychometric properties adds to the current understanding of factors behind Pacific children's early language success. The tests encompass broad elements of children's development such as behavioural and emotional growth, maternal health, acculturation and parenting style. The inclusion of variables that explain cultural influences on Pacific children's learning outcomes is germane to the culturally responsive approach to analysing this particular population. The PIF Study contains information that not only reveals maternal cultural orientation types, but also the length of their stay in New Zealand and the proficiency in the English language and hence provides a unique opportunity to analyse these cultural elements in relation to Pacific children's early language development. The methodological approach taken here makes full use of available data including those with missing predictor values and highly correlated variables (Breiman et al., 1984). Additionally, the overall societal costs (loss) associated with misidentifying children who are at risk of falling behind their peers in their English receptive vocabulary development were conceptualised and the impact of these costs on accurately identifying these children were analysed in this study. Such losses have not been documented previously and are not readily available for use in New Zealand and this paper makes a first step in investigating their impact.

As noted in Crosnoe and Ansari (2016), the period of transition into formal education is a critical point in the emergence of educational disparity, implementation of interventions that can accomplish greater equality, and initiation of structural, social and developmental mechanisms that are directly actionable. Some of the key research focus areas that were identified include the ways in which early childhood experiences shape cognitive processes that support or hinder successful transition into schools. The aim of the current work was to study the factors associated with Pacific children's English receptive vocabulary at age 6 years by constructing a prediction model that integrates various dimensions of children's early development. The prediction model was then used to identify and analyse the common characteristics among Pacific children who are developing well in their English receptive vocabulary skills in comparison to those who are at risk of falling behind.

5.2 Methods

5.2.1 Study Design

Data from birth, 6-weeks, 1-, 2-, 4- and 6-years measurement waves of the PIF longitudinal study were analysed. These included data collected at routine health checks at birth, interviews with mothers and children's performance in the BPVS test.

5.2.2 Study Participants

The eligibility criteria for inclusion in the analyses are described in Section 4.2.2. More detailed information on the recruitment and retention of the PIF participants is provided in the cohort profile publications (Paterson et al., 2006, 2008).

5.2.3 Diagnostic and Measurement Device

The children were tested using the BPVS to measure their English receptive vocabulary skills as part of the 6-years measurement wave assessment. A more detailed account of how the BPVS scores were derived is provided in Section 3.2.

5.2.4 Demographic Information

Sociodemographic Information

The baseline sociodemographic information was obtained through maternal interviews at 6-weeks postpartum. Given the maternal consent, the information that could be matched to those of the hospital records (obstetric and perinatal) and Plunket Society records (6-weeks postpartum) were cross-checked. The baseline sociodemographic information used here included maternal age at childbirth in years, ethnic identification, the highest level of educational qualifications attained, social marital status, household income and household crowding. The categories for these variables were as specified in Section 4.2.6. Maternal self-reported perception of household crowding was used as it has demonstrated higher validity than other standardised crowding indices for this cohort (Schluter, Carter & Kokaua, 2007).

Cultural Environment

Cultural orientation was measured using maternal acculturation measure derived from Berry's bi-directional modelling framework (Berry, 2003, 2006) and the GEQ (Tsai et al., 2000). The four maternal acculturation types applied were: 'Integration' (strong alignment with both the New Zealand and Pacific cultures); 'Assimilation' (strong ties to the New Zealand culture but weak retention of Pacific culture); 'Separation' (retaining strong connection to Pacific culture while largely separated from the New Zealand society); and 'Marginalisation' (weak alignment with both cultures). Cronbach's α of 0.81 and 0.83 have been reported for New Zealand and Pacific acculturation for this cohort (Borrows et al., 2011).

In addition to maternal acculturation, the cultural setting the children were exposed to in their early years was further analysed by categorising the mothers by their length of

stay in New Zealand and fluency in the English language. The mothers were categorised as either: 'Born in New Zealand (NZ)'; 'Born in the Pacific Islands (PI) and lived in NZ for 10+ years'; or 'Born in the PI and lived in NZ for < 10 years'. The mothers' self-reported fluency in the English language was analysed.

Prenatal Conditions and Birth Outcomes

To analyse the impact of prenatal conditions and birth outcomes on children's early receptive vocabulary development, some of the variables measured at birth and the baseline (6-weeks postpartum) were included in the analyses. These included maternal parity, measured as any number of pregnancies that extended beyond 24 weeks of gestational period, sex of the child, small for gestational age and sex (< 2500gm) with a separate category for pre-term births (< 37 weeks) (SGA), alcohol consumption and smoking during pregnancy. The consumption of alcohol during pregnancy was categorised into 'Never', 'Monthly or less' and '2 or more times a month'. A variable for tobacco smoking during pregnancy was dichotomised into 'Yes' for any amount of smoking during the entire period of pregnancy and 'No' for no smoking.

Early Home Environment and Parenting Practice

Children's early home environment was considered using well-established tests with strong psychometric properties. These included 12-item General Health Questionnaire (GHQ) (Goldberg & Williams, 1988) conducted at the 1-year measurement wave to screen for any minor psychiatric disorders in mothers. The mothers who scored above a cut-off of 2 were referred to as being symptomatic. A reliability coefficient of $\alpha = 0.87$ has been reported for the PIF cohort (Gao, Paterson, Abbott, Carter & Iusitini, 2007). Parenting practice was analysed in terms of nurturance and discipline using a modified version of Parent Behaviour Checklist (PBC) (Fox, 1994) administered to mothers at the 2-years measurement wave. The raw scores were categorised into quartiles (0-25th (1Q); 26-50th (2Q); 51-75th (3Q); and 76th-100th (4Q) percentiles) with higher quartile ranges representing greater extent of behaviour on each subscale (Paterson et al., 2013). Reliability coefficients of $\alpha = 0.77$ for discipline and $\alpha = 0.71$ for nurturance on the modified scales have been reported for the cohort (Paterson et al., 2013). Additionally, the mothers' self-reported frequency of story reading to children at the 1-year measurement wave was included to account for the home literacy environment.

Early Developmental Index

The PIF children’s early childhood development was monitored with the Australian Developmental Screening Test (ADST) (Burdon, 1993) at the 2-years (ADST-2y) and 4-years (ADST-4y) measurement waves. The ADST is used for children aged 6 months to 5 years to screen for any developmental delay in psychosocial, language, cognitive, fine motor and general motor skills. Using the examiner’s manual, performances on the tests are categorised as ‘No delay’ (age-expected developmental progress), ‘Monitor’ (some indication of possible minor delay, so monitoring and re-screening in 2–3 months suggested) and ‘Assessment required’ (full developmental assessment recommended).

Early Behavioural Development

The CBCL (Achenbach et al., 2011) is a standardised test that uses age and gender norms and broadly looks at externalising (aggressive and disruptive) and internalising (depressed and withdrawn) problem behaviours. The maternal reports of child behavioural problems at the 6-years measurement wave were used for this study. Cronbach’s α in the range between 0.76–0.93 for internalising, externalising and total scores have been reported for this cohort (Paterson et al., 2013).

5.2.5 Measurement Procedure

All interviews and routine measurements were taken after the maternal written consents were obtained. All interviews were conducted with female Pacific interviewers who were fluent in both English and Pacific language(s). The maternal interviews usually lasted between 1 and 1.5 hours and were conducted at their family home. More detailed information on the measurement procedure can be found in Section 4.2.6.

5.2.6 Ethical Considerations

Ethical approvals obtained by the PIF Study and the considerations given to this research are discussed in Section 3.6. The approval letter for this research from the PIF Study is included in the Appendix A.

5.2.7 Statistical Analysis

The reporting of the material and the analyses presented in this study were informed by the STROBE guidelines (von Elm et al., 2008).

A classification tree model (Breiman et al., 1984) was fitted using the BPVS as a response variable. The BPVS scores were dichotomised into categories for children who are ‘at-risk’ of not developing at the age-appropriate level and those who performed at the

‘age-appropriate’ level. The classification tree method was developed to analyse the common characteristics associated with a particular group. The problem at hand is to predict a binary outcome class (‘at-risk’ or ‘age-appropriate’) that an observation (a child) is in given a set of measurements on that child (predictor values in Table 5.1). The classification tree method is a systematic way of predicting the class (or the outcome) membership for observations (the children). The method employs a recursive partitioning mechanism to categorise each observation into an outcome class. Each observation from a sample has a corresponding vector of values of predictor variables associated with it. For example, a child may have the associated vector of characteristics: (male, first born, Samoan, ..., etc.). For this particular problem there are 22 predictor variables and each child (the observation unit) has values for each of these 22 predictor variables. These predictor variables can be considered to form a 22-dimensional measurement space. The tree mechanism maps each vector of predictor values to the set of binary outcome class, {‘at-risk’, ‘age-appropriate’}. The classifier or the classification rule is then a function defined on the predictor measurement space such that for every vector of predictor values, there is one outcome class membership associated with those measurements. The number (%) of children within each level of predictor variables are summarised in Table 5.1. This table also provides the p-values from Fisher’s exact test performed to analyse any differences between the children included and the children excluded due to missing BPVS scores (Fisher, 1934; McDonald, 2014).

There are two types of misclassification errors in this problem. One is the error of misidentifying children as developing vocabulary at the age-appropriate level when, in fact, their actual scores were below the threshold for the age-appropriate level. Another is misclassifying age-appropriately developing children as being at risk of low receptive vocabulary skills. The two types of misclassification errors are minimised in the model construction. Selection of the best performing models was also made by comparing the two types of misclassification errors between the candidate models. The complexity of the model is determined by the number of possible combinations of predictor values that reach an outcome class or get mapped to a terminal node. The complexity parameter (CP), which is the penalty imposed on the number of terminal nodes, is used to alter the size of the tree. The full model is the most complex tree constructed using the cross validation method. It is specified by using an arbitrarily small CP. The final model was pruned using the CP found from a separate 10-fold cross validation (CV) method. In 10-fold CV, 9 out of 10 observations are used to construct the tree and the remaining 1 out of 10 observations are used to test the model performance. A ‘one standard error’ (1-SE) rule was applied as a selection criterion in the CV method. Hence, the 10-fold CV errors associated with the pruned tree was within 1 SE of the minimum 10-fold CV errors.

The 1-SE rule was used to guide the model selection process, but taking into consideration the over-fitting to the training data which can lead to decreased precision when predicting the test data, a threshold number of splits was also used (Hastie, Tibshirani & Friedman, 2001). Once the final pruned tree model was selected, the CP and the misclassification error ratios associated with that model was tested using the ‘Leave-One-Out’ (L1O) CV method in conjunction with the 1-SE rule. In the L1O-CV method, all observations except one are used to construct the model and the one excluded observation is used to test the model performance. This technique of using one observation as the test observation is repeated for all the observations in the dataset. Hence, all observations take turns in being the test observation. Breiman et al. (1984) suggested that such method would be more rigorous in terms of assessing the model performance. The misclassification errors calculated from the full model, pruned model and L1O-CV models were considered for each model comparison.

The classification tree method allows one to analyse the relative importance of each predictor variables in splitting the measurement space. The `rpart` package (Therneau et al., 2018), which implements the classification tree method in R, takes the misclassification costs into account when computing this variable importance statistic. In addition, the 10-fold CV method used to construct the tree also implies that the resulting splits of the measurement space is optimal in the sense of minimising the CV errors to within the 1-SE of the minimal CV errors. Breiman et al. (1984) stated that growing a very large tree then pruning it upwards starting from the terminal nodes (or leaf nodes) using a measure of tree complexity and a stopping rule led to a more flexible and accurate way to build trees. Typically, as a tree is pruned upward, the estimated misclassification rates decrease slowly then reach the gradual minimum then rapidly increase as the number of terminal nodes becomes small. This is due to the trade-off between bias and variance. The overall approach used here for constructing and testing the models very closely followed the tree fitting method outlined in Breiman et al. (1984). Additional notes on fitting classification trees based on Breiman et al. (1984) are provided in Appendix C.

The classification tree model was fitted using the `rpart` package (Therneau et al., 2018). This implementation allowed the utilisation of observations with missing values in constructing the tree models. This was made possible by using the next best available splitting variable, called the surrogates, when an observation has missing values for the primary variable used to split the node. The final pruned model is illustrated in a dendrogram. The dendrogram depicted the partitioning process starting at the top with the most important splitting variable to gradually move down all the splitting rules to reach the outcome nodes at the bottom. The tree algorithm provides the list of variables that were primarily used in the model building. The variable importance score was measured

by the sum of the goodness of split associated with each time the variable was used as the primary or surrogate splitting criteria. The relative importance of variables used in the final model is demonstrated using dotplots. The loss associated with misclassifying ‘at-risk’ children as developing at the ‘age-appropriate’ level (denoted as L_{12}) and the converse loss (L_{21}) were analysed by varying the ratio of the two losses and plotting the ratio against the resulting misclassification errors. These two types correspond to the losses associated with false negative and false positive misclassification errors. There were no known values for the loss parameters. An *a priori* decision was made to use $L_{12} = 10$ and $L_{21} = 1$ for the initial model building. However, the relative loss of $L_{12} : L_{21}$ was varied in additional analyses to study its impact on the misclassification errors. The misclassification errors between the actual and the predicted response values were calculated by resubstitution to aid in the model selection. The misclassification errors of the resulting model were directly estimated using the L1O-CV method.

All analyses and graphics were performed using R version 3.4.066 (R Development Core Team, 2017) and $\alpha = 0.05$ defined statistical significance.

5.3 Results

5.3.1 Data Description

Data for 1,019 participating PIF children and their mothers were available for analyses. There were 18 multiple births and one child from each multiple birth was randomly selected and removed from the dataset leaving data on 1,001 children to be analysed. The BPVS scores for 877 (88%) children were available hence reducing the data used for model building to that group. Sixty-seven (8%) children scored below the population norm.

The number of missing, unknown or declined responses ranged 0–29% across the predictors for the group. No important differential attrition has been observed for mothers or children for maternal age, ethnicity, education, marital status, or child sex over the measurement period from birth to 6-years (Paterson et al., 2008).

The results of Fisher’s exact tests and the numbers (%) of values for each predictor variable used are shown in Table 5.1. Some differential proportions between the children with and without the BPVS scores were observed for GHQ, PBC discipline and nurturance, ADST-2y, ADST-4y, and CBCL internalising and externalising behaviours. When the tests were performed after removing the missing/unknown/declined responses, these differences in proportions remained for ADST-2y and CBCL externalising behaviours.

Table 5.1: Characteristics of the Children

Predictor	n (%)	p-value
<i>Prenatal and Birth Outcomes:</i>		
Maternal age at childbirth in years ^a		p = 0.05
< 20	73 (7)	
20 – 24	241 (24)	
25 – 29	278 (28)	
30 – 34	229 (23)	
35 – 39	143 (14)	
≥ 40	36 (4)	
Parity ^b		p = 0.01
1	251 (26)	
2 – 4	561 (57)	
5+	172 (18)	
Tobacco smoking during pregnancy ^c		p = 0.82
Yes	234 (24)	
No	761 (76)	
Alcohol consumption during pregnancy ^d		p = 0.87
Never	951 (95)	
Monthly or less	30 (3)	
≥ 2 a month	15 (2)	
Child's sex		p = 0.77
Female	489 (49)	
Male	512 (51)	
Small for gestational age (SGA) ^e		p = 0.88
Pre-term	83 (8)	
No	825 (84)	
Yes	74 (8)	
<i>Early Home Environment:</i>		
GHQ (1-yr) ^f		p = 0.64
Non-symptomatic	817 (88)	
Symptomatic	117 (12)	
Story reading (1-yr) ^g		p = 0.47

Continued on the next page

Predictor	n (%)	p-value
Never	86 (9)	
Several times a year	3 (0)	
Several times a month	22 (2)	
Once a week	65 (7)	
About 3 times a week	321 (34)	
Everyday	440 (47)	
PBC – Disciplinary (2-yr) ^h		p = 0.12
1Q	286 (31)	
2Q	198 (22)	
3Q	194 (21)	
4Q	233 (26)	
PBC – Nurturance (2-yr) ^h		p = 0.39
1Q	262 (29)	
2Q	208 (23)	
3Q	240 (26)	
4Q	201 (22)	
<i>Early Development:</i>		
ADST (2-yr) ⁱ		p = 0.05
Assessment required	319 (38)	
Monitor	59 (7)	
No delay	468 (55)	
ADST (4-yr) ^j		p = 0.96
Assessment required	370 (54)	
Monitor	17 (3)	
No delay	293 (43)	
<i>Behavioural Development:</i>		
CBCL–Internalising (6-yr)		p = 0.29
Age-appropriate	839 (84)	
Borderline	76 (8)	
Clinical	85 (9)	
CBCL–Externalising (6-yr)		p = 0.02
Age-appropriate	709 (71)	
Borderline	145 (15)	

Continued on the next page

Predictor	n (%)	p-value
Clinical	146 (15)	
<i>Cultural Environment:</i>		
Maternal ethnic identification		p = 0.14
Samoan	463 (46)	
Tongan	218 (22)	
Cook Islands Māori	174 (17)	
Other Pacific [†]	78 (8)	
Non-Pacific	68 (7)	
Maternal English fluency		p = 0.55
Not fluent	375 (38)	
Fluent	626 (62)	
Maternal acculturation ^k		p = 0.35
Assimilation	316 (32)	
Separation	314 (32)	
Integration	183 (18)	
Marginalised	178 (18)	
Length of stay in NZ (PI Group) ^l		p = 0.85
NZ born	341 (34)	
PI born, > 10 yrs in NZ	374 (37)	
PI born, ≤ 10 yrs in NZ	284 (28)	
<i>Socioeconomic Background:</i>		
Household income ^m		p = 0.51
≤ \$20,000	331 (34)	
\$20,001 – \$40,000	511 (53)	
> \$40,000	120 (13)	
Perception of household crowding		p = 0.05
No	697 (70)	
Somewhat	227 (23)	
Greatly	77 (8)	
Highest maternal education attainment		p = 0.63
No formal qualification	371 (37)	
Secondary	358 (36)	
Post-secondary	272 (27)	

Continued on the next page

Predictor	n (%)	p-value
Social marital status		p = 0.42
Married	584 (58)	
In de facto relationship	230 (23)	
Not partnered	187 (19)	

Notes:

P-values were obtained using Fisher's exact test.

[†] Included mothers with multiple ethnic identifications.

^a 1 (<1%) missing/unknown/declined response.

^b 17 (2%) missing/unknown/declined response.

^c 6 (<1%) missing/unknown/declined response.

^d 5 (<1%) missing/unknown/declined response.

^e 19 (2%) missing/unknown/declined response.

^f 67 (7%) missing/unknown/declined response.

^g 64 (6%) missing/unknown/declined response.

^h 90 (9%) missing/unknown/declined response.

ⁱ 155 (16%) missing/unknown/declined response.

^j 321 (32%) missing/unknown/declined response.

^k 10 (1%) missing/unknown/declined response.

^l 2 (<1%) missing/unknown/declined response.

^m 39 (4%) missing/unknown/declined response.

5.3.2 Growing and Pruning the Classification Tree

Initially a full model was grown using all the predictor variables in Table 5.1. This was achieved by using an arbitrarily small complexity parameter ($CP = 0$) for the tree. The full model was then pruned using 10-fold CV method. Analysing the estimated 10-fold CV errors associated with each CP and applying 1-SE rule suggested a tree with 18 terminal nodes and $CP = 0.007$.

The tree was pruned using the above 1-SE CP and the resulting classification tables are shown in Table 5.2. The table also provides the results of L1O-CV which directly estimates the prediction errors for the pruned model. The full model shows strong sensitivity and hence low false negative rate below 2%. However, it identified about 24% of children for being at-risk when their actual performance was at an age-appropriate level. The pruned model has lower sensitivity and the false negative rate of 0.19 and the false positive rate of 0.19. The L1O-CV prediction errors show even lower sensitivity. A simpler model performed better in predicting at-risk children than the model over-fitted to the training data. The L1O-CV error for the model pruned to 7 terminal nodes with $L_{12} : L_{21} = 10 : 1$ (not shown in Table 5.2) were slightly better at (0.46, 0.32).

Table 5.2: Predicted and Actual Classifications of Children

Model Type	Predicted/Actual (%)					Misclassification [†]
	At-risk/At-risk	At-risk/Age-app. [†]	Age-app. [†] /At-risk	Age-app. [†] /Age-app. [†]		
<i>L</i> ₁₂ : <i>L</i> ₂₁ = 10 : 1						
Full model (CP=0)	66 (8)	193 (22)	1 (0)	617 (70)		(0.01, 0.24)
Pruned (CP = 0.007)	54 (6)	156 (18)	13 (1)	654 (75)		(0.19, 0.19)
L1O-CV (CP = 0.007)	31 (4)	173 (20)	36 (4)	637 (73)		(0.54, 0.21)
<i>L</i> ₁₂ : <i>L</i> ₂₁ = 20 : 1						
Full model (CP = 0)	67 (8)	208 (24)	0 (0)	602 (69)		(0.00, 0.26)
Pruned (CP = 0.005)	66 (8)	217 (25)	1 (0)	593 (68)		(0.01, 0.27)
L1O-CV (CP = 0.005)	36 (4)	239 (27)	31 (4)	571 (65)		(0.46, 0.30)

[†]Age-appropriate.

[†] The misclassification errors correspond to (False Negative Rates, False Positive Rates).

5.3.3 Variable Importance Score

The variables used in constructing the pruned model are listed in the order of importance and are illustrated using a dotplot in Figure 5.1.

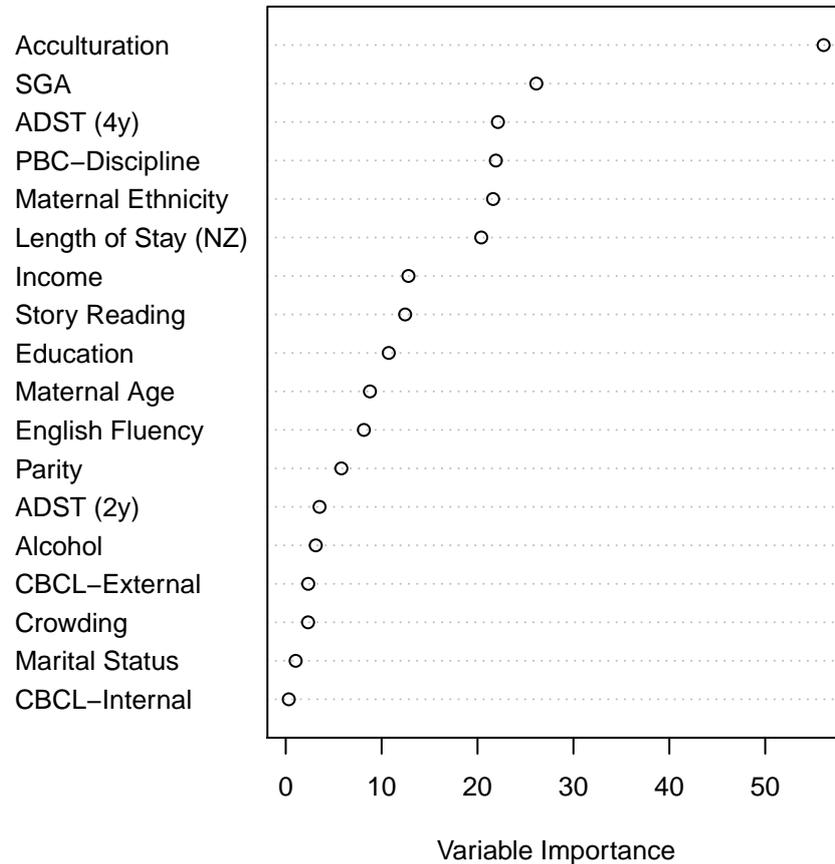


Figure 5.1: Variable Importance in a Tree with $L_{12} : L_{21} = 10 : 1$ and $CP = 0.007$

For the pruned model, the maternal acculturation types were found to be the predominant splitting variable. Given its importance in predicting the BPVS, the distribution of maternal acculturation was further explored using a plot of the median BPVS along with the 95% confidence bands in Figure 5.2. When the median BPVS scores were analysed, the children whose mothers had integrated acculturation type obtained higher median scores (102, 95% CI: 100, 104) than either the separated (95, 95% CI: 94, 96) or marginalised groups (99, 95% CI: 97, 100). The assimilated group had the highest median score of 105 (95% CI: 104, 106) but the score was not statistically different from those of the integrated group. Children's birthweight and ADST scores were also important variables indicating the relevance of healthy birth conditions and early childhood development.

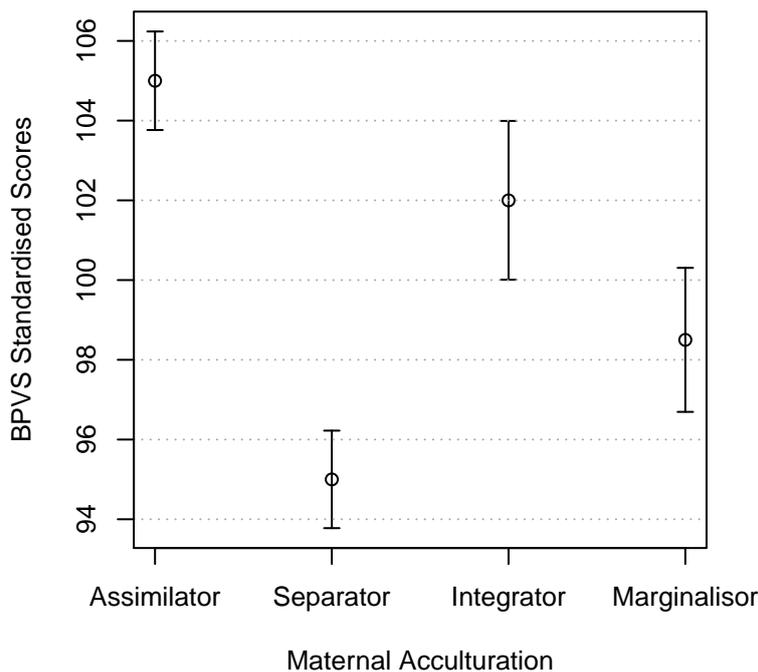


Figure 5.2: Median BPVS Scores with 95% Confidence Bands for Maternal Acculturation

5.3.4 Predicting Outcomes at the Terminal Nodes

A dendrogram was used to depict the pruned tree in Figure 5.3. The nodes show the splitting criteria for only the left branch. For example, at the initial node, those with mothers whose acculturation types are separators, integrators or marginalisors move down along the left branch to the next splitting node. This process is continued until all observations reach terminal nodes. At the terminal nodes, the predicted outcome class is given, and the actual number of children in each class. The left most terminal node predicted that children would be at-risk of low receptive vocabulary skills if the mothers were born in the Pacific Islands, gave birth at ages above 30 years and had acculturation types of separators, integrators or marginalisors and the children were ADST screened as requiring assessment at ages 2 and 4 years (`Acculturation=sprt,intg,mrgn; ADST_4y=assr; Maternal_Age=30-34,35-39,40+; PI_Group=PI-born and NZ<=10yrs, PI-born and NZ 10+yrs; ADST_2y=assr`). At this node, there were 16 children who were actually classified as being at-risk and 48 as developing age-appropriately. The predicted outcome class for the terminal node is ‘at-risk’ due to higher losses assigned to misidentifying ‘at-risk’ children than the ‘age-appropriate’ group.

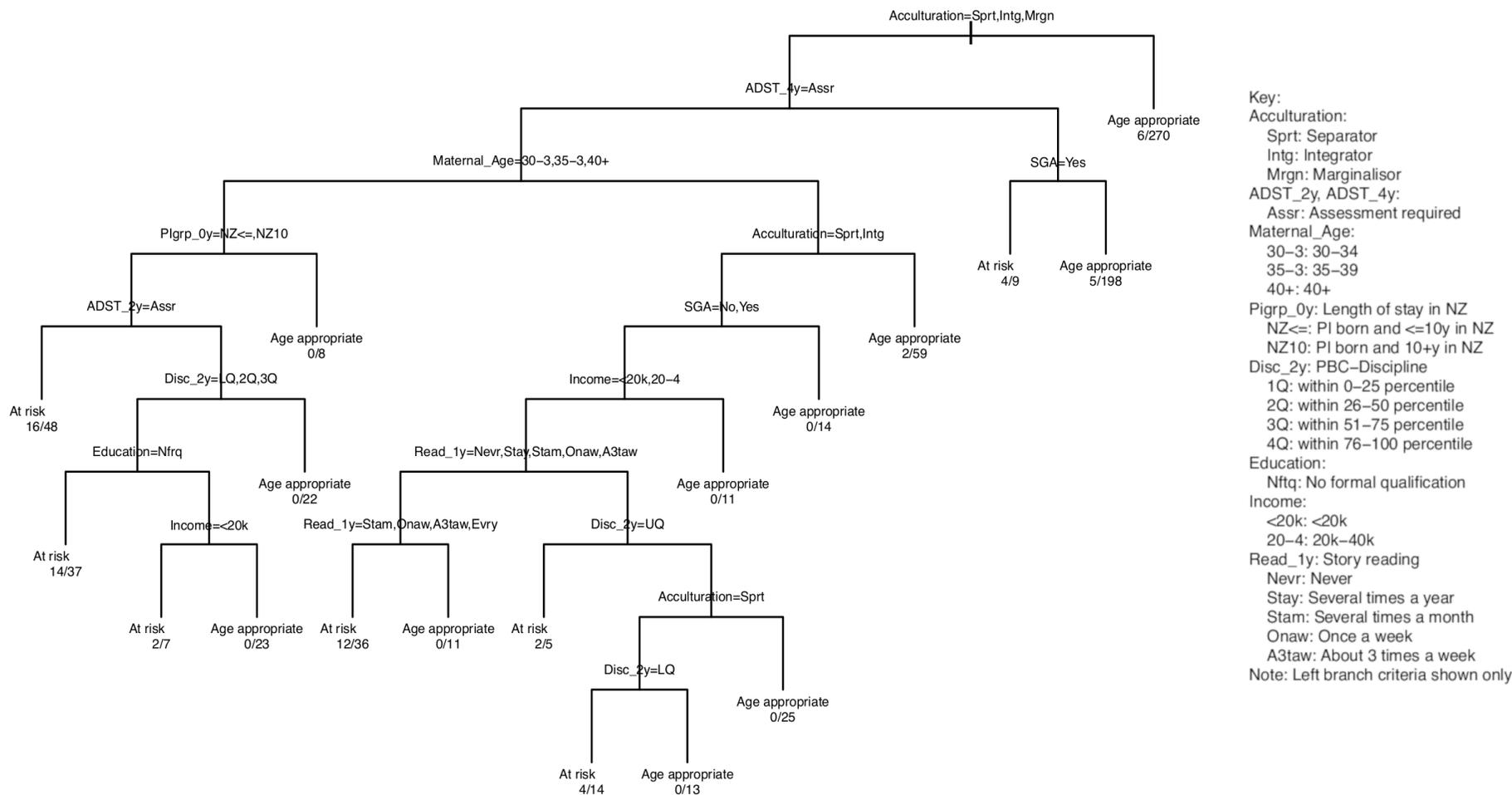


Figure 5.3: Dendrogram of a Tree Pruned to 18 Terminal Nodes with $L_{12} : L_{21} = 10 : 1$ and $CP = 0.007$

5.3.5 Varying the Loss Parameter

The L_{12} loss was varied while keeping $L_{21} = 1$ for the pruned tree ($CP = 0.007$) to analyse different misclassification errors associated with each ratio of losses. The prediction errors for corresponding $L_{12} : L_{21}$ ratios were then estimated directly using the L1O-CV method. The resulting errors are graphed against the relative loss of $L_{12} : L_{21}$ in Figure 5.4.

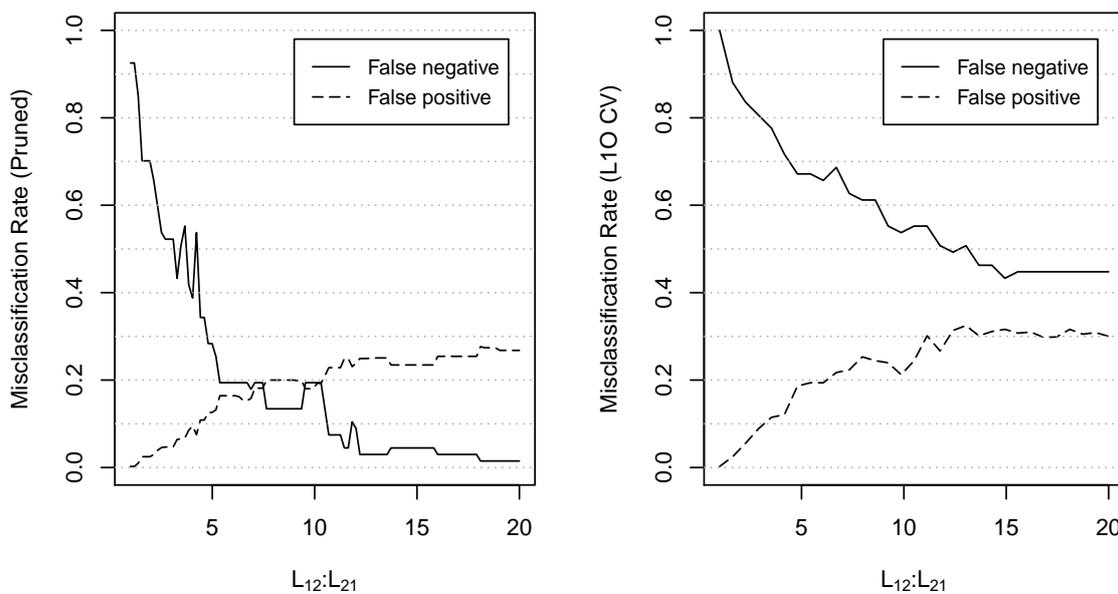


Figure 5.4: Misclassification Rates for Trees Pruned with $CP = 0.007$ and L1O-CV Prediction Errors for Different $L_{12} : L_{21}$ Ratios

Both plots show the trade-off between two types of misclassifications. For the pruned tree, the sensitivity of the model was above 90% for $L_{12} = 10+$ and for further exploration, a full tree, pruned tree and L1O-CV were grown for $L_{12} = 20$. These results are presented in Table 5.2. Figure 5.4 also shows that the ‘at-risk to age-appropriate’ false negative misclassification errors from the L1O-CV analysis taper initially but reach a plateau after $L_{12} = 15+$.

5.4 Discussion

This study showed that the cultural environment to which Pacific children were exposed in early childhood plays an important role in their development of English receptive vocabulary skills. This was evident in the importance of maternal acculturation and the length of mother's stay in New Zealand in predicting the BPVS scores. These variables were separately and importantly associated with the outcome measure and only including one and not the other could limit the understanding of how cultural environment impact on children's English receptive vocabulary development. It is worth noting that maternal acculturation measure, in particular, was more crucial in separating out the typically developing children from those at-risk of low English receptive vocabulary than socioeconomic circumstances and prenatal conditions. This result is nationally and internationally novel given that there has been scant literature on immigrant studies involving psychometrically appealing measures of acculturation with strong face validity (Borrows et al., 2011; Schluter et al., 2011).

In the current study, the children whose mothers were well integrated into both Pacific and New Zealand cultures achieved superior performance in the BPVS than those who were culturally separated or marginalised. The positive relationship between children's English receptive vocabulary skills and their mothers' familiarity with the dominant European culture is perhaps not surprising. Similarly differences in phonemic awareness among children entering the first grade (typically 6 to 7-year olds) have been attributed to environmental influences such as the rich exposure to the English language at home and the cultural and second-language differences of ethnic minority children (Juel et al., 1986). Where the main language of instruction and assessment is English, as is the case in most New Zealand schools, this could explain some of the disparities in the language and academic outcomes between Pacific and European children at age 6 years.

This analysis, however, does not extend to predicting the children's receptive vocabulary in their Pacific languages. There are noted benefits to immigrant or bi- (multi)lingual children retaining their home languages. These include the role of first language in facilitating and maintaining healthy cultural links to the country of their origins, allowing meaningful social interactions with the home community and, in certain cases, assisting in the formation of healthy self-concept and hence mitigating the risks of acculturation related mental health issues (Han & Huang, 2010; Kohnert et al., 2005; Kokaua et al., 2009; Portes & Hao, 2002). For example, in Portes and Hao's (2002) study involving 4,287 second generation immigrant children from the Children of Immigrants Longitudinal Study, fluent bilingualism was associated with the highest level of children's self-esteem and educational aspirations compared to those of the English monolinguals, limited bilinguals and

the foreign language monolinguals. Similarly, in a study following 12,586 children from the kindergarten years to the fifth grade, a growth curve model was used to analyse the associations between language profiles and children's internalising and externalising problem behaviours (Han & Huang, 2010). Compared to the US born, non-Hispanic White American children, the non-English-dominant bilingual and the fluent bilingual Asian American children exhibited the lowest extent of both types of problem behaviours throughout the study periods. On the other hand, the Asian American children who were monolinguals in a non-English-language experienced the worst growth rate in the development of behavioural problems. If the language adaptation can be used to postulate the cultural dominance in a child's home environment, then these results are somewhat similar to what we have found in the present study. That is, the children who came from culturally separated or marginalised homes suffered most acutely in terms of lower English receptive vocabulary skills compared to the children who came from homes with strong connections to both the New Zealand and Pacific cultures.

Pacific children in particular stand to gain from a culturally responsive education as they have experienced adverse outcomes in a Westernised educational system (Fletcher et al., 2009; Nash, 2000; Nakhid, 2003). The results in this study point to the pivotal roles played by the immigrant families' cultural connections and linguistic adaptation profiles on their children's English receptive vocabulary development. The advantage of retaining vital links to both Pacific and the New Zealand European cultures in Pacific children's English receptive vocabulary development suggests that providing an educational environment that reflects and promotes cultural diversity could help enhance students' learning outcomes. This renders support to the more culturally responsive approach to fostering language development for Pacific children growing up in New Zealand as outlined in the MoE's latest Pacific Education Programme (MoE, 2017).

The current study also investigated the influences of prenatal and birth related factors on Pacific children's English receptive vocabulary skills at age 6 years. The low birthweight relative to the infant sex and gestational age was one of the most important factors in classifying the children by their performances in the BPVS. This result is consistent with the findings from the studies investigating the risk factors for children's receptive vocabulary development using the Longitudinal Study of Australian Children (LSAC) cohort (Christensen et al., 2014; Taylor et al., 2013). These studies have also reported low birthweight to be a significant risk factor for receptive vocabulary development. In their study, having 4 or more siblings was also a risk factor. The maternal parity, which was used as a proxy for birth order in the current study, was not as important as the birthweight for children's performances in the BPVS. In addition, maternal behaviours such as tobacco smoking and alcohol consumption during pregnancy were not as crucial

as the low birthweight in the PIF cohort but these behaviours may have had a negative impact on healthy foetal development and birthweight (Carter, 2012; Carter, Jacobsen, J., Sokol, Avison & Jacobsen, S., 2013; Cnattingius, 2004; O’Neil, 2011). Surprisingly, preterm births were not indicative of low BPVS scores for this cohort. This may be due to the closer monitoring of very preterm children who are more likely to be referred than the control children when any developmental delay is suspected (Rajput et al., 2018). Unlike the PIF cohort, a birth cohort study involving 4,019 Australian children aged 5 years found the gestational periods of less than 36 weeks to be associated with lower receptive vocabulary at 5 years (O’Callaghan et al., 1995).

The results of the current analyses provide novel insight into the development of Pacific children’s early English receptive vocabulary development. In particular, the results that demonstrate the relative resilience of Pacific children to the adverse impact of low socioeconomic factors shed new light on the current understanding of the risk and protective factors of language achievement for this population. In this study, the cultural environment and children’s early childhood development were more closely associated with children’s English receptive vocabulary than the household income, household crowding and maternal education. These results are surprising and worth further investigation as higher maternal education consistently acted as a protective factor in children’s receptive vocabulary development in a number of separate studies involving different cohorts (Beitchman et al., 2008; O’Callaghan et al., 1995; Rice & Hoffman, 2015).

But perhaps these results can be reconciled by exploring the relevance of parenting behaviour and the quality in the parent-child interactions on children’s language development. The disciplinary parenting behaviour was indeed ranked as one of the most instrumental influences on the cohort children’s English receptive vocabulary skills. Hart and Risley (1999) reported meaningful differences in the average amount of language experiences provided to children depending on the families’ socioeconomic backgrounds among the 42 families included in their study. However, on a closer inspection, they found that, it was the quality of actual language experiences and the length of time the parents spent talking to the children and not the socioeconomic environment *per se* that influenced their children’s vocabulary growth. An investigation into the long-term interplay between language and literacy skills among 58 children in New Zealand also found correlations in the linguistic profiles of mothers and their children (Suggate et al., 2018). Maternal receptive vocabulary measured when children were aged 3 years had significant positive and concomitant correlations with the children’s receptive vocabulary and longer term positive effect on reading comprehension at age 16 years (Suggate et al., 2018). In a study of 61 low-income African American and Hispanic American children who participated in early Head Start programme, high quality father-child and mother-child linguistic interactions

were conducive to improving children's interests in reading, therefore, indirectly promoted the acquisition of receptive vocabulary skills (Malin et al., 2014). These results, in conjunction with the relevance of disciplinary parenting behaviour found in the current study, provide a solid ground for the observation that the parent-child interactions matter in children's receptive vocabulary development.

The choice of loss parameters played an important role in model selection and performance. This was the first time such losses associated with false negative and false positive misclassification errors were analysed in the context of children's English receptive vocabulary development. It may be of value to compute more reliable measures of the relative cost of not identifying children who are at-risk of low receptive vocabulary to the cost of performing an additional screening on children who are developing at an age-appropriate level. The analytical approach used in this study to predict the development of Pacific children's English receptive vocabulary skills is unique due to its data size and the breadth of predictors included in the model. The analysis was further strengthened by the availability of standardised test results such as the GHQ, PBC, ADST and CBCL that are well-established and known to have strong psychometric properties. Distinctive to this study is the inclusion of maternal acculturation measured using the GEQ with high reliability for this cohort and other cultural factors such as the length of stay in New Zealand and maternal language fluency in predicting the BPVS. The classification tree method used here, the performance of which was tested using L1O-CV, is to our knowledge, unprecedented in the context of predicting receptive vocabulary. The method has a particular strength of allowing the use of all observations including those with missing values for some predictors and with predictors that are highly correlated. The classification tree method has the advantage of interpretability over other machine learning methods such as random forests and neural network (Hastie et al., 2001; Ripley, 1996). Interpretations can be drawn for smaller groups of individuals who exhibit similar characteristics (Hastie et al., 2001). This is appealing when a large sample on the population of interest are available to study factors that are associated with the outcome variable. The constructed tree model performed strongly for the actual PIF cohort used to build the model. The full model was able to correctly identify almost all the children who were at risk of low English receptive vocabulary at age 6 years.

The study, however, is not without its limitations. The measure of the response variable, BPVS, is a Western measure of children's receptive vocabulary normed on a British population and may not be the best instrument to use for Pacific children growing up in New Zealand (Carter, 2005; Goldstein & Kohnert, 2005; Paradis, 2005). The comparison of children with BPVS scores and those without revealed some differential proportions in predictors, indicating that some important children of interest might be missing from the

analyses. There was particular reliance on maternal characteristics and the study did not directly take into account the paternal influences on children's development of receptive vocabulary skills (Leech, Salvo, Rowe & Cabrera, 2013). Despite using a multitude of apposite predictors that provide a holistic view of children's development, the model did not identify over half of the children who were at-risk of developmental delay in receptive vocabulary skills when fitted to the test data. This may have been exacerbated by the small number of at-risk children present in the training sample, implying that even a data size of close to 900 may not be enough to yield a predictive model with strong sensitivity. The problem of identifying children who are at-risk of developmental delay in vocabulary skills is a complex and difficult one even with the breadth of predictors used here (Christensen et al., 2014; Taylor et al., 2013).

Typically for the tree model, each outcome class is the result of a number of interactions of variables and conditional on all the splitting variables prior to reaching the outcome node. This makes interpreting the effect of predictors on the outcome somewhat challenging. The trade-off between accuracy when fitted to the training data and the model's utility as a prediction model for other populations is an important consideration when applying classification tree methods or other machine learning algorithms (Hastie et al., 2000). These results may be an indication that prediction models cannot be substitutes for population-based early language and literacy assessments in detecting children who would benefit the most from early interventions. Even the strongest performing pattern recognition methods need an outcome variable in model construction. Early language screenings are a potential source for such variables.

However, the practicality and performance of population-wide language screening are not without contention and currently there is no universally agreed language assessment method for implementing such screenings (Law, Boyle, Harris, Harkness & Nye, 2000). Washington and Craig (2004) is one example of studies that have investigated the efficacy of language screenings on ethnic minority children. The authors have examined the accuracy of language screening using 196 urban African American children aged between 3 and 6 years. After conducting the proposed language screening that included a test of receptive vocabulary, *Wh*-question comprehension tasks and nonverbal cognitive ability, they identified 36 children presenting with possible language impairment. These children were candidates for full language assessments and additional tests were conducted on them along with 56 randomly selected students from the original sample who passed the first screening. Using the results from the additional assessment, they calculated the values of accuracy measures for their screening protocol. The screening yielded 60.0% sensitivity and 92.7% specificity for detecting children with language impairment. The accuracy improved once the clinical cutoffs that incorporated both the screening and the full as-

assessment were used. That is, the children were symptomatic of language impairment if they failed both the screening and the assessment. However, the accuracy measures were calculated on the sample that consists of all of the children who ‘failed’ the first screening and enough number of randomly selected students who passed to provide adequate power to detect reasonable effect sizes. This unorthodox resampling method to test the accuracy of the screening process need to be further validated. A more prudent method would be to implement a double-blinded study design where the participant recruitment process is separated from the screening process. The candidate screening protocol can be blind tested on a randomly selected mix of children from a different population who were already assessed as having language impairment and who were typically developing (Law et al., 2000). Hence, the tests are administered by language and speech specialists who are blinded to the control and impaired groups of children. Alternatively, as recruitment and administration of screening and assessment could be costly in terms of time and resources, statistical resampling methods such as the cross validation method used in the current study can be applied. A recent study predicting the likelihood of Pacific children receiving reading interventions at school also delivered less than compelling results despite using data from a large nation-wide health screening of children at age 4 years in New Zealand (Schluter et al., 2018b). The authors have emphasised the importance of having apposite outcome and predictor variables that directly account for language and literacy skills. Despite these concerns, the strong performance of the language screening process used in Washington and Craig (2004) for the ethnic minority group, who are often over-represented in language impairment statistics, deserves further attention and investigation.

5.4.1 Conclusion

The task of predicting receptive vocabulary among children is a challenging one as evidenced in this study. However, the study also emphasised the importance of cultural considerations and other factors such as parenting style and healthy maternal behaviours during pregnancy that could help protect children against early language difficulties (Batstra et al., 2003; Davies, 2007; Davis-Kean, 2005, 2009; Guthridge et al., 2015; Malacova et al., 2009). The positive impact of Pacific mothers’ familiarity with the New Zealand culture and society on their children’s English receptive vocabulary skills is worth noting and deserves further investigation. It also renders support to the view of ‘*child-in-their-community*’ (Georgeson et al., 2015, p.1870) and studying children’s development and learning with a focus on individual needs and their needs being shaped by what surrounds them within the cultural context. The association between health, culture, and educational outcomes suggests health be considered as an inclusive concept (Pullon et al., 2015)

and a more holistic and culturally responsive approach is needed in improving the outcomes for Pacific children. These results emphasise the need for closer involvement of and co-construction of Pacific educational frameworks with professionals, parents, and the Pacific communities (Epstein, 1985; Fletcher et al., 2009; Georgeson et al., 2015).

Chapter 6

Phase Three: Pacific Children's Receptive Vocabulary at 6 Years for Different Ethnic Groups

6.1 Introduction

Learning is a complex cognitive and social process that occurs within culturally organised settings (Packer & Goicoechea, 2000). It is important then to understand the impact of culture on learning outcomes (Lynch, 2011). However, such endeavour requires one to quantify or measure the extent to which an individual identifies with a culture. For example, the knowledge of how to prepare and conduct a *kava* ceremony would generally belong to someone who identifies with Pacific cultures (Nosa & Ofanoa, 2009). Breaking down the manifestation of culture as individual practices of cultural activities (values, identities, practices, beliefs, artefacts, etc.), cultural practices can be formulated as a unit of analysis and, ethnicity, theorised as a social construct (Nasir & Hand, 2006). Similarly, the measure of cultural orientation underpinned by Berry's bi-directional framework also uses cultural practices, activities and social interactions in eliciting and quantifying an individual's affinity with a culture (Berry, 2003, 2006; Tsai et al., 2006). Such an approach also enables one's ethnic identity to be part of the picture when an ethnic group is viewed as a community built over generations with a history of participation in common cultural practices (Nasir & Hand, 2006).

6.1.1 Incorporating Pacific Cultural Diversity in Studying the Learning Outcomes of Pacific Children

Ethnicity conceptualised here takes the notion of culture to a deeper level in that it focuses on how one group's collective beliefs and experiences within a given culture may

differ (or may not differ) from other groups (Gorinsky & Fraser, 2006). Culturally held ideas can structure human interactions and activity, and influence learning as evidenced in the qualitative studies of Pacific students and families and their experiences in New Zealand schools (Fairbairn-Dunlop, 1981; Fletcher et al., 2009; Mapa, Sauvao & Podmore, 2000; Podmore, Sauvao & Mapa, 2003). While previous research focused on race, culture, and learning has shed light on the association between these constructs, it has failed to combine *'these links into a multidimensional, multi-layered portrait of human activity'* (Nasir & Hand, 2006, p.468). Pacific cultural values and principles indicate such efforts are necessary when attempting to understand Pacific students' and their families' perspectives on learning and how they navigate through the New Zealand educational system (MoE, 2009, 2012; HRC, 2014). The importance of holism, collectivism, reciprocity and the respect for customs and traditions is commonly emphasised across Pacific ethnic groups and cultures (HRC, 2014; Samu & Suaalii-Sauni, 2009; Taleni, 2017; Tuafuti & McCaffery, 2005). These values exert far-reaching influence on Pacific peoples' health, educational, social and wellbeing outcomes in New Zealand (HRC, 2014).

Pacific communities in New Zealand comprise multiple ethnic groups with different histories of immigration (MoE, 2009). As a group, they account for 7.0% of the New Zealand population, an increase of 11% from the 2006 Census figures (SNZ, 2013). Their median age is about half that of Pākehā, which is also indicated by the relatively high proportion of youth under the age of 20 who made up 46% of the total Pacific population in New Zealand (SNZ, 2013). The presence of Pacific people and their welfare are of national significance (ERO, 2012). In the 2013 New Zealand Census, Samoans comprised the greatest proportion (48.7%) of Pacific peoples in New Zealand. The Cook Islands Māori and Tongans were the next major ethnic groups accounting for 20.6% and 20.4% respectively. Other ethnic groups represented in smaller proportions such as Niueans, Fijians, Tokelauans, Tuvaluans, together made up 10.3% of the total Pacific populations in New Zealand (SNZ, 2013).

The educational outcomes of Pacific children have become a cause for concern among educators and policy makers (ERO 2012; MoE, 2017a, 2017b). Within the educational setting largely defined by Western cultural norms, disadvantages in language, literacy and school achievement levels for Pacific children have been noted in the education literature and the MoE commissioned research papers (Chu et al., 2013; Gorinski, 2005; Gorinski & Fraser, 2006 etc.). The home-school cultural discontinuity was identified as a potential culprit that could prevent Pacific students and families from effectively engaging in the New Zealand educational system. These studies thus emphasised the importance of closer partnerships and involvement of Pacific families and communities in Pacific student's education (Chu et al., 2013; ERO, 2012; Gorinski & Fraser, 2006). These studies have also

identified the lack of research recognising the ethnic diversity among Pacific students and their families and emphasised the need for high quality ethnic-specific data and analysis.

In terms of the number of languages per head, the land area and also the number of different linguistic varieties spoken by single individuals and within communities, the Pacific represents the world's most linguistically diverse area (Crowley, 2007). With the introduction of European culture, languages and the concept of literacy, some indigenous cultural practices and languages declined and some cultural practices took new forms. But as noted by Crowley (2007), '*cultures do not collapse and die only to be replaced by another culture*' (p.173). The interaction, intersection and the bi-directional influence of cultures also form an integral part of Berry's cultural orientation framework (Berry, 2003, 2006). Pacific students' views voiced in qualitative studies indicated the need for such a framework when analysing the impact of Pacific cultures and the dominant Pākehā/European New Zealand culture on Pacific student's learning outcomes (Fletcher et al., 2009; Mapa et al., 2000; Podmore et al., 2003; Schoeffel et al., 1996; Spiller, 2012). The empowerment and full participation as equal members of the New Zealand society without compromising their cultural identity and competence were recurring themes in the studies of Pacific students' perspectives (Fletcher et al., 2009; Lianza, 2017, Tuafuti & McCaffery, 2005; Tuafuti, 2010).

Due to the historical discouragement of bilingualism among Pacific students in New Zealand (for fear of its negative impact on English language acquisition and educational achievement), Pacific children, who were lagging behind in documented academic achievement levels at school were also at risk of losing their home and community Pacific languages (Long, 1994; Mila, 2013; Starks, 2005; Taumoefolau, Starks, Davis & Bell, 2002). It is important to understand whether having strong connections to home communities and Pacific culture indeed place Pacific children at risk of academic underachievement and English language development.

6.1.2 Educational Research on Different Pacific Ethnic Groups

There is very limited quantitative research focusing on Pacific children's early English language and literacy skills. This is partly due to the lack of standardised achievement outcome measures for pre-school and primary school children in New Zealand (Chu et al., 2013). A survey of research on Pacific students' learning outcomes commissioned by the MoE indicated that most quantitative studies involved secondary school achievement results, which were more readily available to researchers (Chu et al., 2013). Given the efficacy and importance of early language and literacy interventions (Gillon et al., 2019; McNaughton et al., 2003; Phillips et al., 2004), the multidimensional factors influencing Pacific children's early English language development need to be studied in order to ensure

their successful transition from their homes and communities to New Zealand schools.

Multiple individual, family and environmental factors affect children's English receptive vocabulary development. These were considered in Section 5.1. The results from the analysis in Chapter 5 highlighted some key factors associated with Pacific children's English receptive vocabulary at age 6 years. Maternal cultural orientation, separately measured for the dominant New Zealand European and Pacific cultures, played an important role in distinguishing Pacific children with strong English receptive vocabulary from those who obtained lower scores. Similarly, the length of mothers' stay in New Zealand and children's low birthweight for their gestational age were other variables relevant for Pacific children's English receptive vocabulary at age 6 years.

However, to recognise the ethnic diversity among Pacific students and their multiple world-views, one can look at each Pacific ethnic group separately and study how these students and families can be better supported to achieve their educational goals (MoE, 2009). To our knowledge, there have been no quantitative research efforts for investigating the association between cultural orientation and English receptive vocabulary among Pacific students in New Zealand. There is a severe lack of quantitative research involving sub-Pacific ethnic groups in any context (Chu et al., 2013). When such efforts were made, most of the studies focused on the Samoan and Tongan communities, which make up the majority proportions among the Pacific migrant populations in New Zealand, and on specific topics of interest such as the impact of bilingual education and bilingualism on school achievement results (Chu et al., 2013; Hamilton & Gillon, 2006; Toloa, McNaughton & Lai, 2009).

For example, Toloa et al. (2009) studied the impact of classroom interventions for English reading comprehension among Samoan students aged 9 to 13 years who were predominantly from low socioeconomic neighbourhoods. A quasi-experimental design was used to analyse the effectiveness of literacy intervention by comparing the reading comprehension achievement levels between Samoan students enrolled in bilingual and the English-medium classes. Within a special instructional context devised through intensive teacher training, the intervention programme positively altered the students' English reading comprehension over the course of two years. The positive effects were seen among both 67 students in bilingual classrooms and 155 students in the English-medium classrooms. The study also found a significant relationship between the students' oral language skills and reading comprehension skills in the Samoan language. However, the general correlation between Samoan oral language scores and English reading comprehension scores was very weak indicating that there was no negative impact from intensive English reading comprehension instruction on students' Samoan oral language status. The authors noted these results as an important outcome in the context of the goals of the bilingual education to foster both

academic achievement and cultural values including languages.

Hamilton and Gillon (2006) focused on phonological awareness in Samoan and English languages among 10 younger students aged between 5 and 7 years. The analyses included the assessments of children's phonological awareness in both Samoan and English languages and hence the results added to the relatively scant evidence-base for the cross-linguistic interactions and plural language fluency among Samoan children. Given the orthographic transparency and syllabic simplicity of Samoan language compared to English, the Samoan-speaking children were expected to perform weaker than the normative sample of English monolingual students. Perhaps surprisingly, as a group, the Samoan-speaking children's scores in the English phonological awareness test were within the age-appropriate range of the normative sample. Although there was a significant positive correlation between the students' combined phoneme level scores in the English and Samoan languages, there were no statistical differences between the scores in subtests for phoneme blending, isolation, segmentation and deletion in the two languages. This indicated that cross-linguistic transfer of phoneme awareness skills could have occurred after formal literacy instruction in English. Like Toloa et al. (2009), the results of this study suggested that bilingualism combined with strong formal literacy programme in the main language of academic instruction could help students reach their academic goals while retaining their cultural identity and first language.

Tongan students were the focus in Otunuku and Brown's (2007) analysis of relationships between students' self-efficacy and liking of an academic subject and how these predict academic performance in that subject. Utilising a large database on secondary school outcomes and applying exploratory analyses, the authors demonstrated that the Tongan students' generally positive attitudes towards mathematics, reading and writing had fundamentally no relationships with their performances in these subjects. For the authors, these results potentially ruled out reactionary or oppositional cultural explanations for Tongan students' lower documented academic performances in the subjects. However, they noted that there may be underlying cultural differences between the types of schooling provided in Pacific nations and those in New Zealand. Based on these results, recommendations to teachers were made to give more challenging and appropriate feedbacks regarding tasks, processes and self-regulation to help promote Tongan students' academic achievement.

Although represented in much smaller numbers than Samoan, the Cook Islands and Tongan immigrant communities in New Zealand, other Pacific ethnic groups share some fundamental cultural values that are common to most Pacific nations (HRC, 2014). For example, an analysis of interviews with Micronesian immigrants in the US revealed very similar cultural values to those of *fa'a Samoa* and more pan-Pacific cultural values pre-

dominantly stemming from collectivist ideals (Ratliffe, 2010).

More recently, an investigation into factors associated with Pacific children requiring reading interventions was conducted using a nation-wide health screening of 4 year olds (Schluter et al., 2018b). The study found that, for Pacific children as a group, being a boy, located in a rural area, and living in a deprived neighbourhood increased the likelihood of receiving literacy interventions. The results also showed that there were significant ethnic differences in the likelihood of receiving literacy interventions in early primary school years. Although the study did not model each ethnic group separately, these results suggested that different processes and configurations of relevant factors could be taking place for individual Pacific ethnic communities.

Studying whether there are differential outcomes across different Pacific ethnic groups could provide the evidence-base needed for implementing more culturally responsive intervention approach as outlined in Gillon and McFarlane (2017). As noted by the MoE (2009, p.2), '*doing better*' for Pacific students requires recognising the rich diversity that exists within Pacific communities. It involves honing on individual cultural differences and experiences and providing the best intervention practices that strengthen their cultural funds of knowledge while at the same time preparing them with literacy skills that could lay the foundations for a brighter future (MoE, 2009).

6.1.3 Research Objectives

Two broad aims are investigated in this chapter. First, ethnic differences within Pacific communities are analysed in relation to how maternal cultural orientation and other key variables identified in Chapter 5 influence children's English receptive vocabulary at age 6 years. The second aim is to study whether the cultural connectedness with both the dominant European New Zealand culture and the Pacific community culture can enhance Pacific children's English receptive vocabulary skills.

6.2 Methods

6.2.1 Study Design

A cross-sectional analysis of data collected at 6-weeks and 6-years measurement waves as part of the PIF birth cohort study was conducted.

6.2.2 Participants

The eligibility criteria for inclusion in the analyses are described in Section 4.2.2. More detailed information on the recruitment and retention of the PIF participants are provided

in the cohort profile publications (Paterson et al., 2006, 2008).

6.2.3 Procedure

The PIF Study, its utilised instruments, and procedures have been described previously in Section 4.2.6 and the cohort profile publications (Paterson et al., 2006, 2008).

6.2.4 Measures

Standardised Measurement

The children were tested using the BPVS to measure their English receptive vocabulary skills as part of the 6-years measurement wave assessment. A more detailed account of derivation of BPVS scores for analyses is provided in Section 3.2.

Self-reported Ethnic Identification and Measures of Cultural Orientation

Maternal ethnicity, cultural orientation, and language profiles were self-identified and self-determined at 6-weeks measurement wave. The mothers were able to choose their ethnicity from a comprehensive set of ethnic groups. For this study, a variable recoded with the following five categories as response options was analysed: Samoan, Cook Islands, Tongan, Other Pacific and Non Pacific Islands. Similarly, maternal English language fluency was elicited using the question, ‘*In your daily life, which languages do you speak fluently?*’. A large set of language options were listed along with an open response option for languages not in the list. Responses were grouped into Pacific (which included: Samoan, Cook Islands Māori, Niuean, Tongan, Fijian, Tokelauan, and Tuvaluan languages), English, and Other languages (which included New Zealand Māori). A dichotomous response variable with levels, ‘*Fluent*’ and ‘*Not fluent*’ in the English language was used for the analysis.

The number of years lived in New Zealand was elicited from questions relating to the country of birth and a numeric variable for years lived in New Zealand. A categorical variable was constructed with levels: ‘*Pacific Island (PI) born, lived in New Zealand (NZ) for 10 or less years*’, ‘*PI born, lived in NZ for more than 10 years*’, and ‘*Born in NZ*’.

Maternal level of acculturation or cultural orientation was measured using Berry’s bi-directional modelling framework (Berry, 2003, 2006) and the GEQ (Tsai et al., 2000) tailored to the Pacific and New Zealand cultural settings (Borrows et al., 2011). The modifications were made for the PIF Study mainly to exclude items that have limited relevance to New Zealand and to add items specific to Pacific culture such as social affiliations and participation in Pacific sports and recreational activities (Borrows et al., 2011). The New Zealand and Pacific cultural alignments were assessed separately using the modified

versions of GEQ adapted to each cultural context. One of the following four acculturation classifications were then assigned depending on the individual score falling below or above the group median on each scale: integration (strong alignment with both the New Zealand and Pacific cultures); assimilation (strong alignment with the New Zealand culture but weak retention of Pacific culture); separation (weak alignment with the New Zealand culture while retaining strong connection to Pacific culture); and marginalisation (weak alignment with both the New Zealand and Pacific cultures). A detailed account of the GEQ adaptation for the PIF Study and its resulting psychometric properties appear in Borrows et al. (2011) and Section 4.2.6.

Sociodemographics

Other maternal demographic information at baseline (6-weeks measurement wave) included age, highest educational attainment, parity, relationship status, perception of household crowding and household income. These variables were as described in Sections 4.2.6 and 5.2.4.

Prenatal and Birth Outcomes

The information available on the children included sex, small for gestational age and sex (<2500gm) with preterm birth (<37 weeks) as a separate category (SGA). Maternal adverse behaviours such as smoking tobacco and alcohol consumption during pregnancy were included in the analysis.

Early Home and Parenting Environment

Children's early home and parenting environment was considered using the GHQ-12 (Goldberg & Williams, 1988) administered with mothers at 1-year to screen for any minor psychiatric disorders. Parenting practice was analysed using nurturance and discipline subscales from the modified PBC (Fox, 1994) administered at the 2-years measurement wave. Both measures were derived as described in Section 5.2.4. Mothers self-reported on the frequency of story reading to their children at the 1-year measurement wave. These were also included in the analysis.

Children's Early Development

The children's progress in multiple domains of early development was monitored using the ADST (Burdon, 1993) at the 2-years and the 4-years measurement waves. The domains screened were psychosocial, language, cognitive, fine motor and general motor skills. The

CBCL (Achenbach et al., 2011) used to screen for any externalising (aggressive and disruptive) and internalising (depressed and withdrawn) problem behaviours at 6-years were also included. The derivation of both measures was described in 5.2.4.

6.2.5 Statistical Analysis

Reporting of analyses was informed by the STROBE guidelines for observational studies (von Elm et al., 2008). Initially, data checks were undertaken, and then participant flow and descriptive statistics were reported. To avoid within-family collinearity bias, one child from all twin births was randomly removed.

A comprehensive set of demographic variables, together with predictors and the response variables, were used to multiply-impute missing values. The values for these predictors were presented in Table 5.1 of Section 5.3. Fully conditional specification approach implemented in R package `mice` was used and the following imputation models were specified: Bayesian linear regression model for numeric variables; Logistic regression for dichotomous response; Proportional odds ordinal logistic regression for ordered categorical variables; and Polytomous unordered regression for categorical variables with 3 or more levels (van Buuren & Groothuis-Oudshoorn, 2011). Imputation results from 50 separate runs were pooled using Rubin’s rules (Rubin, 1987, 1996).

The cohort size dictated that ethnic groups be collapsed into Samoan, Tongan, the Cook Islands and the rest of Pacific, to form Other Pacific group, for ethnic-specific analyses. Those with multiple ethnic identifications were also included in Other Pacific group. Maternal ethnic identification was used as the basis for forming these groups, which are then used as a proxy for children’s ethnic backgrounds. The response variable, the BPVS scores, for each Pacific ethnic group was transformed into an ordered categorical variable with four levels using the quartile range. As the order was preserved under transformation from raw scores to the age-standardised scores with stratification by age, the age-standardised scores were used in the analysis. A separate proportional odds ordinal logistic regression model was run for each ethnic group. The power analyses conducted prior to participant recruitment suggested some ethnic groups may lack sufficient power to draw meaningful conclusions when subsets of these ethnic groups are used (Paterson et al., 2006). An *a priori* decision was made to use only five predictors with the highest variable importance scores from the previous Section 5.3.3. The preliminary analyses using these predictors revealed that including more could result in highly inefficient estimates. The R function `polr` in MASS package version 7.3-47 (Ripley et al., 2017) was used to fit the model with a cumulative logit link function of the following form:

$$\text{logit}[P(Y_i \leq j)] = \alpha_j + \beta_1 x_{1i} + \dots + \beta_K x_{Ki},$$

where, $i = 1, \dots, I,$

$k = 1, \dots, K,$

and $j = 1, \dots, J - 1.$

where β_k indicates the constant and linear effect of the explanatory variables (x_k) on the logit of cumulative probability of scoring within a higher BPVS quartile, j . The total number of levels of response variable is denoted by J . Each predictor included is indexed by k with K being the total number of predictors. There are $J - 1$ or 3 non-redundant levels for BPVS quartiles, Y . The multivariable odds ratios thus obtained were tabulated along with unadjusted odds ratios for each ethnic group. Analyses were performed using R (Foundation for Statistical Language, Vienna, Austria), and $\alpha = 0.05$ defined statistical significance.

6.2.6 Ethics

Ethical approvals obtained by the PIF Study and the considerations given to this research are discussed in Section 3.6. The approval letter for this research from the PIF Study is included in the Appendix A.

6.3 Results

6.3.1 Participants

At the 6-years measurement wave 1,001 maternal and 1,019 child interviews were completed. Randomly removing a child from each multiple birth left 1,001 child-mother pairs. At 6-years, 463 (46%) of mothers identified with Samoan ethnicity, 218 (22%) and 174 (18%) identified with Tongan and the Cook Islands Māori ethnicities respectively. Of the remaining, 78 (8%) mothers identified with multiple ethnic groups or Pacific ethnic groups other than the above and 68 (7%) were of Non-Pacific ethnic groups.

6.3.2 Children's Performance in the BPVS

At 6-years, the PIF children's BPVS raw scores ranged 18 and 104. The mean raw score for the total group was 49.4, with the SD of 11.4. These scores were converted to age-standardised scores using the British population norm. After multiple imputation, 1,001 children's scores were available for the analysis. The age-standardised scores for each ethnic group were then converted into an ordinal categorical variable with four levels (0–25th (1Q); 26–50th (2Q); 51–75th (3Q); and 76th–100th (4Q) percentiles). These

quartiles were used as the response variables in the separate proportional odds ordinal logistic regression analyses for each ethnic group. The summary statistics are presented under each ethnic group section heading.

6.3.3 Characteristics of Participating Children and Mothers

Characteristics of the participants are as in Table 5.1 in Section 5.3. All the variables were included in multiple imputation. The five predictors with the highest variable importance scores in Section 5.3.3 were maternal acculturation, low birthweight measure (SGA), mothers' length of stay in New Zealand, parenting disciplinary behaviour scores and early development screening test scores at 4-years. Across the whole group, the highest proportion (316 mothers, 32%) of mothers had assimilator cultural orientation characterisations. Closely following, 314 (32%) mothers were of separator cultural orientation types. The integrator and marginalisor groups each had 183 (18%) and 178 (18%) mothers respectively. The majority of mothers were born in the Pacific Islands and 284 (28%) of them had lived in New Zealand for 10 or less years. There were 341 (34%) New Zealand-born mothers.

The highest proportion (286 mothers, 31%) of the mothers scored within the lower quartile for disciplinary parenting behaviour in the PBC. The middle 50 percentile accounted for 392 (43%) mothers, while 233 (26%) mothers displayed the harshest disciplinary parenting behaviours. Among the cohort children, 825 (84%) were born with healthy weight, but 74 (8%) children had weights below the threshold for what is expected for their gestational age and sex. Additionally, 83 (8%) children were preterm infants. A surprisingly large proportion (370 children, 54%) of the children required additional screening following the ADST, the early developmental screening test, at 4-years. Of the remaining children, 293 (43%) tested as developing at the age-expected rate but for the other 17 (3%) children, further monitoring and rescreening within 2 to 3 months was recommended.

6.3.4 Factors Associated with Receptive Vocabulary at Age 6 Years for the Whole Cohort

The results from the proportional odds ordinal logistic regression model for the whole cohort are summarised in Table 6.1. In the crude odds ratio analysis, the mothers with integrator cultural orientation types were more likely to have children with the BPVS scores in higher quartiles than the mothers with the separator (OR: 0.38, 95% CI: 0.26, 0.54) and the marginalisor (OR: 0.63, 95% CI: 0.42, 0.94) cultural orientation types. However, the assimilated mothers were 1.66 (95% CI: 1.16, 2.38) times more likely to have children with the BPVS scores in higher quartiles than the integrated mothers. When other predictors were included, the children with assimilated mothers continued to have higher odds ratios (AOR: 1.50, 95% CI: 1.03, 2.20) and the children with separator mothers had lower odds ratios (AOR: 0.50, 95% CI: 0.34, 0.74) compared to the children with integrated mothers.

The crude odds ratio analysis results showed that the children born with healthy birthweight were more likely to have BPVS scores in higher quartiles compared to the smaller infants (OR: 0.63, 95% CI: 0.41, 0.96) and preterm infants (OR: 0.65, 95% CI: 0.43, 0.99). The significantly lower odds ratios remained for infants with lower birthweight compared to the infants born with healthy birthweight when adjusted for other variables. The length of mothers' stay in New Zealand was also a significant predictor in the crude analysis with mothers who spent longer years in New Zealand more likely to have children with higher BPVS scores.

The disciplinary parenting behaviour was more of an equivocal factor in predicting Pacific children's BPVS scores. Only the mothers within the 51 to 75th percentile of the PBC Discipline subscale were significantly less likely (AOR: 0.69, 95% CI: 0.48, 0.99) to have children with higher BPVS scores compared to the mothers employing the most lenient disciplinary methods. As expected, the children who were developing well in early childhood were more likely to score highly in the BPVS scores compared to the children who were screened as requiring further assessment (AOR: 0.28, 95% CI: 0.21, 0.37).

Table 6.1: Crude and Adjusted Odds Ratios for the Whole Cohort

	Whole cohort (n = 1,001)			
	Crude [†]		Adjusted [†]	
	OR	(CI)	OR	(CI)
<i>Child characteristics:</i>				
Small for gestational age (SGA)				
No	1.00	(reference)	1.00	(reference)
Yes	0.63	(0.41, 0.96)	0.50	(0.31, 0.80)
Preterm	0.65	(0.43, 0.99)	0.80	(0.52, 1.24)
Australian Developmental Screening Test (ADST) (4-yr)				
No delay	1.00	(reference)	1.00	(reference)
Monitor	0.52	(0.25, 1.10)	0.56	(0.26, 1.21)
Assessment required	0.27	(0.20, 0.35)	0.28	(0.21, 0.37)
<i>Maternal characteristics:</i>				
Parenting Behaviour (PBC) Discipline (2-yr)				
0-25th (1Q)	1.00	(reference)	1.00	(reference)
26-50th (2Q)	0.80	(0.57, 1.12)	0.85	(0.60, 1.21)
51-75th (3Q)	0.67	(0.47, 0.93)	0.69	(0.48, 0.99)
76-100th (4Q)	0.77	(0.56, 1.08)	0.89	(0.62, 1.27)
Acculturation				
Integration	1.00	(reference)	1.00	(reference)
Assimilation	1.66	(1.16, 2.38)	1.50	(1.03, 2.20)
Separation	0.38	(0.26, 0.54)	0.50	(0.34, 0.74)
Marginalisation	0.63	(0.42, 0.94)	0.78	(0.52, 1.18)
Length of stay in NZ				
Born in PI, NZ \leq 10 yrs	1.00	(reference)	1.00	(reference)
Born in PI, NZ $>$ 10 yrs	1.66	(1.23, 2.22)	1.25	(0.91, 1.73)
Born in NZ	3.23	(2.37, 4.40)	1.83	(1.23, 2.71)

[†] Estimates from multiple imputation analysis.

6.3.5 Factors Associated with Receptive Vocabulary Skills at Age 6 Years by Ethnic Groups

Samoan Group

Characteristics of 463 Samoan children and their mothers are summarised in Table 6.2. There were 32 (7%) children who weighed below the healthy weight threshold and 42 (9%) preterm infants. The majority of the children (177, 55%) were screened as requiring additional assessment at 4-years and 136 (42%) were developing as expected. A large number of mothers (198, 47%) were employing lenient measures when disciplining their children and had scored within the lower quartile in the PBC Discipline subscale. The numbers were progressively smaller for harsher disciplinary parenting behaviours and only 46 (11%) mothers were within the upper quartile range. The separator cultural orientation type was the prevailing acculturation strategy among Samoan mothers with 204 (45%) mothers characterised with this type. Integrator was the next common group with 121 (26%) mothers characterised as being this type, while there were 93 (20%) assimilated and 40 (9%) marginalised mothers. The majority of mothers were born in Samoa and had immigrated to New Zealand.

After the multiple imputation, all the variables in Table 6.2 were used as predictors in the proportional odds ordinal logistic regression model for Samoan cohort. The crude odds ratios and the multivariable adjusted odds ratios from the regression model are summarised in Table 6.3. In the crude analysis, the mothers with integrator acculturation type were more likely to have children with scores in higher quartiles than the mothers who had separator cultural orientation types (OR: 0.43, 95% CI: 0.28, 0.67). The difference remained significant when adjusted for other predictors. No significant differences were found for assimilator or marginalisor groups when compared to the integrator group. The length of mothers' stay in New Zealand continued to be a significant factor for Samoan cohort children's BPVS test performance. In particular, the New Zealand born mothers had children whose scores were 1.8 (AOR 95% CI: 1.01, 3.19) times more likely to be within a higher quartile than the Pacific Island born mothers who had lived in New Zealand for 10 or less years. The early developmental screening test conducted at 4-years also predicted Samoan children's BPVS scores and when adjusted for other predictors, the children requiring full assessment were less likely to score highly (AOR: 0.30, 95% CI: 0.19, 0.45) in the BPVS than the children developing as expected.

Table 6.2: Demographic Profiles for Samoan Group

Samoan Group	(n = 463)	
	n	(%)
<i>Child characteristics:</i>		
Small for gestational age (SGA) ^a		
No	378	(84)
Yes	32	(7)
Preterm	42	(9)
Australian Developmental Screening Test (ADST) (4-yr) ^b		
No delay	136	(42)
Monitor	8	(3)
Assessment required	177	(55)
<i>Maternal characteristics:</i>		
Parenting behaviour - Discipline (2-yr) ^c		
0-25th (1Q)	198	(47)
26-50th (2Q)	106	(25)
51-75th (3Q)	76	(18)
76-100th (4Q)	46	(11)
Acculturation ^d		
Integration (High Pacific/High NZ)	121	(26)
Assimilation (Low Pacific/High NZ)	93	(20)
Separation (High Pacific/Low NZ)	204	(45)
Marginalisation (Low Pacific/Low NZ)	40	(9)
Length of stay in NZ		
Born in PI, NZ ≤ 10 yrs	147	(32)
Born in PI, NZ > 10 yrs	170	(37)
Born in NZ	146	(32)

^a 11 (2%) values missing/unknown.

^b 142 (31%) values missing/unknown.

^c 37 (8%) values missing/unknown.

^d 5 (1%) values missing/unknown.

Table 6.3: Crude and Adjusted Odds Ratios for Samoan Group

	Samoan (n = 463)			
	Crude [†]		Adjusted [†]	
	OR	(CI)	OR	(CI)
<i>Child characteristics:</i>				
Small for gestational age (SGA)				
No	1.00	(reference)	1.00	(reference)
Yes	0.74	(0.37, 1.46)	0.55	(0.27, 1.13)
Preterm	0.83	(0.47, 1.48)	0.93	(0.51, 1.70)
Australian Developmental Screening Test (ADST) (4-yr)				
No delay	1.00	(reference)	1.00	(reference)
Monitor	0.57	(0.19, 1.75)	0.58	(0.18, 1.81)
Assessment required	0.30	(0.20, 0.44)	0.30	(0.19, 0.45)
<i>Maternal characteristics:</i>				
Parenting Behaviour (PBC) Discipline (2-yr)				
0-25th (1Q)	1.00	(reference)	1.00	(reference)
26-50th (2Q)	0.98	(0.63, 1.52)	1.09	(0.68, 1.74)
51-75th (3Q)	0.63	(0.39, 1.03)	0.74	(0.44, 1.24)
76-100th (4Q)	0.92	(0.50, 1.71)	1.00	(0.52, 1.92)
Acculturation				
Integration	1.00	(reference)	1.00	(reference)
Assimilation	1.64	(0.98, 2.74)	1.53	(0.88, 2.67)
Separation	0.43	(0.28, 0.67)	0.60	(0.37, 0.99)
Marginalisation	0.75	(0.37, 1.53)	0.85	(0.41, 1.77)
Length of stay in NZ				
Born in PI, NZ \leq 10 yrs	1.00	(reference)	1.00	(reference)
Born in PI, NZ $>$ 10 yrs	1.40	(0.92, 2.14)	1.12	(0.71, 1.77)
Born in NZ	3.01	(1.94, 4.68)	1.80	(1.01, 3.19)

[†] Estimates from multiple imputation analysis.

Tongan Group

Information was available for 218 Tongan children for analysis. The characteristics of these children and their mothers that were included in the regression analysis are summarised in Table 6.4. Only 10 (5%) Tongan children were born with weight less than the threshold for their gestational age and sex. But 22 (10%) children were preterm infants. A considerable number (92, 61%) of Tongan children were identified as requiring further developmental assessment at 4-years. The highest proportion (45%) of Tongan mothers employed the harshest disciplinary methods and scored within the upper quartile in the PBC Discipline subscale. Separation was the most common acculturation strategy among Tongan mothers followed by marginalisation. Only 21 (10%) Tongan mothers were born in New Zealand.

The results of proportional odds ordinal logistic regression model fitted for Tongan cohort are summarised in Table 6.5. All the predictors in Table 6.4 were included in the analysis after multiply-imputing missing observations. Compared to the children with culturally integrated mothers, the children with culturally separated mothers were less likely to obtain BPVS scores in higher quartiles. This was in both the crude analysis (OR: 0.40, 95% CI: 0.19, 0.83) and the multivariable analysis when adjusted for all other predictors (AOR: 0.45, 95% CI: 0.20, 0.99). In a univariable analysis, the New Zealand born Tongan mothers had children who were 4.05 (95% CI: 1.49, 10.96) more likely to score in a higher quartile than the mothers who were born in the Pacific Islands and had lived in New Zealand for 10 or less number of years. However, the difference was not significant when other predictors were included in the multivariable analysis. Harsher disciplinary parenting behaviour adversely impacted on Tongan children's BPVS performance. When compared to those who used the most lenient measures, Tongan mothers who were in the upper 50 percentiles of PBC Disciplinary subscale scores were less likely to have children with higher BPVS scores. The odds (AOR: 0.34, 95% CI: 0.13, 0.90) remained significant for mothers within the 50 to 75th percentiles of PBC Discipline subscale scores even after adjusting for other predictors. Being identified as requiring full assessment in the early developmental screening test at 4-years was predictive of lower BPVS scores among Tongan cohort children. After taking into account other predictors, the children requiring further assessment were less likely to score within higher quartiles in the BPVS than those developing at the age-expected level with the adjusted odds ratio of 0.34 (95% CI: 0.17, 0.67).

Table 6.4: Demographic Profiles for Tongan Group

Tongan Group	(n = 218)	
	n	(%)
<i>Child characteristics:</i>		
Small for gestational age (SGA) ^a		
No	182	(85)
Yes	10	(5)
Preterm	22	(10)
Australian Developmental Screening Test (ADST) (4-yr) ^b		
No delay	54	(36)
Monitor	4	(3)
Assessment required	92	(61)
<i>Maternal characteristics:</i>		
Parenting behaviour - Discipline (2-yr) ^c		
0-25th (1Q)	24	(12)
26-50th (2Q)	41	(20)
51-75th (3Q)	48	(23)
76-100th (4Q)	93	(45)
Acculturation ^d		
Integration (High Pacific/High NZ)	37	(17)
Assimilation (Low Pacific/High NZ)	38	(18)
Separation (High Pacific/Low NZ)	93	(44)
Marginalisation (Low Pacific/Low NZ)	46	(22)
Length of stay in NZ		
Born in PI, NZ \leq 10 yrs	98	(45)
Born in PI, NZ $>$ 10 yrs	99	(45)
Born in NZ	21	(10)

^a 4 (2%) values missing/unknown.^b 68 (31%) values missing/unknown.^c 12 (6%) values missing/unknown.^d 4 (2%) values missing/unknown.

Table 6.5: Crude and Adjusted Odds Ratios for Tongan Group

	Tongan (n = 218)			
	OR	Crude [†] (CI)	OR	Adjusted [†] (CI)
<i>Child characteristics:</i>				
Small for gestational age (SGA)				
No	1.00	(reference)	1.00	(reference)
Yes	1.10	(0.34, 3.56)	1.20	(0.35, 4.12)
Preterm	0.71	(0.32, 1.54)	0.84	(0.36, 1.94)
Australian Developmental Screening Test (ADST) (4-yr)				
No delay	1.00	(reference)	1.00	(reference)
Monitor	0.46	(0.08, 2.62)	0.53	(0.09, 3.27)
Assessment required	0.32	(0.17, 0.60)	0.34	(0.17, 0.67)
<i>Maternal characteristics:</i>				
Parenting Behaviour (PBC) Discipline (2-yr)				
0-25th (1Q)	1.00	(reference)	1.00	(reference)
26-50th (2Q)	0.45	(0.18, 1.17)	0.46	(0.17, 1.26)
51-75th (3Q)	0.32	(0.12, 0.80)	0.34	(0.13, 0.90)
76-100th (4Q)	0.31	(0.13, 0.74)	0.44	(0.18, 1.12)
Acculturation				
Integration	1.00	(reference)	1.00	(reference)
Assimilation	1.12	(0.46, 2.74)	0.85	(0.32, 2.26)
Separation	0.40	(0.19, 0.83)	0.45	(0.20, 0.99)
Marginalisation	0.48	(0.21, 1.10)	0.49	(0.20, 1.18)
Length of stay in NZ				
Born in PI, NZ \leq 10 yrs	1.00	(reference)	1.00	(reference)
Born in PI, NZ $>$ 10 yrs	1.11	(0.66, 1.87)	1.07	(0.60, 1.90)
Born in NZ	4.05	(1.49, 10.96)	2.88	(0.88, 9.36)

[†] Estimates from multiple imputation analysis.

The Cook Islands Māori Group

There were 174 children in the Cook Islands ethnic group. Their characteristics are summarised in Table 6.6 along with those of their mothers. More than 10% of the children were born with low birthweight. A smaller number (10, 6%) of children were preterm births. The acculturation strategies adopted by the Cook Islands mothers were often on the either extremes of the bi-dimensional scale with 82 (47%) mothers being assimilators and 68 (39%) mothers being marginalised. Much smaller numbers were either separators (10, 6%) or integrators (14, 8%). Only 25 (14%) mothers were born in the Pacific Islands and had lived in New Zealand for 10 or less number of years.

The imputation pooled results from the proportional odds ordinal logistic regression analysis with all the variables in Table 6.6 as predictors are presented in Table 6.7. Maternal cultural orientation was not significantly associated with children's BPVS scores for the Cook Islands ethnic group. The children born with healthy birthweight were more likely to score highly in the BPVS compared to the children with low birthweight in the crude analysis. The difference, however, was not significant when controlled for other predictors. The longer number of years spent in New Zealand by the Cook Islands mothers was associated with their children's higher performances in the BPVS in a univariable model. The only predictor that remained significant once adjusted for other predictors was the early developmental screening test results. The children who tested as developing well were more likely to obtain BPVS scores in higher quartiles than the children requiring further assessment. The adjusted odds ratio for this comparison was 0.25 (95% CI: 0.12, 0.52) with the typically developing children as the reference group.

Other Pacific Ethnic Group

Given the ethnic categorisation in Section 6.2.5, the remaining Pacific group comprised 78 children and their mothers. Their characteristics are presented in Table 6.8. More than half of Other Pacific mothers (40, 52%) were in the assimilator group. Separator was the least common type among these mothers. The New Zealand-born mothers comprised almost half of the cohort (37, 49%).

The variables in Table 6.8 were used as predictors in the ordinal logistic regression model for Other Pacific group. The imputation pooled results are summarised in Table 6.9. Some predictors were highly variable over the imputation runs for this group. For example, separator acculturation type had the pooled variance of 20.18. Compared to this value, the assimilator and marginalisor types had pooled variances of 0.57 and 0.74 respectively. As such, the 95% confidence interval for the separator adjusted odds ratio was very wide. Similarly, the preterm birth and ADST-monitor levels both had wide 95%

Table 6.6: Demographic Profiles for the Cook Islands Group

Cook Islands Group	(n = 174)	
	n	(%)
<i>Child characteristics:</i>		
Small for gestational age (SGA) ^a		
No	144	(83)
Yes	19	(11)
Preterm	10	(6)
Australian Developmental Screening Test (ADST) (4-yr) ^b		
No delay	52	(46)
Monitor	4	(4)
Assessment required	58	(51)
<i>Maternal characteristics:</i>		
Parenting behaviour - Discipline (2-yr) ^c		
0-25th (1Q)	31	(21)
26-50th (2Q)	34	(23)
51-75th (3Q)	31	(21)
76-100th (4Q)	55	(36)
Acculturation		
Integration (High Pacific/High NZ)	14	(8)
Assimilation (Low Pacific/High NZ)	82	(47)
Separation (High Pacific/Low NZ)	10	(6)
Marginalisation (Low Pacific/Low NZ)	68	(39)
Length of stay in NZ		
Born in PI, NZ ≤ 10 yrs	25	(14)
Born in PI, NZ > 10 yrs	77	(44)
Born in NZ	72	(41)

^a 1 (< 1%) values missing/unknown.

^b 60 (35%) values missing/unknown.

^c 23 (13%) values missing/unknown.

confidence interval estimates. From the crude analysis, the children developing at the age-expected rate were more likely to score highly in the BPVS compared to the children requiring additional assessment (OR: 0.31, 95% CI: 0.11, 0.91). But the difference was not significant when adjusted for other predictors.

Table 6.7: Crude and Adjusted Odds Ratios for the Cook Islands Group

	Cook Islands (n = 174)			
	Crude [†]		Adjusted [†]	
	OR	(CI)	OR	(CI)
<i>Child characteristics:</i>				
Small for gestational age (SGA)				
No	1.00	(reference)	1.00	(reference)
Yes	0.37	(0.14, 0.93)	0.44	(0.16, 1.21)
Preterm	0.73	(0.23, 2.29)	0.94	(0.26, 3.35)
Australian Developmental Screening Test (ADST) (4-yr)				
No delay	1.00	(reference)	1.00	(reference)
Monitor	0.77	(0.15, 3.89)	0.53	(0.10, 2.98)
Assessment required	0.24	(0.12, 0.48)	0.25	(0.12, 0.52)
<i>Maternal characteristics:</i>				
Parenting Behaviour (PBC) Discipline (2-yr)				
0-25th (1Q)	1.00	(reference)	1.00	(reference)
26-50th (2Q)	0.54	(0.22, 1.33)	0.55	(0.21, 1.46)
51-75th (3Q)	0.50	(0.20, 1.26)	0.54	(0.20, 1.45)
76-100th (4Q)	0.72	(0.32, 1.62)	0.59	(0.24, 1.46)
Acculturation				
Integration	1.00	(reference)	1.00	(reference)
Assimilation	0.88	(0.28, 2.70)	0.70	(0.20, 2.42)
Separation	0.23	(0.05, 1.16)	0.27	(0.05, 1.60)
Marginalisation	0.41	(0.13, 1.29)	0.46	(0.13, 1.66)
Length of stay in NZ				
Born in PI, NZ \leq 10 yrs	1.00	(reference)	1.00	(reference)
Born in PI, NZ $>$ 10 yrs	2.96	(1.17, 7.50)	1.49	(0.51, 4.37)
Born in NZ	2.80	(1.09, 7.18)	2.10	(0.73, 6.05)

[†] Estimates from multiple imputation analysis.

Table 6.8: Demographic Profiles for Other Pacific Ethnic Group

Other Pacific Ethnic Group	(n = 78)	
	n	(%)
<i>Child characteristics:</i>		
Small for gestational age (SGA) ^a		
No	66	(87)
Yes	6	(8)
Preterm	4	(5)
Australian Developmental Screening Test (ADST) (4-yr) ^b		
No delay	23	(45)
Monitor	1	(2)
Assessment required	27	(53)
<i>Maternal characteristics:</i>		
Parenting behaviour - Discipline (2-yr) ^c		
0-25th (1Q)	16	(24)
26-50th (2Q)	11	(17)
51-75th (3Q)	20	(30)
76-100th (4Q)	19	(29)
Acculturation ^d		
Integration (High Pacific/High NZ)	10	(13)
Assimilation (Low Pacific/High NZ)	40	(52)
Separation (High Pacific/Low NZ)	7	(9)
Marginalisation (Low Pacific/Low NZ)	20	(26)
Length of stay in NZ ^e		
Born in PI, NZ \leq 10 yrs	13	(17)
Born in PI, NZ $>$ 10 yrs	26	(34)
Born in NZ	37	(49)

^a 2 (3%) values missing/unknown.

^b 27 (35%) values missing/unknown.

^c 12 (15%) values missing/unknown.

^d 1 (1%) values missing/unknown.

^e 2 (3%) values missing/unknown.

Table 6.9: Crude and Adjusted Odds Ratios for Other Pacific group

	Other Pacific (n = 78)			
	OR	Crude [†] (CI)	OR	Adjusted [†] (CI)
<i>Child characteristics:</i>				
Small for gestational age (SGA)				
No	1.00	(reference)	1.00	(reference)
Yes	0.56	(0.11, 2.84)	0.53	(0.07, 3.93)
Preterm	0.40	(0.06, 2.79)	*	*
Australian Developmental Screening Test (ADST) (4-yr)				
No delay	1.00	(reference)	1.00	(reference)
Monitor	*	*	*	*
Assessment required	0.31	(0.11, 0.91)	0.3	(0.09, 1.05)
<i>Maternal characteristics:</i>				
Parenting Behaviour (PBC) Discipline (2-yr)				
0-25th (1Q)	1.00	(reference)	1.00	(reference)
26-50th (2Q)	0.95	(0.23, 4.03)	0.90	(0.18, 4.64)
51-75th (3Q)	1.05	(0.32, 3.49)	1.11	(0.28, 4.47)
76-100th (4Q)	0.93	(0.27, 3.19)	1.35	(0.32, 5.74)
Acculturation				
Integration	1.00	(reference)	1.00	(reference)
Assimilation	1.91	(0.54, 6.75)	2.79	(0.64, 12.26)
Separation	0.15	(0.02, 1.27)	*	*
Marginalisation	0.61	(0.15, 2.51)	1.01	(0.19, 5.47)
Length of stay in NZ				
Born in PI, NZ ≤ 10 yrs	1.00	(reference)	1.00	(reference)
Born in PI, NZ > 10 yrs	2.08	(0.56, 7.76)	1.29	(0.27, 6.24)
Born in NZ	2.24	(0.62, 8.08)	1.06	(0.23, 4.85)

[†] Estimates from multiple imputation analysis.

* Unestimatable due to high variance.

6.4 Discussion

Each Pacific ethnic group was analysed separately to study the association between the key predictors identified in Chapter 5 and the children's English receptive vocabulary skills at age 6 years measured using the BPVS. The results confirmed the initial conjecture that the predictors had differential impact on children's BPVS scores based on their ethnic and cultural environment. When the children were considered as a whole cohort, all five variables included were significant in the multivariable adjusted model. For example, compared to the children born with low birthweight, the children with healthy birthweight and age-expected early development were more likely to obtain higher BPVS scores. The statistical significance of the adjusted odds ratios for maternal cultural orientation found here also corroborated the results in Chapter 5. The mothers who were strongly aligned with both the New Zealand and Pacific cultures were more likely to have children with higher BPVS scores than the mothers who were largely separated from the dominant New Zealand culture. The New Zealand-born mothers were more likely to have children with higher BPVS scores than the recently migrated Pacific born mothers. These findings reinforce the results of the prediction model constructed using a classification tree method in Chapter 5. In addition to these results, the ethnic-specific analysis demonstrated that different factors or distinct configurations of the same factors were likely to be associated with Pacific children's English receptive vocabulary at 6 years for each ethnic group. For example, the disciplinary maternal parenting behaviour was only significant for Tongan children's BPVS scores. Maternal cultural orientation also yielded disparate results across different Pacific ethnic groups. However, some important patterns of similarities also emerged. Notably, the early developmental screening test results were relevant across Samoan, Tongan and the Cook Islands children.

The adverse impact of cultural and social separation from the dominant New Zealand culture on the children's BPVS performance found in the whole cohort analysis was replicated in the analyses of Samoan and Tongan groups. Looking at the demographic characteristics for each ethnic group, it can be observed that the separator acculturation strategy was the most common cultural orientation characterisation for these groups. It is important to note that together, these two groups comprised the majority of the cohort data and may have driven the whole cohort analysis results. However, it is also important to acknowledge the ethnic differences in the proportions of mothers representing each cultural orientation type and to the disparate degrees to which maternal cultural orientation influenced the children's BPVS scores. The PIF cohort and the general Pacific population in New Zealand are also characterised by their cultural and linguistic diversity (Borrows et al., 2011; MoE, 2009; Taylor, 2011). The results here provide the quantitative evidence-

base for the expedience of recognising ethnic and cultural diversity among Pacific children and incorporating their cultural environment in studying the receptive vocabulary outcomes. It also validates the notion that there is no one-size-fits-all type of solution but rather a more context-specific and flexible support is required to promote Pacific children's literacy success (MoE, 2009).

This study was able to utilise a measure of cultural orientation that was specifically tailored for the Pacific migrant population in New Zealand. It included questions relating to one's social connections and community activities. Although the relevance of acculturation in understanding what drives migrant outcomes in multicultural settings has been recognised, most previous attempts at applying this concept have used measures that lack theoretical foundation or psychometrically appealing properties (Borrows et al., 2011; Schluter et al., 2011). The particular implementation of Berry's bi-directional framework for the PIF Study, although based on the abbreviated 11-item questionnaire for each culture, has made apparent the distinct patterns of cultural practice and acculturation strategies across different Pacific ethnic groups. For example, compared to the more balanced distribution of acculturation strategies employed by the whole cohort, more than 40% of Tongan mothers were characterised as separators. Such attention to Pacific families' engagement and participation in their cultural practices is what sets this study apart from others. Previous studies looking at risk factors for children's English receptive vocabulary development have limited their attention to maternal ethnicity, non-English speaking background or more occasionally, the length of stay in the host country as predictors to account for families' cultural backgrounds (Christensen et al., 2014; OCallaghan et al., 1995; Taylor et al., 2013). Although these studies involving over 4,000 Australian children aged 4 to 8 years found the maternal non-English speaking background to be a moderate risk factor, they were not able to provide any insight into how families' social connections and cultural orientation influence children's English receptive vocabulary development.

The social context provided by immigrant parents plays a decisive role in the adaptation outcomes of their children in the host country (Portes & Rumbaut, 2005). Portes and Rumbaut (2001, 2005)'s syntheses of results from the Children of Immigrants Longitudinal Study, initially involving over 5,000 second-generation immigrant American youths, have shown significant differences in adaptation process experienced by the second-generation immigrants by their nationality and social class. In the current analysis, an attempt was made to account for this variation across ethnic groups by incorporating both maternal acculturation strategies and the length of stay in New Zealand. These were both significantly and separately associated with the children's BPVS scores indicating that these variables, although related, contain and reveal different information about Pacific children's English

receptive vocabulary development.

The superior BPVS performance found among Samoan and Tongan children with integrator type mothers compared to those with separator type mothers indicate that the acculturation profiles may have distinct influences on educational and health outcomes. In Borrows et al. (2011), a stronger sense of communal support experienced by the separator type mothers were noted as one of the factors that may have led to better infant health and maternal behavioural outcomes among those mothers. However, the results in this study indicate that the mothers' familiarity with the New Zealand culture as well as their strong maintenance of the Pacific culture may be more conducive to their children achieving greater English receptive vocabulary skills. This result is not surprising when considering the value of involvement and effective engagement of Pacific parents and communities in their children's education in improving outcomes for Pacific learners (Gorinski, 2005). The discontinuity of cultural values, beliefs and experiences between home and school may act as a barrier to achieving balance of power in ethnic minority groups' interactions with New Zealand schools (Gorinski & Fraser, 2006). Then the parents' unfamiliarity with the dominant New Zealand culture and the English language may impede their effective engagement in the New Zealand education system and negatively impact on Pacific students' learning.

Mapa et al. (2000) documented experiences of Pacific children, parents and teachers in children's transition from the Pacific Islands early childhood centres to English-language medium primary schools. They interviewed six families from each of the following five Pacific ethnic groups: Samoan, Tongan, the Cook Islands, Tokelauan and Niuean. Although some teacher sentiments were expressed about making schools more culturally inclusive, a bigger proportion of teachers in the study were concerned with Pacific children's language and academic abilities. For example, 18 (82%) primary school teachers interviewed expressed their concerns over Pacific children's shyness and limited spoken English and listening skills. In comparison, 12 (45%) teachers wanted more support from parents for language and cultural activities at school and 10 (45%) teachers wanted the schools to employ Pacific teachers and community people to teach Pacific languages and cultures at school. Some also expressed the need for teacher education on Pacific languages and cultures. These results suggest that the teachers understood the importance of home-school cultural continuity for Pacific children but the academic and curricular continuity was of a more pressing nature to them.

In addition to the maternal acculturation types, the mothers' length of stay in New Zealand and whether they were born in New Zealand or Pacific Islands were associated with their children's BPVS performance. This is consistent with the results from O'Callaghan et al. (1995) in their model for Australian children's English receptive vocabulary. But

what is surprising about our results is that the difference between the New Zealand-born mothers and the Pacific-born mothers were not fully mediated by the inclusion of acculturation variable. Schoeffel et al.'s (1996) interviews with 25 Pacific migrant families in New Zealand revealed that there were pronounced differences in life experiences between the Pacific-born and New Zealand-born generations. Most Pacific parents they interviewed had grown up in rural communities in which their main social interactions were with children whom they were related or connected through their community and shared common values and beliefs. This was contrasting to their experiences in New Zealand where children and the families were expected to interact and socialise with children from different ethnic and cultural backgrounds who bring with them their own set of values and beliefs.

Disciplinary parenting behaviour was significant in the whole cohort analysis. Schoeffel et al. (1996) studied Pacific cultural attitudes regarding the socialisation and discipline of children in New Zealand and found that how Pacific parents defined parenting skills were at variance with those of New Zealand Europeans. Pacific parents talked about strict discipline enforced in primary and intermediate schools back in the Pacific Islands. The parents generally expressed their confidence in knowing the right way to teach their children the correct standards of behaviour and they imparted this knowledge through direct discussion or indirectly through prayer. However, conversations with children on such matters were generally limited to parents giving advice or instructions to children and the children listening to their parents. The children's participation in discussion among adults were generally discouraged. Only very few children interviewed felt that they had open communication with their parents. In the current study, harsher disciplinary parenting behaviours were associated with children's lower BPVS scores compared to more lenient behaviours. The connection between discipline of children, socialisation and the lack of dialogues between parents and children explained in Schoeffel et al. (1996) could help explain some of these results. Hart and Risley (1999) reported the association between greater language exposure through richer parent-child linguistic interactions and stronger oral language skills in young children studied over a three-year period. However, as Schoeffel et al.'s (1996) study demonstrates, simply challenging the way Pacific parents discipline their children will not enhance Pacific children's language and academic outcomes. A more culturally nuanced approach is needed to encourage Pacific children's oral vocabulary and language development.

The PIF cohort children's strong performance in the early developmental screening test at 4 years was associated with higher BPVS scores for Samoan, Tongan and the Cook Islands groups. This outcome is consistent with the results found in the LSAC studies where low performances in the school readiness measure was associated with lower initial English receptive vocabulary (Christensen et al., 2014; Taylor et al., 2013). For the Cook

Islands group, the ADST result was the only significant predictor in the adjusted model indicating its potential utility in early detection of children with low English receptive vocabulary for this group. Similarly, compared to being born a small infant, healthy birthweight was associated with higher BPVS scores in the whole cohort analysis, and the univariable analysis for the Cook Islands group. Again, low birthweight was a risk factor for English receptive vocabulary among the participating children in the LSAC studies (Christensen et al., 2014; Taylor et al., 2013).

The children in Samoan group comprised almost half of the whole cohort. In the Samoan group analysis, the separator acculturation strategy was a significant risk factor for children's English receptive vocabulary. However, the maintenance of Samoan language and cultural values are important to Samoan communities in New Zealand (Tuafuti & McCaffery, 2005). Approximately 80% of the Samoan population in New Zealand were reported to be able to speak the Samoan language indicating strong language preservation among Samoan migrants in New Zealand (Toloa et al., 2009). Being relatively recent arrivals in New Zealand, they retained their first generation ambitions of succeeding academically and acquiring English language skills without abandoning their language and *fa'a Samoa* values (Tuafuti & McCaffery, 2005).

In Mapa et al.'s (2000) study, there were differing views on the value of language continuity and what supports language development among Samoan parents and the primary school teachers. Samoan parents saw value in the experiences that their children could gain from attending *a'oga àmata* (Samoan language immersion early childhood programme) and considered Samoan language development as an important part of their children's education. The teachers, however, prioritised curriculum continuity (Mapa et al., 2000; Podmore et al., 2003). Similarly, students' adherence to *fa'a Samoa* values was observed to be at conflict with what was expected of the students in New Zealand schools (Fletcher et al., 2009; Schoeffel et al., 1996). The Samoan cultural values of conformity, obeying authority figures without questioning and showing respect and humility were seen as being discordant with the process of Western education that involved more independent inquisition and critical thinking (Fairbairn-Dunlop, 1981; Fletcher et al., 2009; Schoeffel et al., 1996). In Samoa, '*fa palagi*' (wanting to be like a European) is used as a derisive expression (Schoeffel et al., 1996). The empowerment of Samoan students within both Samoan and the dominant New Zealand cultural framework seems a challenging but necessary task to support them achieve academically and at the same time retain and strengthen their cultural identity. Some have suggested additive bilingual education as an effective strategy to help Pacific students retain their cultural values and first languages while empowering them within the dominant cultural context (Hamilton & Gillon, 2006; Toloa et al., 2009; Tuafuti, 2010).

Samoan parents were predominantly using lenient methods in disciplining their children in this study. As a teacher in Fletcher et al.'s (2009) study noted, the common trait among high achieving Samoan students were that they came from homes where the children were encouraged to talk openly with their parents and families, the results that were consistent with Hart and Risley's observations (Hart & Risley, 1999). However, there were financial constraints, coupled with long working hours and cultural commitments that prevented the parents from spending more time with their children and from engaging in quality oral language discourse in both Samoan and English languages. Some teachers in the study took an active role in making oral language instruction culturally relevant by using Pacific stories and encouraging Pacific children to use what they are familiar and confident with, and to find out from their families about their own culture and report back in classrooms. This seemingly inexpensive way to promote cultural awareness and harness the students' own funds of knowledge to unlock their potential for learning aligns with the MoE's emphasis on culturally connected learning environment and the view of diversity as enriching classroom community (Fletcher et al., 2009; MoE, 2009).

Another example of promoting learning while at the same time fostering cultural values is found where a buddy system was used to pair up more fluent English speaking Samoan students with students newly arrived from Samoa (Fletcher et al. 2009). Tapping on familiar communitarian values, the newly arrived students could feel supported and receive help in navigating the school system in New Zealand while the pair could also maintain and extend their cultural knowledge, connection and values. The importance of involving Pacific liaison personnel in facilitating communication between parents and schools has also been emphasised (Fletcher et al., 2009; Gorinski & Fraser, 2006). One principal interviewed in Taleni (2017) described their Samoan staff as a '*lifeline*' to new parents and students in their school (p.83). Samoan bilingual programmes have been touted as an effective way to engage Samoan students in their education, promote academic success, improve home-school communication and also to empower students (Tuafuti and McCaffery, 2005). Bilingual education also provides students with languages, skills and confidence to be able to move freely in both Pacific and *Palagi*/European worlds. A European school principal in Taleni (2017)'s study was quoted as saying to Samoan students '*you're Samoan and Samoans are high achievers*' (p.77), which emphasises his high expectations for Samoan students and his way of alluding to successful Samoan students as role models to encourage other students.

When each ethnic group was analysed separately, the disciplinary parenting behaviour was only significant in Tongan model. Different parenting behaviours across ethnic groups are likely to be associated with immigration patterns, and the impact of acculturation would be more distinct among migrants with longer history in New Zealand (Cowley-

Malcome et al., 2009). Tongan parents, being relatively recent migrants, may have retained their disciplinary behaviours commonly practiced in Tonga. The social, political and cultural differences between countries may also contribute to differing parenting behaviours. Tongan mothers rather than fathers may be the chief disciplinarian and the role of mothers and fathers in each country need to be further investigated (Cowley-Malcome et al., 2009).

Otunuku and Brown's (2007) results have shown that Tongan students' academic achievement probably has less to do with culturally reactive behaviour towards the dominant New Zealand culture than the genuine need for high quality feedback and information on their performance. In the current study, the highest proportion of Tongan mothers were separators, which indicate that the mothers were more dependent on their Tongan cultural enclaves for support and information. This could reflect their more recent immigration history but it also signals the need for accurate and specific information on what is expected of Tongan students in New Zealand schools and timely feedback on their achievement results (Otunuku & Brown, 2007). It is also possible that the cultural separation implies significant differences in cultural values upheld between Tongan homes and New Zealand schools, which could result in cultural mismatch and confusion for students. The questioning, independent expression and critical thinking process of Western education all conflict with Tongan cultural values of obedience, respect and conformity (Kavapalu (1991) as quoted in Schoeffel et al., 1996). Fletcher et al. (2009) observed Pacific students' reluctance to take risks in terms of expressing their knowledge in front of others. Risk taking in extrapolating meaning and making predictions, all essential elements in acquiring new skills and strategies, was an additional challenge for many Pacific students.

Despite potential cultural mismatch inherent in Tongan students' attendance in New Zealand schools, some specific ways to support Pacific students to embrace both Pacific and *Palagi* worlds have been prescribed in Fletcher et al. (2009) and more recently in Taleni (2017). These include more visibility of Pacific languages in classrooms and teaching materials and incorporating Pacific cultural practices such as song and dance. As a father interviewed in Fletcher et al. (2009) noted, celebrating a child's heritage will enhance their self-confidence, which in turn will encourage their learning.

The Cook Islands immigrants, who comprise the second largest Pacific community in New Zealand, have historically enjoyed a closer political connection with New Zealand and are allowed automatic New Zealand citizenship and free access (Fraenkel, 2012; Kokaua et al., 2009; Taumoefolau et al., 2002). There is a bigger Cook Islands Māori population in New Zealand than in the Cook Islands and the community language loss is rapid (Starks, 2005, Taumoefolau et al., 2002). Our results suggest that many mothers in the Cook Islands group were marginalised or assimilated both of which are more distinct and extreme

patterns of acculturation. The results also showed that more than 85% of the Cook Islands mothers were either born in New Zealand or had lived in New Zealand for 10 or more years. The ethnic and cultural identity formation does not just depend on social class and the degree of linguistic and cultural similarities with the dominant group but also on the context of reception and the level of discrimination experienced by the immigrant group (Portes & Rumbaut, 2001). The Cook Islands mothers, whose immigration history is longer than other Pacific groups and the Cook Islands being under the New Zealand jurisdiction, may have felt the need to conform and be more assimilated or to be marginalised in the face of more exclusionary reception taken towards Pacific people and the historical discouragement of Pacific languages over English in New Zealand (Long, 1994). The difference in the level of burden of immigration and acculturation borne by the first and the second generation migrants is evident in Kokaua and Wells' (2009) study which showed higher prevalence of mental health disorders among the younger or New Zealand-born Cook Islands Māori in New Zealand. The very different acculturation strategies employed by the Cook Islands mothers and the differing impact on their children's English receptive vocabulary found in this study is worth noting. It highlights the diversity across Pacific ethnic communities in New Zealand, and emphasises the need to look at individual needs rather than lump them into one homogenous group. Taleni (2017) more succinctly urged the teachers and principals to '*cast the net into deeper waters*' (p.82) to dig deeper and to go an extra mile to develop genuine, in-depth knowledge of their Pacific students and to explore ways to support them realise their academic aspirations.

The results of Other Pacific group again reinforce the evidence of diversity among Pacific students. Niueans and Tokelauans, included in Other Pacific groups, both fall under the New Zealand jurisdictional rule implying different political landscape to other Pacific nations (Kupa, 2009). Although there are strong pan-Pacific values shared across the Pacific Islands, no one universal framework can encompass all Pacific values. For example, the role of matriarchal title in Tokelau is not captured by the *Fonofale* model, which is primarily based on Samoan culture (Kupa, 2009). In the current univariable analysis for Other Pacific group, the children exhibiting healthy early childhood development obtained higher BPVS scores than the children who required full assessment in the early developmental screening test at 4 years. However, none of the predictors were found to be significant in the adjusted model for Other Pacific group. This probably has more to do with the participant size rather than the irrelevance of the predictors. Among Niuean and Tokelauan migrants, life style changes upon their arrival in New Zealand have been documented, which indicate some degree of acculturation (Gray & Nosa, 2009; Kupa, 2009). Some changes such as heavy drinking (especially among women, which was traditionally unaccepted in the Pacific Islands) and children experiencing daily stress like

learning English adversely impacted on their health and wellbeing (Gray & Nosa, 2009; Kupa, 2009).

Almost half of the mothers in Other Pacific group had assimilated cultural orientation in this study. Although the assimilated group had the strongest BPVS performance in the whole cohort analysis, they are also disconnected from their Pacific cultures. Most Pacific nations, including Tokelau, Tonga and Samoa place significant value to adhering to their traditional beliefs and customs. It is evident in their concept of *mala*, a curse or illness that results from breaking cultural *tapu* (taboo), and not conforming to social values and expected norms (Kupa, 2009; Vaka et al., 2009). Considering this social and historical context, observing cultural values is of more importance than it being mere personal stance on cultural alignment or life style choices. The current results not being significant do not necessarily mean that cultural orientation is irrelevant to children's English receptive vocabulary for these groups but indicates more comprehensive and in-depth information is required to unpack these influences among less represented Pacific ethnic groups.

This research benefited from using psychometrically appealing measures for English receptive vocabulary and cultural orientation. The measure of cultural orientation was based on short questionnaires that were easy and practical to administer but comprehensive enough to yield some important implications. In most interviews for the PIF Study, the gender, ethnicity and languages were matched between interviewers and participants resulting in higher reliability and participant retention (Paterson et al., 2006). Ethnic-specific quantitative analyses have been attempted giving much needed attention to the identified gap in the existing Pacific education research (Chu et al., 2013). Maternal cultural orientation was taken into consideration in analysing Pacific children's BPVS scores, which, to the candidate's knowledge, has not been previously attempted. The study provides novel findings of ethnic differences in how the BPVS scores are associated with the cultural environment.

Despite these strengths, the study is not without some important limitations. Due to the data size, not all relevant predictors were included in the model construction. However the results from the previous section were used to select the most relevant variables to the cohort children's BPVS scores. The reduced power in some ethnic analysis would make the test less likely to find significance. Hence the relevance of the included variables is likely to have been understated for less represented ethnic groups such as the Cook Islands and Other Pacific groups. Like most sociodemographic variables, the predictors were correlated, which may inflate the standard errors of the estimated coefficients. However, the whole cohort analysis found all variables significant in the adjusted model, which indicates that the variables must contain some unique information. The BPVS may suffer

from cultural bias and does not provide information on children's receptive vocabulary in their Pacific languages. A cross-sectional analysis was performed, which could not provide insight into the longitudinal impact or the change in the outcome over time. Some ethnic groups may have simply lacked participant number for meaningful results to be drawn from the analysis (Paterson et al., 2006). However, the clear ethnic differences in the demographic patterns and the results of the models are worthy of consideration.

6.4.1 Conclusions

Early cultural environment was found to play an integral role in Pacific children's English receptive vocabulary development. The results of separate analyses for each ethnic group indicated that there were clear ethnic differences in the acculturation strategies employed by Pacific mothers and the associated impact on their children's English receptive vocabulary at age 6 years. These results, together with the relevance of mothers' length of stay in New Zealand, suggest that ethnic and cultural diversity needs to be taken into account when investigating Pacific children's English receptive vocabulary development (MoE, 2009).

Such efforts aimed at incorporating cultural context into studying Pacific children's language and educational outcomes will involve constructing an integrated model where multiple perspectives and streams of knowledge from the child's parents, family, community and the educators are all taken into consideration (Gillon & Macfarlane, 2017). Pacific students and their families often expressed their views of successful education as being one that not only equips the children to be productive members of the New Zealand society but one that also strengthens their Pacific cultural identity and competence (Fletcher et al., 2009; Taleni, 2017; Tuafuti & McCaffery, 2005). These views bode well with the positive connection between the integrator maternal cultural orientation and children's English receptive vocabulary performance found in this study. However, the results of current analysis also point to some important ethnic differences in the ways in which Pacific families identify with Pacific and New Zealand cultures. Although there are some commonalities among Pacific immigrant populations in New Zealand, they are a culturally diverse group of people and this heterogeneity needs to be recognised and reflected in studies of Pacific children's educational outcomes.

Chapter 7

Discussion

Well-developed language skills are integral to successful literacy acquisition and educational attainment (Catts, 2017; Rose, 2006; Snow, 2016). Starting well in these essential skills is important as an early gap in reading achievement levels can broaden with age (Cunningham & Stanovich, 1997, 1998; Sparks et al., 2014). There is unequivocal evidence of variation in internal language capacity and externalised speech, hearing and language abilities across individuals (Bishop & Snowling, 2004). Some children who have well-developed verbal skills will progress to experience reading related difficulties. Yet, there are others who struggle with both the language and reading related tasks (Bishop & Snowling, 2004; Catts, 2017). The putative effect of starting late in literacy skills attainment can persist over one's entire academic career and has been shown to impact certain groups (for example, indigenous, immigrant, ethnic minority, or of low socioeconomic background) more than others (Crosnoe & Ansari, 2016; Johnston et al., 2009; McNaughton et al., 2003). As educational success is inextricably connected with health and social outcomes in Pacific and non-Pacific people, early identification and intervention is key to mitigating the risks of these children not fulfilling their academic potential (Catts, 2017; Rose, 2006). This is especially relevant to achieving social equity as enhanced educational achievement is thought to be associated with increased chances of social mobility and better health outcomes (Johnston et al., 2009; Low et al., 2005). This indicates a need for concerted inter-sectoral efforts in policy interventions to achieve more equitable outcomes and ensure all children can realise their full potential.

In this doctoral research on Pacific children's early learning outcomes, a deliberate stance has been taken to incorporate elements from multiple domains of Pacific children's early development. This view reflects the holistic concept of health and wellbeing valued by Pacific people and is consistent with the SDH framework (HRC, 2014; Lancet, 2018; Solar & Irwin, 2010). The doctoral research also sought to analyse the impact of ethnic and cultural diversity on Pacific children's early language development. This was motivated by

the diversity in Pacific people's cultural heritage and its manifestation in many differing traditions, languages, and histories of immigration (Paterson et al., 2006). Pacific cultural values and adherence to traditions importantly shape Pacific people's views on education, health and wellbeing (Fletcher et al., 2009; HRC, 2014). Pacific cultural values being the foundation for Pacific children's learning helped to guide the direction in this research (Talení, 2017). The association between Pacific children's cultural and ethnic backgrounds and their learning outcomes was explicitly investigated in all three stages of this research.

The learning outcomes of Pacific children were the subject of numerous studies and research papers commissioned by the MoE (Chu et al., 2013; Gorinski, 2005; Gorinski & Fraser, 2006; McNaughton et al., 2003; Phillips et al., 2004; Schluter et al., 2018a, 2018b). Although Pacific students bring their own rich cultural and linguistic funds of knowledge to school (MoE, 2009; Talení, 2017), in an environment where the English language is the dominant language of instruction, their disadvantages in language, literacy and school achievement levels have been documented through these studies. The cultural and linguistic discontinuity between home and school acting as barriers to Pacific students' and their families' effective engagement in the New Zealand educational system was highlighted while recommendations were made for a closer involvement of Pacific families and communities in Pacific students' education (Gorinski, 2005; Gorinski & Fraser, 2006).

The doctoral study aimed to quantitatively shed insight into factors behind the documented educational disparity in outcomes between Pacific students and the general population. It was hoped that the results could inform the process of developing efficacious strategies for mitigating the risk of Pacific children being left behind in the current English-medium educational system. The study also analysed the common characteristics of successful Pacific learners. The study was structured in three separate phases that were connected but also self-contained, each with its own distinct objectives. In Phase One, the study set out to analyse the perceptions of Pacific children's academic performance at age 6 years held by the children, mothers and teachers. In Phase Two, a prediction model for Pacific children's English receptive vocabulary was constructed to analyse elements of Pacific children's early environment that are crucial to distinguishing children with strong receptive vocabulary from the rest of the cohort. Finally, in Phase Three, ethnic-specific analyses were undertaken to gauge environmental elements that serve as risk or protective factors for Pacific children's English receptive vocabulary development at age 6 years.

7.1 Overview of the Findings

The main focus of this doctoral research was to study various family-related and environmental factors associated with Pacific children's early academic performance and language development using data on a large birth cohort of Pacific children. In Phase One, the doctoral study investigated the association between sociodemographic factors and the level of agreement among Pacific children, their mothers and teachers on their perceptions of children's academic performance at age 6 years. These perceptions were further compared to the children's performances in a direct measure of receptive vocabulary skills. Important differences between Pacific children, their mothers and teachers were observed in their perceptions of children's school work performance at age 6 years. Pacific children and their mothers were more likely to rate the performance more highly compared to the teachers. Almost all Pacific children expressed very positive views on their own school work performance indicating their strong self-perception of academic mastery after about one year of school. When Pacific families' sociodemographic backgrounds were analysed some features stood out as having significant influences on whether the perceptions of children's school work performance held by the children and their mothers agreed with the teacher assessments. A larger proportion of mothers with higher educational qualifications or fluency in the English language were found among mothers who concurred with the teachers about their children's school performance. Similarly, maternal English language fluency and the children's own performance in a direct measure of English receptive vocabulary were found to be significant factors that differentiate child-teacher concordant pairs from the discordant pairs. Given that the teachers assessed the cohort children as performing mostly at a satisfactory level rather than at the either extreme, the teacher assessment of children's oral language skills was compared to children's test scores in a direct measure of receptive vocabulary skills. The analysis revealed that the teachers provided evaluations that were significantly and positively correlated with the children's test scores in the direct measure. This result validated the teacher assessment of children's oral language development in the sense that the teacher assessments resembled the distribution of an assessment tool that is based on externalised and directly measurable standards. Overall, the study found that Pacific children, their mothers and teachers had very different perceptions when it came to assessing the children's academic performance and those perceptions were strongly influenced by the families' cultural and linguistic backgrounds and maternal education. These internationally novel empirical findings emphasised the importance of cultural considerations and improving home-school communication and cultural continuity for achieving optimal intervention and academic outcomes.

In Phase Two, Pacific children's English receptive vocabulary at age 6 years was used

as the outcome variable in a prediction model that included predictors related to birth outcomes, maternal health, socioeconomic and cultural backgrounds, and children's early behavioural and cognitive development. The prediction model aimed to distinguish strong performers from the rest using a classification tree method. The model performed strongly for the actual cohort data and yielded high sensitivity and specificity in classifying the students into two outcome classes. The model highlighted maternal cultural orientation, birthweight, early childhood development, and parenting behaviour as some of the most important variables in accurately distinguishing children with strong English receptive vocabulary at age 6 years. This result indicated that Pacific children's early language development is truly multifaceted and a framework that integrates cultural factors, physical and psychosocial health and education is necessary to better serve Pacific children and families. Although the prediction model performed strongly for the actual cohort data, its predictive utility for other populations was compromised due to overfitting to the cohort data. This result parallels the performances reported in other studies that have attempted to predict children's early educational success (Christensen et al., 2014; Schluter et al., 2018b).

In Phase Three, statistical models were constructed to analyse environmental factors that could support or hinder Pacific children's English receptive vocabulary development at age 6 years. A model for the whole cohort was constructed first with the view of analysing the risk and protective factors of English receptive vocabulary for the 6-year-old general population of Pacific children. In recognition of ethnic and cultural diversity among Pacific children growing up in New Zealand, ethnic-specific analyses were performed for different Pacific ethnic groups represented in the study. The results of the models were interpreted for each ethnic group. When the 6-year-old Pacific children were combined as a group, some of the salient features associated with strong English receptive vocabulary scores included being born full-term and with healthy birthweight and showing age-appropriate early childhood development measured at age 4 years. Their early cultural environment also played a pivotal role as indicated by the advantage of having mothers with longer periods of stay in New Zealand and strong connections to both the New Zealand and Pacific cultures. Some of these factors remained relevant when the children were categorised into their own ethnic groups. For example, the age-appropriate early childhood development at age 4 years was indicative of strong English receptive vocabulary skills at age 6 years among Samoan, Tongan and the Cook Islands children. Overall, the ethnic-specific analyses revealed that disparate factors or distinct configurations of factors were relevant for English receptive vocabulary at age 6 years across ethnic groups. This result serves as the quantitative evidence for cultural and ethnic diversity across Pacific children and suggests that future research be conducted in a manner that takes this diversity into account.

7.2 Interpretation and Implications of the Results

In this section, the results from the three separate phases are brought and woven together and the main implications of the research are discussed in relation to teacher education, language intervention design, utility of prediction models and integrated health, education and social service provisions for Pacific children. Future directions in research and further analyses to address some of the limitations identified in the previous chapters are explored. Recommendations for Pacific parents, educators and policy makers are also discussed.

7.2.1 Perceptions of Pacific Children's School Work Performance

Academic self-concept can be linked to one's perceptions and attitudes toward their own ability, competence and proficiency in broad areas of academic tasks (Chapman, Tunmer & Prochnow, 2000). Academic self-concept, like other domains of self-concept is generally considered to be a multidimensional construct and to have a reciprocal relationship with academic achievement (Chapman et al., 2000; Denston, 2016; Everatt & Denston, 2019). In Chapman et al.'s (2000) longitudinal study of 60 children aged between 5 and 8 years, the children with positive academic self-concept performed more strongly on reading related tasks than did the children with negative or typical academic self-concept. Their study also demonstrated that academic self-concept could influence academic achievement much earlier than previously hypothesised. This result indicates that reinforcing positive academic self-perception could help support Pacific children's learning. It also serves as a reminder that sowing the seed of negative academic self-perception by sending out unfavourable messages about their performances early in school years could adversely impact on Pacific children's school achievement results.

The results in the current analysis suggest that most children in the cohort had positive perceptions about their academic performance, which was not always corroborated by their performance judged by their teachers or in the standardised measure of English receptive vocabulary skills. Perhaps these results concord more with the theory of delayed formation of academic self-concept that correlates with actual attainment (Nicholls, 1978, 1979). The cohort children's generally positive self-perceptions at age 6 years are certainly consistent with the results found in Stipek (1981) and Chapman and Tunmer (1995). However, the results from the additional analyses linking the concordance patterns to environmental factors in the present study confirmed the influence of children's strong English receptive vocabulary skills on the concordance between their academic self-perception and the achievement level assessed by their teachers. On the other end of the spectrum, the children who were assessed by their teachers as not performing as strongly as their peers were somehow protected from developing negative academic self-perception.

Considering the association between academic self-perception and achievement, this in itself may not be a deleterious outcome. Nevertheless, the results suggest that the communication between home and school about children's school work performance may not have been completely effective. The language may have been a barrier to some Pacific mothers considering that a higher proportion of them reporting lower proficiency in the English language were rating their children's performance more favourably compared to the teachers' assessments. The premise that there may have been potential issues with communication is also more convincing given that there was a higher degree of agreement between teachers and mothers who had higher educational qualifications. A longitudinal analysis is needed to investigate the dynamic interaction between academic self-perception and the achievement results across this cohort. The study should also incorporate more comprehensive measures of self-concept as done, for example, in Chapman and Tunmer (1995) and Denston (2016, 2018).

In a recent study, the interplay between literacy skills and psychosocial development for primary school aged students was made apparent (Denston, 2018). In the study, the impact of general literacy interventions on students' academic and global self-esteem, general self-efficacy and resilience was investigated for 112 students aged between 8 and 11 years. After a pre-assessment for literacy learning difficulties, 21 students were assigned to the intervention group. Additional 91 students were selected as the control group. The students in the intervention group were given explicit instruction in general literacy skills that included decoding, vocabulary and reading fluency over a 6-week period. Significant gains were made in reading comprehension and accuracy for students after the interventions. Further, the literacy interventions also had significantly positive influences on students' psychosocial development in the areas of self-esteem and self-efficacy. These results demonstrate that literacy interventions could have important positive side-effects on students' self-concept that could start a feedback loop for literacy success. To focus on pathways that lead to educational success, interventions that foster healthy self-concept and self-efficacy need to be explored (Everatt & Denston, 2019). For Pacific students, whose assessment results have attracted concern and negative feedback for many years, enhancing their academic self-concept and achievement and doing so within a culturally responsive framework is not only relevant but a necessary and urgent task (Talení, 2017).

7.2.2 Importance of Home-School Cultural Continuity

The results of the present study also emphasise the importance of Pacific mothers' familiarity with the New Zealand culture and the English language in being able to accurately gauge the teachers' views of their children's progress in school work. This suggests that the language used to communicate children's progress may be a relevant factor as well as the

understanding of the New Zealand educational system and the expectations around what the children are expected to achieve in the first year of school. These findings reaffirm the importance of teachers and schools demonstrating cultural responsiveness towards Pacific students and their families and using appropriate avenues when communicating and providing feedback on Pacific children's academic progress (ERO, 2012; Gorinski & Fraser, 2006; MoE, 2009).

Perhaps, efforts can be made to make cultural diversity more visible in the educational arena. One way to enhance cultural responsiveness of teaching spaces may be to reflect different cultures and ethnicities in the physical teaching environment by altering the linguistic landscapes of classrooms. Linguistic landscape is the term used to describe all the visible languages in signs and displays in particular areas (Gorter, 2017 as cited in Harris, Cunningham & Davis, 2018). A recent study conducted by Davis and colleagues extended this notion to encompass digital spaces and documented the physical and digital ecosystems inhabited by young multilingual children growing up in New Zealand (Davis, Harris & Cunningham, 2019). Their extension of Davis' Arena Framework to early childhood education (ECE) ecology established the role of teachers as being crucial in the expression of culture(s) in the teaching environment. Their case studies on the linguistic landscape that reflect the linguistic and cultural diversity of children in early childhood centres (ECC) highlighted its positive impact on making children and families feel that their home languages are socially supported within those spaces (Davis et al., 2019; Harris et al., 2018a, 2018b). Improving home-school cultural continuity and dismantling cultural barriers experienced by Pacific mothers largely separated or marginalised from the New Zealand culture could help encourage them to participate in discussions around their children's academic progress and be more involved at their children's schools (Gorinski & Fraser, 2006). Having their home languages and cultural artefacts visible in learning spaces would undoubtedly make Pacific children's transition from home to ECCs more seamless.

7.2.3 Culturally Responsive Strength-Based Interventions

Everatt and Denston's (2019) and Davis et al.'s (2019) studies herald new frontiers in culturally safe intervention research. Applications of a culturally responsive framework do not have to be confined to language, literacy and academic interventions. Interventions can be instigated to render physical and digital spaces more culturally inclusive (Davis et al., 2019; Harris et al., 2018a, 2018b). Psychosocial intervention programmes can also be used to challenge deficit theorising and promote positive academic self-concept (Denston, 2016, 2018; Everatt & Denston, 2019). These possibilities are important as the historical strategy of assimilation and dominance of the English language has not worked for Pa-

cific students (Long, 1994; Spiller, 2012; Tuafuti & McCaffery, 2005). The implications of educational ecosystems that reflect the ethnic, cultural and linguistic diversity that exists in New Zealand classrooms warrant further investigation as is the study of impact the linguistic landscape and the use of digital technology have on children's holistic development (Davis et al., 2019). Denston's exploratory study into interactions between positive self-concept and academic achievement also signal the potential utility of literacy interventions in enhancing students' psychosocial development (Denston, 2016). The reciprocal relationship between academic achievement and self-concept (Chapman et al., 2000) imply that improved self-concept should reinforce the positive outcomes of academic or literacy interventions. Extensions of Denston's study to more ethnically representative samples of students can be of value to researchers interested in the strength-based approach to enhancing Pacific students' learning outcomes (Everatt & Denston, 2019).

Such interventions should be used to implement and consolidate the strength-based approach in efforts to lift Pacific children's learning outcomes. In particular, the enhancement of Pacific students' self-concept and self-efficacy is germane to the student empowerment and partnership in education approach (MoE, 2009). The strength-based approach can also be operationalised by instigating interventions before students' low academic self-concept become entrenched in their psyche (Gillon et al., 2019). The empowerment of Pacific students is especially essential in an environment where younger generations of Pacific people struggle to form their cultural identity and feel sense of belonging in New Zealand (Mila, 2013).

The relevance of early cultural environment on Pacific children's English receptive vocabulary and perceptions of their own academic performance at age 6 years evidenced in the present study suggests that children's cultural backgrounds be given due consideration in implementing language and academic interventions. More specifically, children's cultural backgrounds elicited by maternal cultural orientation and fluency in the English language were associated with concordance patterns in children's self-assessment and the teacher assessments. These results are important as they suggest that such cultural and linguistic influences exist as early as the first year of primary school and that any intervention strategies should take into account these cultural considerations. To this end, more traditional language and literacy interventions could be bolstered by incorporating a culturally responsive framework. Some ways to achieve this are by making intervention materials more relevant for each language and culture, closely involving Pacific people and communities, co-constructing intervention and teaching materials and incorporating Pacific funds of knowledge (Gillon & Macfarlane, 2017; Gillon et al., 2019; Macfarlane et al., 2007; Taleni, 2017).

Such framework was used in Gillon and colleagues' recent study of children from mul-

ticultural backgrounds (Gillon et al., 2019). The study explored the feasibility of teacher-implemented interventions targeted at improving phonological awareness, letter and vocabulary knowledge among 141 children who entered school with lower oral language skills. The children aged around 5 years were all from schools in low socioeconomic communities where additional stress was still present 6 years after the devastating earthquakes in Christchurch. There was no differential impact of interventions based on ethnicity and children from all ethnic backgrounds including Māori and Pacific benefited from improved phonological awareness and vocabulary knowledge.

The intervention programme devised in Gillon et al. (2019) was novel in a number of ways. The programme was implemented during the first year of school, positively intervening in children's progress of literacy development before any gap between them and higher achieving children can exacerbate. A culturally responsive intervention framework was used where words and ideas from children's own cultural backgrounds were integrated into intervention materials making it possible for children to relate the texts to their own experiences. Teachers' knowledge of children's abilities, interests and behaviours was utilised in designing and implementing intervention programmes. This co-construction of intervention, although its effect was not investigated directly, helped guide the process and informed the researchers of intervention practicality and fidelity.

Earlier studies such as McNaughton et al. (2003) and Philips et al. (2004) involving Māori and Pacific students from low socioeconomic communities in Auckland have also demonstrated the efficacy of early assessment and interventions on raising the literacy achievement of these groups. These pan-Pacific studies have demonstrated that significant improvements can be made when intervention programmes are instigated early enough. However, it is important to point out that the approach taken in Gillon et al. (2019) was also strength-based in a sense that children were able to positively relate their own cultural experiences with learning and developing literacy skills, which undoubtedly would promote their sense of cultural identity and competence. The feasibility of incorporating the classroom-based intervention design that was found effective in Gillon et al. (2019) into teacher education need to be explored. Extensions of the study design to include different regions and contexts could establish the external validity of the results and ensure that the wider implementation would be both practical and cost effective.

7.3 Limitations of the Research and Recommendations for Remedial Approach

The analyses contained in this thesis led to some internationally novel results and implications regarding Pacific children's early language and learning outcomes. However, the study was not without some important limitations. These limitations are summarised in this section along with some suggestions for future research that could help redress them.

7.3.1 Methodological Limitations of the Prediction Model

The prediction model for Pacific children's English receptive vocabulary in Phase Two was constructed using the classification tree method, which is typically used for analysing large dimensional and sparse data structure (Breiman et al., 1984). The model performed strongly with high sensitivity and specificity for the training data, the actual cohort PIF data used to construct the model. The performance of the model depended on the values of complexity parameter and the relative risk parameter. The highest sensitivity (that is, the proportion of accurately classifying children at risk of low English receptive vocabulary) obtained for the training data was 1 (100%) with the corresponding specificity of 0.74 (74%). However, the constructed model had lower accuracy when used on the test data indicating that the overfitting to the training data may have occurred (Hastie et al., 2001). This may have also been due to the relatively small data size used in the model. Machine learning algorithms are typically applied to and perform better with larger datasets (Christodoulou et al., 2019). The low performances in the test data indicate the model's limited utility as a prediction model for Pacific children's English receptive vocabulary. Christensen and colleagues' study of LSAC Australian children aged between 4 and 8 years reached similar conclusions although they have only relied on the training data to evaluate the predictive utility of their model or have not reported and documented using a test set for validation (Christensen et al., 2014). A recent study predicting the likelihood of Pacific children receiving reading interventions at school also delivered underwhelming results despite using data from a large nation-wide health screening of children at age 4 years (Schluter et al., 2018b). All the above studies have focused on characterising children based on their social, health and environmental backgrounds. When it comes to predicting children's language and literacy outcomes, it just may not be enough to rely on social determinants. These results may be an indication that prediction models cannot be substitutes for population-based early language and literacy assessments in detecting children who would benefit the most from early interventions. Even the strongest performing pattern recognition methods need apposite outcome variable and predictors in

model construction. Early language screenings are a potential source for such variables.

7.3.2 Time for Population-wide Language Screening?

The present analysis focused on predicting receptive vocabulary, which is an important element of children's language development. A broader set of early language measures would have been ideal if they had been available (NICHD, 2005; Suggate et al., 2018). However, the strong associations between the cohort children's BPVS scores and the teacher assessment of children's overall school work performances as well as the oral language skills render some support to the use of this measure as a proxy for language and academic performance for this cohort. The use of this measure as the outcome variable led to some significant interpretations of environmental factors relevant to Pacific children's English receptive vocabulary skills at age 6 years. Nevertheless, the prediction model did not perform strongly when used on the test data. The costs involved with implementing a population-wide language and literacy screening for preschool-aged children need to be carefully weighed against the utility of prediction models. Such costs may indeed be prohibitive and constructing highly sensitive and specific prediction models may be the most pragmatic option available.

Moreover, the utility of universal language, speech and hearing screening is not without contention. Although, studies such as Washington and Craig (2004) have demonstrated the potential of language screenings in yielding high accuracy in detecting language impairments among ethnic minority groups – urban African American preschool and kindergarteners in their study – the accuracy was validated using the dataset over-representing the clinical cases. This strategy makes it difficult to extend their results to universal screenings (Law et al., 2000). Law et al. (2000) conducted a systematic review of language and speech screening test performances and found no papers included in the review had reported results from a random allocation of children to screened and unscreened populations. In general, the studies that were deemed to be of high quality in terms of reliability and validity of study design were more likely to report lower sensitivity than specificity. This suggested that the detection of clinical cases was challenging for most existing language screening tools when samples included unaffected cases, which represents a more realistic setting for population screening. Based on the absence of a universally accepted measure for language and speech development and the state of knowledge at the time, the authors voiced their reservations about population-wide screenings. An extensive review of extant literature on the feasibility and utility of universal language screenings that have surfaced since Law et al. (2000) is outside the scope of this thesis. But considerations have to be given to the accuracy of language screening tools, and the performances of existing universal language screenings in detecting children with language difficulties

need to be compared to those of the prediction models.

Research suggests that early detection of language difficulties and timely instigation of intervention are important as early language ability is closely linked to emergent literacy skills (Bishop & Snowling, 2004; Dilnot et al., 2016; NICHD, 2005; Suggate et al., 2018) and reading differences can start early and have a lasting impact on an individual's academic career (Cunningham & Stanovich, 1997; Sparks et al., 2014). Early intervention usually refers to those targeted at children in early childhood (Denston, 2016). The availability of high quality language measures is essential in detecting language difficulties among young children (Schluter et al., 2018a). Even using the modern machine learning techniques, the low signal-to-noise ratio inherent in predicting educational outcomes can penalise accuracy of prediction models as evidenced in the present research. The adaptive non-linear algorithms have also been shown to have limited utility in clinical research due to low signal-to-noise ratio in human medical data (Ennis et al., 1998). The feasibility of population-wide screening and utilising existing platforms such as Plunket nurses (<https://www.plunket.org.nz>) or B4 School Checks (B4SC) (<https://www.health.govt.nz/our-work/life-stages/child-health/b4-school-check>) for language screenings need to be explored.

In New Zealand, Plunket nurses conduct routine health checks and measurements to monitor the infant and early childhood development from birth to ages 2-3 years. These checks cover comprehensive domains of children's early development from vision, hearing, speech, immunisation, weight and height to family environment. During these checks, the Plunket nurses interview the primary caregivers and assess whether each child is meeting their developmental milestones set for the age group. The parents can also voice their concerns over their children's language development through the Parents' Evaluation of Developmental Status (PEDS) forms. The PEDS questionnaire is very brief and any additional language screenings are usually instigated by the nurses in consultation with the parents. However, there usually is a gap between the ages 2 and 4 years during which children's physical, mental and language development is not assessed or monitored by health professionals via routine checks. During this period, any additional health checks or language screenings are contingent on the parents identifying issues with their children's expressive and receptive language development. As evidenced in the respondent agreement study in Phase One, Pacific mothers' perceptions of their children's school performances differed greatly from the teacher assessments and the traditional standardised measurements of children's English receptive vocabulary at age 6 years. The discordance between Pacific mothers' concerns over their children's weight and the healthy weight standards set for the general international population has also been documented in Heimuli et al. (2011). Given the importance of early language and speech development, more attention needs

to be paid to investigating whether the current health checks in place adequately detect early childhood language difficulties or whether there is a need for more comprehensive assessment tools and more frequent assessment between ages 2 and 4 years.

Most New Zealand children now undergo physical, cognitive, behavioural and psychological checks before they start attending primary schools as part of the population-wide B4SC screenings. These checks are often administered by the families' general practitioners and cover a broad range of developmental domains. The extension of these platforms to include more comprehensive language and emergent literacy skills assessments could also be explored. For example, in Australia, the ADST contains a language domain sub-test at age 2 years. There are existing avenues to exploit if universal language and speech screenings were to be implemented in New Zealand but further research is required to ascertain the optimal screening protocols for ethnically, culturally and linguistically diverse children.

7.3.3 Culturally and Linguistically Responsive Measures

Many Pacific children are emerging bilinguals as evidenced in the PIF study (Taylor, 2011). Differentiating language difficulties from language differences is another challenge for language/speech therapists and clinicians when attempting to detect language weaknesses among bilingual children (Carter et al., 2005; Goldstein & Kohnert, 2005; Law et al., 2000; Paradis, 2005; Washington & Craig, 2004). Many of the current language measures are developed for monolingual populations and can present cultural bias when used on bilingual children and in different cultural settings (Paradis, 2005).

Physical, cultural and social surroundings determine what type of early experiences are available to children and these experiences can have a direct impact on children's growth and what can be measured of their development (Carter et al., 2005). The role of family in providing the primary cultural context that underpin the development of children's nascent social, emotional, cognitive and communication skills is emphasised in Kohnert et al. (2005). Despite the recognition of culture as being integral to children's early language development, there are few guidance materials currently available on how to develop culturally valid assessments (Carter et al., 2005). The results in the current analysis suggest that the children who struggled the most with English receptive vocabulary were from homes that were culturally separated from the dominant New Zealand culture and society. In order to ensure accurate assessments of Pacific children's language development, speech and language therapy training should include culturally responsive approaches and culturally valid assessment tools. Further, interventions in both the English and home languages were endorsed by Kohnert et al. (2005) for linguistic minority children to stave off home language attrition and to facilitate skills that are vital to retaining important

connections with their home communities. Within the New Zealand context, encouraging young children to engage in their families' languages and cultures is seen as an important aspect of encapsulating heritage and enhancing children's *mana* (power, prestige or authority) (Davis et al., 2019).

The current research focused on Pacific children's receptive vocabulary development in the English language. However, the lack of analogous standardised measures in Pacific languages meant that the analyses could not be extended to studying children's receptive vocabulary development in Pacific languages. The limitations to this approach need to be brought to attention. Carter et al. (2005) reviewed research papers on cross-cultural language and speech assessments and noted that many studies conducted in countries where assessments had not been standardised on the population have used the translated versions of assessments designed in the UK or US. New Zealand is not an exception to this. Although there was no need to translate the BPVS to the English language, the normative data used to assess Pacific children's age-appropriate development in English receptive vocabulary were from a British monolingual population, which could have introduced a cultural bias. However, the order of high to low scores was preserved in age-standardisation on the normative data. Particular care has been taken to not interpret the results of the analyses in relation to the normative data, but rather, to compare the characteristics of high scorers to low scorers within the cohort. Despite this, the study cannot have been free of cultural bias as language is inextricably and reciprocally related to culture and language is considered as a '*medium for conveying and internalising culture*' (Carter et al., 2005, p.392). Language is also '*the major vehicle for communicating the family's values and expectations, . . . , and interpreting world experiences.*' (Kohnert et al., 2005, p.253). Even in the same language, standardised assessments usually require adaptation and revision as '*item content and assessment format may be more familiar in one culture than another*' (Carter et al., 2005, p.392). For Pacific children growing up in homes that are culturally removed from the dominant European New Zealand culture and its language, measuring their receptive vocabulary skills in their home languages are relevant to accurately assessing their language development. Concerted efforts between Pacific communities and language/speech specialists need to be made to remedy this situation.

The results of the present study also point out the need for larger datasets on less strongly represented Pacific ethnic groups such as Tokelauans, Niueans and Fijians. The diversity in cultural orientation across Pacific ethnic groups evidenced in this study warrants further investigation into its impact on Pacific children's learning outcomes. However, the data size and the power it affords were not sufficient for a closer analysis of these groups and what influences their English receptive vocabulary development. What this research points to is that the Pacific populations in New Zealand are heterogeneous

in terms of their immigration histories and linguistic and cultural orientations and that these differences need to be taken into account in future studies.

7.4 Strengths of this Research and Further Considerations

In this section, some of the salient features of the research are discussed along with some considerations toward future research direction.

7.4.1 Reflection of Culture and Ethnicity

The strong association between Pacific children's cultural backgrounds and their English receptive vocabulary found in this study provides another motivation for incorporating more culturally valid and appropriate tools into analyses of their learning outcomes. The implementation of Berry's bi-directional framework (Berry, 2003, 2006) in the PIF Study and the impact it had on Pacific children's English receptive vocabulary and early school work performances as judged by their teachers corroborate the utility of this measure in understanding Pacific children's learning outcomes. The potential for extending this measure to other contexts needs to be further explored. This is especially relevant and important for Pacific children who are growing up in a multicultural environment. Acculturation and cultural orientation have been considered as important factors in health outcomes among immigrant populations in health research (Borrows et al., 2011; Kokaua et al., 2009; Schluter et al., 2011). The importance of cultural backgrounds and social connections for children's learning has been recognised in education research (see for example, Fletcher et al., 2009; Mapa et al., 2000; Tuafuti & McCaffery, 2005) but the application of these in quantitative studies have been minimal. The results of the current study indicate that these constructs are integral to understanding Pacific children's learning outcomes and deserve due consideration.

7.4.2 Comprehensiveness of Information Contained in the Dataset

The analyses contained in this thesis would not have been possible without the rich set of information available from a large, contemporary longitudinal study. The data collected by population cohort longitudinal studies are typically more comprehensive and provide deeper insight into children's holistic development than the routinely collected administrative data. In New Zealand, researchers are currently uniquely placed to be able to access information collected by large, contemporary longitudinal studies with capabilities in data linkages to routinely collected administrative data. These resources can be used to validate the results of the present analysis.

For example, the Growing-up in New Zealand (GUiNZ) Study of the University of Auckland's Centre for Longitudinal Research explores the multidimensional aspect of children's development within the context of health and wellbeing, family/whānau life, education, psychological development, neighbourhood and environment, and culture and identity (<http://www.growingup.co.nz>). This is achieved through following approximately 7,000 children from before birth to currently around 9 years of age. The study has a stratified representation of diverse ethnicities present in New Zealand with approximately 24% of the children identified as Māori, 21% Pacific, and 16% Asian. The GUiNZ Study participants are currently at the ideal age group for conducting research on early educational outcomes and their records can be matched to the information captured by other large datasets maintained by the MoE, the MoH, and the Integrated Data Infrastructure (IDI) (<https://www.stats.govt.nz/integrated-data/integrated-data-infrastructure/>). The IDI is maintained by the SNZ and is a platform for integrating data maintained by various government organisations and research centres. It contains information on health, education, income and business activities. The IDI datasets rely on routinely collected administrative data and population surveys, and the capability to link those to the information collected by longitudinal studies such as the GUiNZ study is appealing for researchers who are interested in more in-depth analyses of these outcomes. For example, one of the IDI datasets, B4SC can be matched to the study participants of GUiNZ Study because the data collections for B4SC overlapped with the duration of the GUiNZ Study. The B4SC data from 2009 to 2015 contain information on approximately 250,000 children and cover over 75% of all New Zealand children aged between 4 and 5 years. Despite its formidable coverage of the population, the B4SC data delivered less than compelling results when used to predict children's literacy outcomes in early primary school years (Schluter et al., 2018a, 2018b). The concerns about the lack of apposite language and literacy assessment results to include as predictors or outcomes in these models are reiterated here. More comprehensive information on children's early language and literacy development can help improve the accuracy of prediction models.

7.4.3 Incorporation of Measures for Acculturation and Cultural Orientation

The intricate and complex role that language and culture plays in New Zealand born Pacific peoples' identity formation and sense of belonging was discussed in Mila (2013). The current study was able to utilise a measure of cultural orientation that was specifically tailored to the Pacific migrant population in New Zealand. It included questions relating to one's social connections and community activities. By analysing each ethnic group outcomes in relation to their acculturation strategies, socially and politically collective

notion of ethnicity, influenced by the historical context of migration and reception from the host culture, was separated from the individual participation in cultural activities and social engagement. There is an identified need for sociocultural analysis to examine the interplay between the global processes around racial and social categories that delineate local contexts of cultural activity and the individual agency and goal-directed behaviour that accommodate and reshape those categories (Nasir & Hand, 2006). These ideas resonate strongly in the approach taken in this empirical study of Pacific children's receptive vocabulary development.

Although the relevance of acculturation in understanding what drives migrant outcomes in multicultural settings has been recognised, no widely accepted measures of it exist (Borrows et al., 2011) and when attempts have been made to apply the concept, the measures used often lacked theoretical foundations or desirable psychometric properties (Schluter et al., 2011). The particular implementation of Berry's bi-directional framework for the PIF Study, although based on the abbreviated 11-item questionnaire for each culture, has made apparent the distinct patterns of cultural practices and acculturation strategies across different Pacific ethnic groups. Pacific cultural identity, immigration and acculturation are dynamic and fluid constructs among Pacific people in New Zealand (Mila, 2013). Language plays an important part in this. Those who were without their heritage language could face social punishment and exclusion from within as well as outside their cultures (Mila, 2013; Samu et al., 2019). In the present study, the information on acculturation strategies was augmented by the measures for language fluency and the length of stay in New Zealand. Both constructs were relevant in eliciting the dynamic representations of immigration, acculturation and Pacific cultural identity.

The distinct patterns of acculturation strategies are likely to be related to the groups' immigration histories and the sociopolitical positions of the immigrant families (Portes & Rumbaut, 2001, 2005). The older generations of Pacific immigrants have endured more overt and systematic racism and deficit-theorising within the dominant New Zealand culture, which culminated in the specific targeting of Pacific immigrants by the New Zealand police in Dawn Raids in the 1970s (Fraenkel, 2012). In the ethnic-specific analyses, the Cook Islands Māori group stood out from the rest in terms of their assimilationist and marginalised cultural adaptation strategies. Although the Cook Islands Māori enjoy automatic New Zealand citizenship and closer political ties with New Zealand, the connection did not come without cost. The rapid community language loss among the Cook Islands Māori population both in New Zealand and the Cook Islands is a well-noted consequence of the long immigration history rooted in assimilation (Samu et al., 2019; Starks et al., 2005; Taumoevalau et al., 2002). Higher prevalence of mental health disorders in the New Zealand-born and younger generations of Cook Islands Māori immigrants compared to the

recent migrants from the Cook Islands is another notable result of acculturation and the attenuation of cultural identity (Kokaua & Wells, 2009). Despite the long length of stay in New Zealand, the Cook Islands children from culturally marginalised homes achieved relatively lower BPVS scores compared to those from culturally integrated or assimilated homes in the ethnic-specific analyses. This hints at the influence of cultural adaptation on Pacific children's English vocabulary development that is distinct from those of the length of stay in New Zealand and maternal English fluency. This result emphasises that the length of stay in a host country does not necessarily translate to English language success among younger generations of Pacific immigrants.

It is important to recognise the strong convergence of socialisation, disciplinary parenting behaviour and the maintenance of Pacific cultural values and belief systems. This is evident in many Pacific (Polynesian) parents' struggles against unfamiliar libertarian values of choice and freedom in New Zealand and their fear that their children may neglect their responsibilities to family, disobey their parents and teachers, adopt new lifestyle, abandon church going and reject other cherished cultural values (Schoeffel et al., 1996). The connection between culture and socialising behaviour is made explicit in the current study in items relating to church attendance, the language used during socialisation, access to cultural resources and participation in cultural activities.

Portes and Rumbaut's (2005) analysis of second-generation American immigrants provides possible explanations on why some acculturation experiences may vary across different immigrant nationalities. Alternative paths of adaptation depended on a number of factors such as the history of first-generation, the first- and second-generation differences, the cultural and economic barriers faced by the second-generation immigrants in achieving successful adaptation, and the family and community resources for confronting these barriers. The results in Phase Three indicate that there are clear ethnic differences in the acculturation strategies employed by the Pacific mothers and the associated impact on the children's English receptive vocabulary skills at age 6 years. These results, together with the relevance of mothers' length of stay in New Zealand, suggest that ethnic and cultural diversity need to be taken into account when investigating Pacific children's receptive vocabulary development.

7.4.4 Interaction between Culture and Oral Language Development

Carter et al. (2005) observed that '*the social rules around discourses - who may speak to whom and in which situations - are culturally bound*' (p.389). Within the family context, language can be the major tool for imparting cultural expectations and values, expressing care and concern and providing discipline (Kohnert et al., 2005). This is very much relevant to Pacific cultures in which the practices of customs, values, parenting and socialisation

merge and interact (Mapa et al., 2000; Podmore et al., 2003; Schoeffel et al., 1996). Schoeffel et al. (1996) studied Pacific cultural attitudes regarding the socialisation and discipline of children in New Zealand and found that how Pacific parents defined parenting skills were at variance with those of New Zealand Europeans. Pacific parents talked about strict discipline enforced in primary and intermediate schools back in the Pacific Islands and some expressed that such methods of teaching children discipline, morality and obedience were superior to those found in New Zealand schools.

In the current study, harsher disciplinary parenting behaviours were associated with children's lower BPVS scores compared to more lenient behaviours. The connection between discipline of children, socialisation and the lack of dialogues between parents and children explained in Schoeffel et al. (1996) could help explain some of these results. Hart and Risley (1999) reported the association between a richer language exposure and greater oral language skills in young children studied over a three-year period. A teacher interviewed in Fletcher et al. (2009) articulated the positive connection between Pacific students' oral language skills and reading achievement. Her more successful literacy-achieving Pacific students were characterised by the openness in the homes where the children were encouraged to talk and discuss openly with their family members. If her Pacific students were '*not confident with the oral language, then they were not confident with the reading.*' (p.28). However, as Schoeffel et al.'s study (1996) demonstrates, simply challenging the way Pacific parents discipline their children will not improve the children's learning outcomes. A more nuanced approach is needed to encourage Pacific children's oral vocabulary and language development without imposing the *Palagi* (European) ways of raising children.

7.4.5 A Pasifika Solution

Taleni (2017) outlined the Pacific method of *talanoa* process (an inclusive, participatory and transparent discussion) where all those involved in children's education come together to weave knowledge and hold discussions in meaningful ways to raise the achievement levels of Pacific students and at the same time, observe *fa'a-Pasifika* (Pacific ways of life). In his study, *talanoa* was also used as a research method to interview school principals and Pacific education advisory group to gather information on the framework needed to support effective school leadership, teacher inquiry into their own practice, and ways to promote Pacific students' achievement. His *Fale Fa'afaletui o Ao'a'oga* Model (*fale* means house in Samoan) symbolically illustrates the framework for accelerating Pacific students' educational success. The foundations of the house, which symbolises the foundations of learning, are the Pacific cultural values, principles and languages: *faka'alofa* (love), *'fakalilifu* (respect), *tautua fakamaoni* (service), *va fealoa'i* (relationship), *fakalaumalie*

(spirituality), *fetausia'i* (reciprocity), *vuvalé* (family), *fakataki* (leadership), *turanga tau* (integrity), *ipukarea* (belonging) and *duavata* (inclusion). These Pacific cultural elements are holistic and broader than what the traditional Western research has considered as elements that scaffold children's learning. Taleni (2017) emphasised the value of schools and teachers understanding and demonstrating the knowledge of these Pacific principles and recognising the importance of them in supporting Pacific students' learning. He urged that when their cultural values and languages are reflected in their learning environment, Pacific students will feel safe to bring their cultural wisdom and funds of knowledge to school.

The teacher initiated inquiry in Taleni (2017) corroborated the teachers as learners approach explored in the MoE (2009) document. Both recognise the importance of unlocking Pacific students' cultural funds of knowledge and promoting cultural identity and competence in efforts to support their language development and educational success. There is a consensus on the benefits of Pacific children retaining their languages and cultural identity in discourses around Pacific students' education and achievement (Fletcher et al., 2009; Lianza, 2017; Mapa et al., 2000; MoE, 2009; Podmore et al., 2003; Taleni, 2017; Tuafuti & McCaffery, 2005). The positive impact of integrated cultural orientation on Pacific children's English receptive vocabulary found in this study is well aligned with the goal of power sharing between Pacific families and New Zealand schools and the empowerment of Pacific students so that they can move freely in both Pacific and *Palagi* worlds identified in the above Pacific education literature.

7.4.6 Intersectoral Coordination and Wrap-around Services to Better Serve Pacific Children and Families

Overall, the most important implication resulting from the studies conducted as part of this thesis is the relevance of integrating health, cultural factors and other sociodemographic information in analysing language and learning outcomes for Pacific children and also recognising the diversity inherent in that population. The positive impact of Pacific mothers retaining strong ties to both the dominant New Zealand and Pacific cultures was again evident in the prediction model for Pacific children's English receptive vocabulary skills constructed in Phase Two. The results highlight the relevance of cultural considerations in studying Pacific children's English receptive vocabulary development. In addition, the association between healthy birthweight, early behavioural, cognitive and motor skills development, cultural backgrounds, and English receptive vocabulary suggests that health be considered as an inclusive concept (Pullon et al., 2015) and a holistic approach is required in improving the outcomes for Pacific children.

The results from the ethnic-specific analyses of different Pacific ethnic groups revealed

distinct patterns of cultural orientation and acculturation strategies employed by Pacific mothers across ethnic groups and the differential impact these had on their children's English receptive vocabulary at age 6 years. These results provided the quantitative evidence-base for cultural diversity among Pacific children and emphasised the importance of understanding the differences in the learning outcomes based on their cultural and social adaptation of the dominant New Zealand culture and their own unique immigration histories.

To incorporate Pacific children's and their families' cultural context into studies of children's language and educational outcomes, an integrated model which reflects multiple perspectives and streams of knowledge from the children's families, communities and educators is required (Gillon & Macfarlane, 2017). The ethnic groups represented in the study cohort had taken varied adaptation strategies upon encountering the dominant New Zealand culture. This diversity implies that a cultural specific approach could work better in order to fully reflect Pacific children's diversity and support the realisation of their academic potential. Such tailored approach would necessitate collecting and analysing more in-depth and comprehensive pupil-level information. To this end, it behoves to maintain a coordinated and integrated system for accessing administrative data collected by separate service providers including education, health and social services. However, the routinely collected administrative data can be strengthened by richer sets of information that provide deeper insight into the policy priority populations. Although any mitigating actions need to be taken more urgently for Pacific children to uplift their educational outcomes, high quality pupil-level information can be used to benefit all students.

Much information is collected on children growing up in New Zealand by different agencies and research centres. Currently, these agencies are disjointed and the coordination of schools on deriving more comparable and standardised achievement level data was made difficult with the local governance structure of the Tomorrow's schools model. The socioeconomic-based decile system used as the equity funding mechanism was seen as exacerbating the destructive competition between schools (PPTA, 2013). Pacific students are strongly represented in low decile schools (MoE, 2016c) and material difficulties are often compounded with social, educational and health disadvantages in New Zealand (Superu, 2017). Educational (or health) outcomes cannot be tackled in isolation from other sources of disparities.

There is an identified need for developing indicators of inter-service coordination to better monitor the outcomes for children receiving services from various sectors such as health, educational, and social services (Craig, Baker, Baxter, & Jackson, 2016; Pullon et al., 2015). Developing indicators of inter-service coordination will involve facilitating integration and coordination of information across service providers. There exists such

capability in New Zealand with large databases that can be linked across different domains on an individual child basis. There is also a possibility of analysing children's educational outcomes using various child characteristics obtained from different databases.

The potential for developing quantifiable indicators for children's educational outcomes using information from large longitudinal studies and the linked data from various databases held by government agencies need to be explored. Such indicators can be used to identify children who are at most risk of being left behind in terms of realising their educational aspirations. These indicators will also signal important risk and protective factors of educational attainment associated with these children. The use of linked information across these databases also implies that it is possible to obtain the necessary information to tailor the intervention programmes to accommodate the individual needs of the children. This will allow an enhanced inter-service coordination and provision of coherent services to the children who would benefit the most from targeted intervention programmes.

7.4.7 Aligning Equity Funding with School Incentives

Early intervention is important as there is strong research evidence suggesting the benefits of starting well in reading-related skills on later literacy and education outcomes (Cunningham & Stanovich, 1997; Sparks et al., 2014). In particular, promoting early language development is essential to a good start as it positively influences later oral language and code-based competencies (NICHD, 2005). Environments rich in language stimulation and conversation not only help to build general language skills but also foster development of vocabulary and metalinguistic skills (Hart & Risley, 1999; NICHD, 2005). The persistent impact of starting well on students' later achievement suggests that the measure of educational effectiveness should take into account the incremental value created by education rather than the outcomes measured at the end of children's school-life.

This may argue for a school-entry assessment-level-based equity funding mechanism, such as the value-added models seen in England, in conjunction with a socioeconomic-based funding mechanism such as the decile system. The PIF cohort was deliberately recruited from the district where there is a strong community of Pacific immigrants (Paterson et al., 2006) and most of the schools around the catchment area were graded as low decile schools (MoE, 2018). The school leaver outcomes are markedly lower in low decile schools compared to those of high decile schools (MoE, 2016c). Measuring school effectiveness based only on school leaver outcomes will not take into account the incremental value added by the schools that have higher intakes of students with lower early literacy and numeracy skills. The value-added models of allocating equity funding in England were introduced in recognition that the effectiveness of school's educational programme should

be assessed based on the incremental effect of education over a child's school years and not just on the achievement levels when leaving school (Ray, 2006). The implementation was made possible by the establishment of a national curriculum and the availability of new sources of linked national databases on pupil-level characteristics. The pupil-level characteristics collected included gender, ethnicity, special educational needs, student's first language, home postcode along with a socioeconomic proxy. This enabled the ministry to analyse achievement levels in connection with these characteristics and also have a system of assessing school effectiveness and allocating equity funding to schools that are most in need (Goldstein et al., 1993; Ray, 2006; Schagen & Hutchison, 2003).

In New Zealand a capability to explore such mechanism exists with the ongoing development of large databases that can be linked across different domains. For example, the achievement results maintained by the MoE can be linked with the B4SC database of the IDI on a pupil-level. Similarly, the prenatal information on the cohort children of the PIF and GUiNZ studies can be linked with both the MoE and the B4SC databases. These capabilities in accessing information on different facets of children's development, be it educational, health, social, and cultural domains, need to be explored when attempting to promote better outcomes for children starting off facing higher barriers to learning.

7.5 Summary of Recommendations

A number of recommendations were made based on the results of the analyses contained in this thesis. In particular, the importance of early detection of language difficulties and instigation of intervention was noted. To facilitate this, the need for studies on the utility of population-wide language screenings, perhaps as early as 2 years, is highlighted. For Pacific children, developing culturally valid language and speech assessment tools and measures standardised on Pacific populations is long overdue. Concerted efforts between Pacific communities and language/speech specialists need to be made to remedy this situation.

Future studies on Pacific children's learning outcomes should consider extending and incorporating the cultural orientation measures. The importance of cultural backgrounds and social connections has been recognised in health and educational research but the application of these in quantitative studies have been minimal. The results here indicate that these constructs are integral to understanding Pacific children's learning outcomes and deserve due consideration.

The application of such constructs necessitates the continuation of longitudinal studies with capabilities in data linkages to routinely collected administrative data, which ideally should include language development measures between the ages 0 and 3 years. The data collected by longitudinal studies are typically more comprehensive and provide deeper insight than the administrative data. The richness in information collected by longitudinal studies is paramount to our improved understanding of holistic development in contemporary children.

The discussion also highlighted the possibility of extending culturally responsive frameworks to language, psychosocial, and cultural interventions. A culturally responsive language intervention framework could include intervention materials that are relevant for each culture, involvement of Pacific people, co-construction of materials, and tapping into Pacific funds of knowledge (Gillon & Macfarlane, 2017; Gillon et al., 2019; Macfarlane et al., 2007; Taleni, 2017). Cultural intervention programmes could explore the use of linguistic landscapes that reflect the ethnic, cultural and linguistic diversity that exists in New Zealand classrooms (Harris et al., 2018a, 2018b). Psychosocial intervention designs can be used to investigate the interaction between positive self-concept and academic achievement (Chapman et al., 2000; Denston, 2016, 2018; Everatt & Denston, 2019). A connection could also be made between psychosocial interventions and the strength-based approach whereby the efficacy of early intervention is analysed in relation to enhanced self-esteem and self-efficacy.

The association between various environmental factors and Pacific children's English receptive vocabulary and the holistic nature of children's early language development sug-

gest that inter-service coordination is essential in providing coordinated, wrap-around services to children. Formulation of an indicator for monitoring and quantifying the effectiveness of inter-agency service coordination is desired.

Finally, to make better use of the data currently collected by multiple organisations, strengthen the monitoring of student outcomes and give incentives to schools to achieve the highest incremental value given allocated resources, a value-added approach to school funding can be explored. Such system rewards schools for lifting their students' educational achievement levels rather than penalising them for adverse school leaver outcomes. The linked information across research centres and routinely collected administrative data currently available in New Zealand provides investigators with opportunities to explore the potential implementation of such value-added models in assessing educational effectiveness.

Overall, recommendations were made based on the individual diversity and importance of cultural orientation on Pacific children's early language and learning outcomes found in this thesis. Some recommendations also reflected more aspirational goals or visions of New Zealand schools where the cherished oral traditions of Māori and Pacific cultures are honoured and all children enjoy strong self-concept, sense of cultural identity and belonging, and ability to achieve and excel in their endeavours in multiple (Māori, Pacific, *Palagi* etc.) worlds.

7.6 Conclusions

One's concept of ethnicity, cultural identity, and belonging is considered dynamic, fluid, and multi-dimensional (Callister, 2011; Mila, 2013). There is a real struggle for New Zealand-born Pacific immigrants in forming their own identity and thriving in the dominant New Zealand society while staying connected to their Pacific roots, which has become somewhat of a balancing act (Mila, 2013; Samu et al., 2019). The insistence on authenticity and conflation of language mastery and cultural identity has led to this younger generation of Pacific people feeling rejected and marginalised from their own communities (Samu et al., 2019). Such struggle is also apparent among Māori youth who in the wake of revival of *te reo* find themselves the transitional generation. Derby and Macfarlane (2018) discussed the identity issues and Māoriness being beyond that can be measured by the *Reo* quantum. But the Pacific participants in Mila (2013)'s interviews also expressed optimism for the future generations of Pacific people as illustrated by a New Zealand-born Pacific mother who looked to her child and said, '*You're going to be something different*' (p.41).

There is a sense of change in the landscape. If *Te Kōhanga Reo* was the bottom-up

initiative to have the indigenous voices heard, *Te Whāriki* (MoE, 2017b), the Ministry guidance document for ECC, is a top-down commitment to give *mana* to the language of the first people of *Aotearoa* - New Zealand. It celebrates New Zealand's bicultural foundation and puts *te reo* on the foreground (Harris et al., 2018a; MoE - *Te Whāriki*, 2017). Harris et al.'s (2018a, 2018b) documentation of the linguistic landscapes of six English-medium ECCs revealed the diminishing dominance of English language that are visible within these spaces. The change in the linguistic landscapes and the use of multiple languages in signs displayed on the walls within the centres between 2016 and 2017 was palpable as was the qualitative impact it had on the multilingual children and their families.

Perhaps, the motivations for the studies on linguistic and cultural identity, linguistic landscapes that reflect the ethnic and cultural diversity, improving engagement and involvement of *whānau* (extended families) and communities, and enhancing children's self-esteem and self-efficacy can converge under one overarching aim: to celebrate our children and where they come from. Everyone involved in children's development and wellbeing must continue their efforts to understand how to help our children feel that they belong here, their identities are celebrated, and that they can '*come as you (who they) are*' (Mila, 2013, p.28). Indeed, Pacific children should feel safe to bring to school all that they are to help them learn, thrive and realise their academic aspirations (Talení, 2017).

Pacific parents have high educational aspirations for their children, which is often one of their main reasons for migrating to New Zealand (Tuafuti & McCaffery, 2005). However, there is evidence of mismatch between high aspirations and measured outcomes (Nash, 2000; Talení, 2017; Toloa et al., 2007; Tuafuti & McCaffery, 2005). Many Pacific parents do not question the teachers or the *Palagi* wisdom partly due to their cultural values of respect and partly because there is a power imbalance between the dominant culture and the ethnic minority groups (Fletcher et al., 2009; Tuafuti, 2010; Tuafuti & McCaffery, 2005). High quality and timely assessment feedback and home-school communication are needed to improve Pacific students' educational outcomes (Talení, 2017; Toloa et al., 2007). Recent research suggests efficacy of early intervention on lifting literacy achievement levels of Pacific children (Gillon et al., 2019). Different cultural orientation and acculturation strategies employed by each Pacific ethnic group studied, and the relative importance of such strategies on their children's English receptive vocabulary found in this thesis indicate more nuanced and culturally responsive intervention strategies are required. To successfully implement culturally responsive intervention programmes, teachers also need to develop their own cultural competence by being aware of one's own culture and how it influences thoughts and actions, developing sensitivity to cultural differences, and learning to adapt to differing cultural environments (Gillon & Macfarlane, 2017).

Although the importance of incorporating cultural diversity among Pacific children in studying their learning outcomes have been acknowledged, no studies to date have analysed such relationships using quantitative methods utilising psychometrically strong measures of cultural orientation. The linkage between cultural orientation and Pacific children's English receptive vocabulary was investigated explicitly in this doctoral study. Some important patterns of divergence in the cultural orientation across Pacific ethnic groups have been observed. However, more research is needed to understand how this relationship manifests among less strongly represented Pacific ethnic groups in New Zealand. Combining Pacific groups under a single unified banner does not do justice to the diversity in their cultural and linguistic heritages and histories (MoE, 2009). To improve our understanding of drivers behind Pacific people's education, health and wellbeing outcomes, ethnic-specific investigations are necessary (Chu et al., 2013; MoE, 2009).

For many Pacific migrants in New Zealand, success in education means to achieve and experience success without compromising their Pacific identities and values (Lianza, 2017; Tuafuti & McCaffery, 2005). It is to be able to live and '*grow up in New Zealand in the context of (their) own languages, cultures, values and beliefs*', to gain the necessary skills and knowledge required to be fully integrated members of New Zealand society (Lianza, 2017, p.5; Tuafuti & McCaffery, 2005). Or more simply put, it is to be '*able to move freely and easily in both Pasifika and Palagi language and cultural settings*' (Tuafuti & McCaffery, 2005, p.488). To support Pacific students achieve literacy and educational success, there is a need to understand their views of success, embrace and reflect cultural values and principles and hence make educational curriculum relevant to their context (MoE, 2009). This involves schools building closer connection with and encouraging participation of Pacific parents and communities, working in partnership with Pacific communities. The recognition of not only cultural differences, but also of ethnic diversity among Pacific students and their families, is critical for schools to develop effective and engaged relationships with parents and community (Gorinski & Fraser, 2006).

A societal shift is needed to conceptualise health as an integrated system, which includes social, economic, and educational wellbeing, contextualised within the social determinants of health framework. Successful transition to school marks an important milestone in a child's development. Providing the best environment possible at this critical juncture of a child's life can positively shape their life trajectory of health, education, social adaptation and economic wellbeing. Recognising and celebrating our children's diversity is an important part of providing a culturally safe and empowering environment. The celebration of children's diversity should indeed form an integral part of strategies aimed at achieving our agenda of giving every New Zealand child the best start and the best chance at life.

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Appendix A

Ethics Approval Letter - PIF Study

August 31, 2016

Hyun Min Kim
PhD Candidate
School of Health Sciences
University of Canterbury

Dr. El-Shadan Tautolo
Director
Pacific Islands Families Study
Faculty of Health and Environmental Sciences
AUT University
Private Bag 92006
Auckland 1142

Dear Dr. Tautolo,

I would like to ask for an approval to use the *Pacific Islands Families* (PIF) study in the research performed as part fulfilment of the Doctor of Philosophy (PhD) degree at the School of Health Sciences, University of Canterbury.

The PhD research will be conducted as part of the National Science Challenge *E Tipu e Rea, A Better Start* and in particular, used in predicting early literacy success, a project led by Professor Philip Schluter. Although I do not require a separate ethics approval from the University of Canterbury Ethics Committee, I am advised to obtain an acknowledgement from the PIF study team for using the data for fulfilling the requirement of the PhD.

In accessing and using the PIF study data for the PhD research, I agree to:

- Confine the scope of the study to that outlined within the National Science Challenge project, *E Tipu e Rea* and only use the data for the purpose stated for the project;
- Conduct the research in accordance with the ethical clearances already obtained for this project – and comply with the ethical standards for human experimentation, as established by the Helsinki Declaration;
- Analyse and disseminate the data in a culturally appropriate manner;
- Protect the privacy of the study participants;
- Obtain additional permission prior to publishing the results of the study; and
- Dispose of the data upon the completion of the research.

I would appreciate it if you can kindly approve the use of PIF data by signing your acknowledgement on the following page.

Yours sincerely,

Hyun Min Kim



August 31, 2016

In my capacity as Director of the Pacific Islands Families Study, I agree to the terms outlined above in this letter.

Signed:  (Dr. El-Shadan Tautolo) Date: 31 / 8 / 2016

Appendix B

Phase One Paper Manuscript

1 **Perceptions of Pacific children’s academic performance**
2 **at age 6 years: a multi-informant agreement study**

3 **Short: Agreement in perceptions of academic performance at age 6 years**

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16

17

18 **Abstract**

19 **Purpose:** In New Zealand, Pacific immigrants are among the fastest growing ethnic
20 minorities but, as a group, they are also at most risk of not realising their literacy and
21 educational aspirations critical for achieving their human potential and wellbeing. This may
22 be due, in part, to a misalignment in the shared understanding of academic success between
23 students, parents and their teachers within largely non-Pacific school environments. This
24 study aims to report levels of agreement in child-mother, child-teacher, and mother-teacher
25 perceptions of Pacific children's academic performance at age 6 years.

26 **Method:** A cohort of Pacific infants born during 2000 in Auckland, New Zealand, was
27 followed as part of the Pacific Islands Families study. Maternal home interviews were
28 conducted at 6-weeks and 6-years postpartum, together with separate child and teacher
29 elicitations at 6-years. Pairwise agreement of academic performance responses was
30 assessed using Cohen's weighted κ statistic, along with symmetry and marginal homogeneity
31 tests.

32 **Results:** At 6-years, information was available for 1,001 children and their mothers, and
33 teachers' evaluations for 549 children. Negligible to slight agreements and significant
34 asymmetry were found between the child-mother ($\kappa = 0.03$, 95% CI: -0.03, 0.09), child-
35 teacher ($\kappa = 0.04$, 95% CI: 0.01, 0.08), and mother-teacher ($\kappa = 0.07$, 95% CI: 0.03, 0.11)
36 pairwise assessments – with children and mothers more likely to rate Pacific children's
37 academic performance higher than their teachers. Significantly higher concordances with
38 teacher assessments were found among mothers with post-secondary education,
39 proficiency in English, and stronger alignment with New Zealand culture and for children
40 who performed strongly on a standardised measure of performance relative to their peers.

41 **Conclusion:** Early standardised assessments and strategies are needed to align Pacific
42 students' and parental perceptions with documented educational achievement outcomes.
43 The importance of closer collaboration, communication and shared understanding of
44 academic performance between teachers and families is highlighted.

45

46 **Introduction**

47 Education is a vital catalyst for child development and the realisation of human potential and
48 wellbeing. Indeed, the 2015 Incheon Declaration confirms that education develops the skills,
49 values and attitudes that enable citizens to lead healthy and fulfilled lives, make informed
50 decisions, and respond to local and global challenges [1]. Despite this, educational
51 achievement and its bi-directional connection to health have received relatively scant
52 attention within the domain of population health research [2-4]. Language and literacy
53 acquisition precedes most other children’s educational development, and successful early
54 attainment of these skills is essential for later educational achievement [5]. However, within
55 New Zealand, a developed and relatively wealthy nation, one in five children struggle with
56 learning to read [6]. Moreover, the nation’s disparity between children’s high and low
57 reading and numeracy performance is one of the largest in the developed world [6]. Children
58 of Māori and Pacific ethnic identities, and those of lower socioeconomic positions, are over-
59 represented in these poor statistics [6, 7]. The current situation is unacceptable to many (see
60 for example, [8]), including the Ministry of Education – te Tāhuhu o te Mātauranga (MoE)
61 which has a stated purpose to lift aspirations, and raise educational achievement for every
62 New Zealander [9].

63 Pacific people in New Zealand constitute a relatively young, fast growing immigrant
64 ethnic minority, comprising 7% of the nation’s population with median age 22.1 years at the
65 2013 Census, compared to the dominant European population which comprised 74% of the
66 population with median age 41.0 years [10]. Pacific people’s cultural heritage is diverse and
67 manifests in many differing traditions, languages, and histories of immigration [11]. Their

68 cultural values and adherence to traditions importantly shape their views on education,
69 health and wellbeing [12, 13]. For most Pacific communities, health is not confined to the
70 physical domain but is an embodiment of physical, mental, social and spiritual domains that
71 indicates a general state of wellbeing at both individual and community levels [13]. Pacific
72 students' cultural identities are also reflected on their educational goals and expectations [8,
73 12, 14]. The value of education to Pacific people is central, indeed it often forms part of the
74 *raison d'être* for immigration, yet New Zealand's inequitable and poor statistics belie this,
75 and may represent different expectations or understandings of success.

76 Within New Zealand, education, and literacy in particular, has been largely defined by
77 its European population, and is monolingual English dominated. This is likely to differ from
78 how literacy is understood by many Pacific people, who also emphasise other forms to the
79 written symbol such as the spoken word, metaphors, proverbs, visual arts, and song –
80 together with their own written language [7]. The level of discord in perceptions of literacy
81 achievement held between Pacific and European populations is unknown, yet it may
82 importantly contribute to the disparity in New Zealand children's documented reading
83 performance [6, 7]. The impact of discordance would be particularly marked if perceptions
84 of language and literacy achievements and markers of educational success differ between
85 these ethnic groups, teachers and the measured benchmarks.

86 Perhaps surprisingly, studies investigating the concordances between child-parent,
87 child-teacher, and parent-teacher perceptions of children's academic performance within
88 the general population have received limited research attention. Most of the literature has
89 focused on the concordances in the perceptions of academic outcomes among children with
90 known learning difficulties (LDs) and their parents and teachers. For example, Montgomery

91 (1994) studied the perceptions of academic self-concept of students with LDs aged 11 to 16
92 years and found slight to moderate agreements between parent-child, child-teacher, and
93 parent-teacher dyads [15]. Other studies have focused on agreement across the speech-
94 language assessment (SLA), teacher and family assessments of language ability and/or
95 language intervention need rather than academic success [16-18]. Williams (2006) compared
96 teacher judgement with standardised measures of general language and phonological
97 awareness in 60 children. Although judgements were significantly related, sensitivity and
98 specificity were less than acceptable particularly for preschool-aged children (estimated at
99 86% and 68%, respectively) [16]. Similarly, Massa et al. (2008) reported moderate
100 concordance rates between parent and teacher observational rating scales and standardised
101 language and literacy assessment [17].

102 Harrison et al. (2017) compared formal SLA and teacher and parent report of
103 identification of speech sound disorder in 157 children aged between 4 and 5 years. Higher
104 rates of concordance (86-90%) were reported for parent-SLA than for teacher-SLA (63-80%)
105 [18]. The authors attributed low concordance between SLAs and teachers to state policy
106 regarding eligibility for speech therapy which was generally focused around children with
107 most significant intervention need. Other factors that may have underpinned discordance
108 across groups were not explored. Future work that focuses on larger samples of children and
109 relates SLA to parent and teacher ratings of academic success is also necessary as we look
110 towards a model of greater collaboration and partnerships between teachers and families to
111 help children achieve functional goals.

112 A recent paper on the level of agreement between mothers', fathers' and teachers'
113 ratings of behavioural and emotional problems in 4,469 children aged between 3 and 5 years

114 has also reported poor agreement between the parent and teacher ratings [19]. The inter-
115 rater agreement on the responses to the Strengths and Difficulties Questionnaire was
116 analysed using both Pearson's correlation and intraclass correlations. The analyses revealed
117 poor agreement in both the mother-teacher and father-teacher ratings indicating the need
118 for incorporating both parents' and teachers' judgements on children's behavioural and
119 emotional functioning.

120 Although some attributed the lack of concordance among different informants to
121 response unreliability, others have argued that they reflect valid contributions of different
122 information [17-20]. Indeed, pooling information from multiple informants and analysing
123 differences can help researchers to obtain a more comprehensive picture with which to
124 predict children's behaviours or diagnose LDs [19, 21-23].

125 Academic self-concept can be linked to one's perceptions and attitudes toward their
126 own ability, competence and proficiency in broad areas of academic tasks [24]. Academic
127 self-concept, like other domains of self-concept is generally considered to be a
128 multidimensional construct and to have a reciprocal relationship with academic
129 achievement [24-26]. In Chapman et al.'s (2000) longitudinal study of 60 children aged
130 between 5 and 8 years, the children with positive academic self-concept performed more
131 strongly on reading related tasks than did the children with negative or typical academic self-
132 concept [24]. Their study also demonstrated that academic self-concept could influence
133 academic achievement much earlier than previously hypothesised. It is thus important to
134 investigate Pacific children's academic self-concept and how it may relate to the
135 documented assessment results in their early years at school.

136 Murray, Murray and Waas (2008) noted that the primary basis often cited by re-
137 searchers for not including children's perspectives is the lack of reliability and validity in
138 children's self-reported measures [27]. However, this stance conflicts with the peer- and
139 self-assessment (PASA) strategies promoted by those who support using learning
140 assessments primarily for formative purposes [28-30]. The proponents of formative learning
141 practices emphasise the benefits of PASA in empowering students, developing students' self-
142 regulation and communication skills, and improving student engagement [31-33]. Harris and
143 Brown's (2013) synthesis of students' and teachers' perspectives on PASA practices observed
144 in New Zealand classrooms revealed that students and teachers placed different emphases
145 across the main conceptions of assessment [30]. This may explain the low to moderate
146 concordances between students' self-assessment and teachers' evaluations or test
147 performances found in studies reviewed by Brown et al. (2015) [32]. However, the
148 relationship between differing perceptions arising from cultural differences and the impact
149 on children's academic performance remains largely unknown. The present study explicitly
150 investigates children's perspectives on their school performance in the first year of school.

151 General population information on perceptions of children's early academic
152 performance within New Zealand has not been routinely collected. However, the Pacific
153 Islands Families (PIF) study, a birth cohort study of 1,398 Pacific children growing up in New
154 Zealand [11], has elicited perceptions of early academic performance held by Pacific children
155 aged 6 years, their mothers, and teachers. All children in New Zealand are legally required to
156 have started their formal education by age 6 years. However, most start their primary school
157 education on their 5th birthday, which means that they would have had approximately one
158 year of formal instruction by the age 6 years. The availability of teacher's overall assessment

159 of children’s literacy and numeracy skills at this age allows the researchers to study the
160 outcomes of children’s early instruction. Therefore, Pacific children’s self-reported academic
161 performance at this age can be obtained from the 6-years measurement wave of the PIF
162 Study and contrasted with the responses from the children’s mothers and teachers. This
163 enables the empirical investigation into the concordance or discordance of these
164 perceptions among a general Pacific population. Accordingly, the primary aim of this study is
165 to report levels of agreement and symmetry in child-mother, child-teacher, and mother-
166 teacher perceptions of Pacific children’s academic performance. A secondary aim is to
167 investigate characteristics that differ between concordant child-teacher and mother-teacher
168 pairs and their discordant pair counterparts. This aim seeks to identify subgroups who may
169 most benefit from further information and communication about New Zealand’s educational
170 context and expectations. Another secondary aim is to relate teachers’ assessments of
171 children’s oral language skills to the students’ performance in a psychometrically robust,
172 direct measure of receptive vocabulary skills, the British Picture Vocabulary Scale (BPVS)
173 [34]. This latter aim is used to establish the reliability of teachers’ assessments, as an
174 educational achievement reference standard.

175 **Methods**

176 **Study design**

177 A cross-sectional agreement study nested within the PIF birth cohort study was conducted.

178 **Participants**

179 The PIF study follows a birth cohort of Pacific children born in 2000, and incorporates data
180 elicited from these children, their mothers and teachers.

181 **Procedure**

182 A detailed account of the PIF study, utilised instruments, and its procedures has been
183 described previously [11, 35]. In brief, the cohort was drawn from births at Middlemore
184 Hospital, South Auckland, between 15 March and 17 December 2000. All potential
185 participants for the PIF study were selected from births where at least one parent was
186 identified as being of Pacific ethnicity and a New Zealand permanent resident. Recruitment
187 occurred through the Birthing Unit, in conjunction with the Pacific Islands Cultural Resource
188 Unit, and consent was sought to make a home visit within 6 weeks of their births.
189 Approximately 6-weeks postpartum, potential participants were visited at home by female
190 Pacific interviewers fluent in both English and Pacific language(s). Once eligibility was
191 confirmed and written informed consent obtained, mothers participated in one-hour
192 interviews concerning family functioning and the child's health and development. Home
193 visits were repeated approximately 1-year, 2-years, 4-years, and 6-years postpartum. With
194 maternal consent and child assent, the children were independently interviewed for the first
195 time at the 6-years measurement wave, mostly within their school settings. Also at this time,
196 the children's teachers were approached to participate within the study.

197 **Measures**

198 **Standardised measurement**

199 The BPVS was used to measure children’s receptive vocabulary skills at 6-years [34]. It is a
200 standardised test where participants are asked to select the appropriate answer from four
201 possible pictures. Word-items get progressively more difficult until each child’s limit is
202 reached. Entries cover a wide range of language levels as well as word classes and are
203 allocated to different semantic and/or grammatical groupings (e.g. actions, adjectives,
204 animals and parts, books, human body parts, buildings, emotions and social expression,
205 food). The test consists of 14 question sets, with each set containing 12 vocabulary entries.
206 Here, raw scores were age-standardised employing the British population norm [34].

207 **Self-reported assessment of children’s academic performance**

208 Mothers, teachers and children were asked to evaluate the children’s academic performance
209 at 6-years using 5-point Likert-type scales. Children responded to the statement “I am good
210 at school work”, with options: yes always (C5); yes sometimes (C4); neither yes or no (C3);
211 no sometimes (C2); and, no always (C1). Mothers provided response to the question “Based
212 on your knowledge of your child’s school work, how is he/she doing in school this year?”,
213 with response options: very well (M5); well (M4); average (M3); poorly (M2); and, very
214 poorly (M1). Teachers were asked to separately evaluate the children’s performance in
215 reading, oral language, written language and mathematics domains. Response options used
216 the scale: excellent (5); very good (4); satisfactory (3); needs improvement (2); and, very
217 poor (1). To form a global score assessment, these four scores were summed and

218 categorised into five levels using the derived mean (\bar{x}) and standard deviation (SD), via: [$\bar{x} +$
219 $1.5 \times \text{SD}$, 20] (T5); [$\bar{x} + 0.5 \times \text{SD}$, $\bar{x} + 1.5 \times \text{SD}$] (T4); [$\bar{x} - 0.5 \times \text{SD}$, $\bar{x} + 0.5 \times \text{SD}$] (T3); [$\bar{x} - 1.5 \times \text{SD}$, $\bar{x} -$
220 $0.5 \times \text{SD}$] (T2); and, [4 , $\bar{x} - 1.5 \times \text{SD}$] (T1).

221 **Sociodemographics**

222 Maternal information at baseline (the 6-weeks measurement wave) included age, ethnic
223 identification, highest educational attainment, parity, relationship status, English language
224 fluency, cultural orientation, and household income (see supplementary materials). Cultural
225 orientation was conceived using Berry's bi-directional framework [36] and measured via an
226 adapted General Ethnicity Questionnaire (GEQ) [37] tailored to the New Zealand and Pacific
227 cultural settings [38]. Mothers were categorised into one of the following four orientation
228 types: integration (strong alignment with both cultures); assimilation (strong New Zealand,
229 weak Pacific); separation (weak New Zealand, strong Pacific); and marginalisation (weak
230 alignment with both cultures).

231 Child information included sex, ethnic identification, and internalising/externalising
232 problem behaviours. For the latter, mothers were asked to complete the Child Behaviour
233 Checklist (CBCL) for children aged 6-18 years [39] to assess internalising
234 (depressed/withdrawn) and externalising (aggressive/ disruptive) problem behaviours; see
235 supplementary materials [40].

236 Teacher information included sex, ethnic identification and years of teaching
237 experience. The teachers were asked to disclose all ethnic groups that they identified with
238 and to select the one that they identified with the most. Preference was given to the latter
239 information.

240 **Statistical analysis**

241 Reporting of analyses was informed by the STROBE guidelines for observational studies [41]
242 and the GRRAS guidelines for reporting reliability and agreement studies [42]. Initially, data
243 checks were undertaken, and then participant flow and descriptive statistics were reported.
244 To avoid within-family collinearity bias, one child from all twin births was randomly
245 removed. Patterns of missing data for child and maternal characteristics between those with
246 and without a teacher's assessment were evaluated using Fisher's exact test [43].
247 Participants' pairwise response distributions were assessed using McNemar's test of
248 symmetry [44] and Stuart-Maxwell's test of marginal homogeneity [45], and inter-rater
249 agreement was assessed using Cohen's weighted kappa (κ) statistics with the square
250 function penalty [46]. The computed κ statistics were interpreted using Landis and Koch's
251 (1977) approach where $0 \leq \kappa \leq 0.2$ represents negligible to slight agreement; $0.2 < \kappa \leq 0.6$
252 represents fair to moderate agreement; and $0.6 < \kappa$ represents strong agreement [47].
253 Teacher assessment of children's oral language skills was compared to the children's
254 performances in the BPVS raw scores using unadjusted and adjusted ordinal logistic
255 regression models fitted using the proportional odds assumption. Finally, Fisher's exact test
256 was also employed to investigate the patterns of child-teacher and mother-teacher
257 concordance and discordance over the considered sociodemographic variables [43].
258 Analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA) and Stata
259 SE version 5.1 (StataCorp, College Station, TX, USA), and $\alpha=0.05$ defined statistical
260 significance.

261 **Ethics**

262 Ethical approval for the PIF study was obtained from the Auckland Branch of the National
263 Ethics Committee and the Health and Disability Ethics Committee. The PIF study adheres to
264 the guidance stipulated under the Helsinki Declaration for human experimentation [11].

265 **Results**

266 **Participants**

267 At baseline, 1,376 mothers and 1,398 children (22 twins) participated in the PIF study. The
268 mean maternal age at birth was 27.9 years (range: 14, 57 years), with 8% younger than 20
269 years. Overall, 1,107 (80.5%) mothers were living together in married or de facto
270 partnerships, 454 (33.0%) were New Zealand-born, and 535 (38.9%) had no formal
271 educational qualifications. At the 6-years measurement wave 1,001 maternal and 1,019 child
272 interviews were completed (retention rate of 72.7% and 72.9%, respectively). Randomly
273 removing a child from each multiple birth left 1,001 child-mother pairs. Teachers'
274 information was available for 549 (54.8%) of these children, along with their evaluations for
275 the children's performance in at least one of the four academic areas: reading, writing, oral
276 language, and mathematics. Characteristics of the participants appear in Table 1.

277

278 **Table 1. Distribution of the participating children's (n=1,001), mothers' (n=1,001), and**
 279 **teachers' (n=549) characteristics**

	n	(%)
Child characteristics		
<i>Sex</i>		
Female	485	(48.5)
Male	516	(52.5)
<i>Ethnic identification^a</i>		
Samoan	463	(51.3)
Tongan	174	(19.3)
Cook Islands Māori	47	(5.2)
Other Pacific	218	(24.2)
<i>CBCL internalising behaviour^b</i>		
Normal range	841	(84.1)
Borderline	75	(7.5)
Clinical	84	(8.4)
<i>CBCL externalising behaviour^b</i>		
Normal range	709	(70.9)
Borderline	145	(14.5)
Clinical	146	(14.6)
Maternal characteristics at baseline		
<i>Age at childbirth (years)^b</i>		
<20	73	(7.3)
20-24	241	(24.1)
25-29	278	(27.8)
30-34	229	(22.9)
35-39	143	(14.3)
≥40	36	(3.6)
<i>Ethnic identification</i>		
Samoan	463	(46.3)
Tongan	218	(21.8)
Cook Islands Māori	174	(17.4)
Other Pacific	78	(7.8)
Non-Pacific	68	(6.8)
<i>Highest educational qualification</i>		
No formal qualification	371	(37.1)
Secondary school	358	(35.8)
Post-secondary school	272	(27.2)
<i>Parity^c</i>		
1	251	(25.5)
2-4	561	(57.0)
≥5	172	(17.5)
<i>Relationship status</i>		
Married/de facto	814	(81.3)

Single	187	(18.7)
<i>English fluency</i>		
Proficient	626	(62.5)
Otherwise	375	(37.5)
<i>Cultural orientation^d</i>		
Integration (High Pacific/High NZ)	183	(18.5)
Assimilation (Low Pacific/High NZ)	316	(31.9)
Separation (High Pacific/Low NZ)	314	(31.7)
Marginalisation (Low Pacific/Low NZ)	178	(18.0)
<i>Household income (New Zealand dollars)</i>		
≤\$20,000	331	(33.1)
\$20,001-\$40,000	511	(51.0)
>40,000	120	(12.0)
Unknown/declined to answer	39	(3.9)
Teacher characteristics at 6-years		
<i>Sex^e</i>		
Female	515	(94.7)
Male	29	(5.3)
<i>Ethnic identification^f</i>		
New Zealand European/Pākehā	262	(48.3)
Pacific	95	(17.5)
Māori	27	(5.0)
Other	158	(29.2)
<i>Years of teaching experience^g</i>		
0-5	256	(47.9)
6-10	126	(23.6)
>10	153	(28.6)

280 Note: ^a99 (9.9%) values missing; ^b1 (0.1%) value missing; ^c17 (1.7%) values missing; ^d10 (1.0%) values
281 missing; ^e5 (0.9%) values missing; ^f7 (1.3%) values missing; ^g14 (2.6%) values missing.
282

283 The availability of teacher assessment was not related to any of the child and
284 maternal characteristics presented in Table 1 (all Fisher's exact test $p > 0.05$), except for
285 maternal education (Fisher's exact test $p = 0.001$) and parity (Fisher's exact test $p = 0.03$).
286 Children without a teacher's assessment were more likely to have mothers without any
287 formal qualifications (43.1% vs. 32.1%) and parity of 1 (27.6% vs. 23.8%) or ≥ 5 (19.9% vs.
288 15.5%) than children with an assessment.

289 **Assessments of children’s academic performance**

290 Complete self-assessment data were available from 870 (86.9%) children, together with 998
291 (99.7%) maternal responses and 545 (99.3%) teacher global measures. Fig 1 presents the
292 distribution of these responses, together with a histogram of the BPVS raw scores, available
293 from 877 (88.6%) children. At age 6 years, the BPVS raw scores ranged between 18 and 104
294 with mean score of 49.4 (SD = 11.4). Fig 1 reveals that the teachers’ global assessment
295 distribution is largely symmetrical, whereas both the children’s and maternal distributions
296 are heavily left-skewed and the BPVS score distribution is right-skewed.

297 **Fig 1. Perceptions of Pacific children’s academic performance at age 6 years**

298 [Insert Fig 1 here]

299 Fig 1. Note: Each participant group rated the children’s academic performance using a Likert-type
300 scale from 1 to 5 with 5 being the highest level of achievement.

301

302 A salient feature of the children’s distribution is the disproportionately small number
303 of C3 responses; a potential limitation of the question as elicited. As such, a secondary
304 analysis reports agreement between affirmative responses (C4 and C5) vs. non-affirmative
305 responses (C1, C2 and C3) for children, and for mothers (M4-M5 vs. M1-M3) and teachers
306 (T4-T5 vs. T1-T3).

307 **Pairwise agreement between assessments of academic**
308 **performance**

309 Table 2 presents the pairwise distributions of academic performance perceptions between

310 child-mother (n=870), child-teacher (n=531), and mother-teacher (n=545) participants.

311 **Table 2. Pairwise distributions of academic performance perceptions between child-**
 312 **mother (n=870), child-teacher (n=531), and mother-teacher (n=545) assessment pairs**

	n (%)	n (%)	n (%)	n (%)	n (%)
	Mother				
Child	M1	M2	M3	M4	M5
C1	0 (0.0)	0 (0.0)	2 (0.2)	5 (0.6)	3 (0.3)
C2	0 (0.0)	0 (0.0)	9 (1.0)	18 (2.1)	17 (2.0)
C3	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)
C4	1 (0.1)	3 (0.3)	55 (6.3)	143 (16.4)	117 (13.4)
C5	0 (0.0)	3 (0.3)	68 (7.8)	243 (27.9)	182 (20.9)
	Teacher				
Child	T1	T2	T3	T4	T5
C1	0 (0.0)	3 (0.6)	1 (0.2)	0 (0.0)	0 (0.0)
C2	5 (0.9)	4 (0.8)	10 (1.9)	4 (0.8)	1 (0.2)
C3	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)	0 (0.0)
C4	15 (2.8)	42 (7.9)	75 (14.1)	44 (8.3)	11 (2.1)
C5	24 (4.5)	68 (12.8)	115 (21.7)	82 (15.4)	26 (4.9)
	Teacher				
Mother	T1	T2	T3	T4	T5
M1	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)	0 (0.0)
M2	0 (0.0)	0 (0.0)	2 (0.4)	1 (0.2)	0 (0.0)
M3	9 (1.7)	30 (5.5)	28 (5.1)	13 (2.4)	0 (0.0)
M4	34 (6.2)	53 (9.7)	106 (19.4)	55 (10.1)	13 (2.4)
M5	6 (1.1)	37 (6.8)	69 (12.7)	62 (11.4)	26 (4.8)

313 Note: C1, M1 and T1 are the lowest perceived ratings for children, mothers and teachers
 314 respectively, whereas C5, M5 and T5 are the highest perceived ratings.

315

316 **Child-mother assessment pairs**

317 Both the test for symmetry ($p < 0.001$) and marginal homogeneity ($p < 0.001$) were significant,
318 underlining the distributional differences observed in Fig 1. Children's self-assessments were
319 more frequently higher than their mothers than vice versa. The pairwise agreement
320 estimate was $\kappa = 0.03$ (95% CI: -0.03, 0.09), representing negligible agreement beyond
321 chance. When dichotomising the responses, significant asymmetry and marginal
322 heterogeneity remained (both $p < 0.001$) and agreement continued to be negligible ($\kappa = 0.02$;
323 95% CI: -0.04, 0.09).

324 **Child-teacher assessment pairs**

325 Again, both the symmetry ($p < 0.001$) and marginal homogeneity tests ($p < 0.001$) were
326 significantly different between assessment pairs. Here, children's self-assessments were
327 more frequently higher than their teachers' global assessments than vice versa. The
328 estimated κ was 0.04 (95% CI: 0.01, 0.08), which indicates negligible agreement beyond
329 chance. Significant asymmetry and marginal heterogeneity remained (both $p < 0.001$) when
330 responses were dichotomised, and agreement did not improve ($\kappa = 0.02$; 95% CI: -0.01, 0.04).

331 **Mother-teacher assessment pairs**

332 The symmetry ($p < 0.001$) and marginal homogeneity tests ($p < 0.001$) were significant for the
333 mother-teacher assessment pairs. Mothers' assessments were more frequently higher than
334 the teachers' global assessments. The estimated κ was 0.11 (95% CI: 0.07, 0.15), which
335 represents only slight agreement. Similarly, significant asymmetry and marginal

336 heterogeneity remained when responses were dichotomised (both $p < 0.001$), and estimated
337 agreement was negligible ($\kappa = 0.07$; 95% CI: 0.03, 0.11).

338 **Teacher oral language assessment against the BPVS direct** 339 **measure**

340 Teachers' assessments of children's oral language skills were plotted against the children's
341 raw test scores from the BPVS in Fig 2. A higher median BPVS raw score was observed for
342 each level increase in teacher assessment ratings; an observation supported by ordinal
343 logistic regression whereby the estimated odds of receiving a higher teacher rating increased
344 by 1.08 (95% CI: 1.06, 1.09) for each unit increase in the BPVS raw scores. These odds
345 remained significant when adjusted for household income, teachers' sex, ethnicity and
346 experience, and children's sex and ethnicity; estimated as 1.08 (95% CI: 1.06, 1.10). The
347 estimate for intraclass correlation coefficient in the BPVS scores within each teacher rating
348 was 0.22 (95% CI: 0.08, 0.70).

349 **Fig 2. Teachers' assessments of children's oral language skills and the BPVS raw scores**

350 [Insert Fig 2 here]

351 Fig 2. Note: The dotted line (the BPVS raw score of 49) indicates the median for the whole group.
352

353 **Participant characteristics associated with concordance**

354 **patterns**

355 Given teacher’s training and experience, the marginal distributions presented in Fig 1, and
356 the significant increasing association between teachers’ oral language assessment of
357 children against their BPVS direct measure, the teacher’s global assessment of the children’s
358 academic performance was treated here as a reference standard in these secondary
359 analyses. Child-teacher and mother-teacher assessments were each investigated, comparing
360 those who yielded concordant (i.e. pairs with the same rating, such as [C5 and T5]) or nearly
361 concordant assessments (i.e. pairs differing by one level, such as [C5 and T4] or [T5 and C4])
362 to those who were discordant and had a substantially greater academic performance
363 perception than their teacher (i.e. [C5 and T1], [C5 and T2] and [C4 and T1] for the child-
364 teacher comparison, and [M5 and T1], [M5 and T2], and [M4 and T1] for the mother-teacher
365 comparison). Overall, there were 261 and 335 concordant or nearly concordant (C) response
366 pairs for the child-teacher and mother-teacher assessments, respectively; and 107 and 77
367 discordant and greater academic performance perception than teacher (D) responses. The
368 characteristics of study participants partitioned by these C and D classifications appear in
369 Table 3.

370

371 **Table 3. Distribution of characteristics of child-teacher and mother-teacher responses for**
 372 **those with complete or near concordance (C) compared to those who were discordant and**
 373 **had a substantially greater academic performance perception than the teacher (D)**

	Child-teacher			Mother-teacher		
	C	D	p-value	C	D	p-value
	n (%)	n (%)		n (%)	n (%)	
Child characteristics						
<i>Sex</i>			0.82			0.70
Female	125 (47.9)	53 (49.5)		155 (46.3)	38 (49.4)	
Male	136 (52.1)	54 (50.5)		180 (53.7)	39 (50.6)	
<i>Ethnic identification</i>			0.58			0.25
Samoaan	117 (49.8)	54 (53.5)		141 (46.7)	44 (59.5)	
Tongan	42 (17.9)	12 (11.9)		58 (19.2)	13 (17.6)	
Cook Islands Māori	13 (5.5)	5 (5.0)		19 (6.3)	3 (4.1)	
Other Pacific	63 (26.8)	30 (29.7)		84 (27.8)	14 (18.9)	
<i>CBCL internalising behaviour</i>			0.19			0.39
Normal range	206 (78.9)	92 (86.0)		272 (81.2)	61 (79.2)	
Borderline	25 (9.6)	9 (8.4)		28 (8.4)	10 (13.0)	
Clinical	30 (11.5)	6 (5.6)		35 (10.4)	6 (7.8)	
<i>CBCL externalising behaviour</i>			0.33			0.10
Normal range	174 (66.7)	79 (73.8)		218 (65.1)	58 (75.3)	
Borderline	40 (15.3)	15 (14.0)		54 (16.1)	12 (15.6)	
Clinical	47 (18.0)	13 (12.1)		63 (18.8)	7 (9.1)	
<i>BPVS standard score</i>			<0.001			<0.001
Below norm	8 (3.1)	17 (15.9)		9 (2.7)	9 (12.3)	
At norm	212 (81.2)	88 (82.2)		281 (85.4)	64 (87.7)	
Above norm	41 (15.7)	2 (1.9)		39 (11.9)	0 (0.0)	
Maternal characteristics at baseline						
<i>Age at childbirth (years)</i>			0.12			0.15
<20	17 (6.5)	10 (9.3)		23 (6.9)	7 (9.1)	
20-24	55 (21.1)	24 (22.4)		70 (20.9)	20 (26.0)	
25-29	82 (31.4)	24 (22.4)		107 (31.9)	13 (16.9)	
30-34	64 (24.5)	29 (27.1)		79 (23.6)	23 (29.9)	
35-39	37 (14.2)	12 (11.2)		44 (13.1)	11 (14.3)	
≥40	6 (2.3)	8 (7.5)		12 (3.6)	3 (3.9)	
<i>Ethnic identification</i>			0.21			0.16
Samoaan	117 (44.8)	54 (50.5)		141 (42.1)	44 (57.1)	
Tongan	42 (16.1)	12 (11.2)		58 (17.3)	13 (16.9)	
Cook Islands Māori	63 (24.1)	30 (28.0)		84 (25.1)	14 (18.2)	
Other Pacific	14 (5.4)	7 (6.5)		23 (6.9)	3 (3.9)	
Non-Pacific	25 (9.6)	4 (3.7)		29 (8.7)	3 (3.9)	
<i>Highest educational qualification</i>			0.004			<0.001
No formal qual.	68 (26.1)	41 (38.3)		98 (29.3)	33 (42.9)	
Secondary	102 (39.1)	46 (43.0)		126 (37.6)	34 (44.2)	

Post-secondary	91	(34.9)	20	(18.7)	111	(33.1)	10	(13.0)
<i>Parity</i>				0.07				0.27
1	64	(24.8)	22	(21.2)	75	(22.7)	16	(21.1)
2-4	160	(62.0)	58	(55.8)	210	(63.6)	44	(57.9)
≥5	34	(13.2)	24	(23.1)	45	(13.6)	16	(21.1)
<i>Relationship status</i>				0.46				0.99
Married/de facto	210	(80.5)	90	(84.1)	277	(82.7)	64	(83.1)
Single	51	(19.5)	17	(15.9)	58	(17.3)	13	(16.9)
<i>English fluency</i>				<0.001				0.03
Proficient	184	(70.5)	55	(51.4)	223	(66.6)	41	(53.2)
Otherwise	77	(29.5)	52	(48.6)	112	(33.4)	36	(46.8)
<i>Cultural orientation</i>				0.04				0.11
Integration	58	(22.5)	20	(18.9)	61	(18.4)	19	(25.3)
Assimilation	101	(39.1)	29	(27.4)	121	(36.4)	17	(22.7)
Separation	63	(24.4)	40	(37.7)	94	(28.3)	26	(34.7)
Marginalisation	36	(14.0)	17	(16.0)	56	(16.9)	13	(17.3)
<i>Household income (NZD)</i>				0.78				0.54
≤\$20,000	81	(31.0)	34	(31.8)	104	(31.0)	23	(29.9)
\$20,001-\$40,000	136	(52.1)	53	(49.5)	178	(53.1)	44	(57.1)
>40,000	35	(13.4)	14	(13.1)	42	(12.5)	6	(7.8)
Unknown/declined	9	(3.4)	6	(5.6)	11	(3.3)	4	(5.2)
Teacher characteristics at 6-years								
<i>Sex</i>				0.99				0.57
Female	241	(93.1)	99	(93.4)	317	(94.9)	69	(93.2)
Male	18	(6.9)	7	(6.6)	17	(5.1)	5	(6.8)
<i>Ethnic identification</i>				0.01				0.03
NZ European/Pākehā	117	(45.5)	50	(48.1)	164	(49.4)	36	(49.3)
Pacific	53	(20.6)	18	(17.3)	66	(19.9)	8	(11.0)
Māori	4	(1.6)	9	(8.7)	9	(2.7)	7	(9.6)
Other	83	(32.3)	27	(26.0)	93	(28.0)	22	(30.1)
<i>Years of teaching experience</i>				0.03				0.05
0-5	117	(46.1)	48	(47.1)	156	(47.6)	36	(48.6)
6-10	72	(28.3)	17	(16.7)	87	(26.5)	11	(14.9)
>10	65	(25.6)	37	(36.3)	85	(25.9)	27	(36.5)

374 Note: p-values derived from Fisher's exact test.

375

376 Among the child-teacher responses, significantly higher proportions of children in C

377 pairs were found to score above the population norm on the BPVS test ($p < 0.001$); have

378 mothers with higher educational qualifications ($p = 0.004$), English proficiency ($p < 0.001$),

379 assimilated or integrated cultural orientation ($p = 0.04$); and have teachers with 6-10 years of

380 teaching experience ($p=0.03$), and who were of Pacific ethnicity ($p=0.01$). For the mother-
381 teacher responses, significantly higher proportions of mothers in C pairs were found to have
382 post-secondary educational qualifications ($p<0.001$), be proficient in English ($p=0.03$), and
383 have children who performed above the population norm on the BPVS test ($p<0.001$). A
384 significantly higher proportion of teachers in these C pairs were found to be of Pacific
385 ethnicity ($p=0.03$).

386 **Discussion**

387 Important asymmetrical differences in the perceptions of academic performance held by
388 Pacific children, mothers, and teachers were identified. Children and mothers were
389 significantly more likely to rate Pacific children's academic performance highly than their
390 teachers. Moreover, there was negligible to slight agreement beyond chance found between
391 any of the pairwise investigations. This implies that some mothers' and Pacific children's
392 perceptions are likely to be in stark contrast to their teachers. Results from the ordinal
393 logistic regression demonstrated that the teachers provided oral language evaluations that
394 significantly and consistently increased with the children's increasing BPVS scores. If
395 teachers' assessments more closely align to the criteria used for established and reported
396 performance measures, then this child and maternal discordance in perceptions may
397 contribute to New Zealand's relatively large international literacy and numeracy disparity,
398 and over-representation of Pacific children [6, 48].

399 The cohort children's generally positive academic self-perceptions at age 6 years are
400 consistent with the results found in earlier literature on children's academic self-concept
401 [49-52]. However, the results from the additional analyses linking the concordance patterns

402 to environmental factors in the present study confirmed the association between children's
403 strong English receptive vocabulary skills and the concordance between their academic self-
404 perception and the achievement level assessed by their teachers. On the other end of the
405 spectrum, the children who were assessed by their teachers as not performing as strongly as
406 their peers were somehow protected from developing negative academic self-perception.
407 Considering the positive association between academic self-perception and achievement
408 [24-26], this in itself may not be a deleterious outcome. However, the results nevertheless
409 suggest that the communication between home and school about children's school
410 performance may not have been completely effective. The language may have been a
411 barrier to some Pacific mothers considering that a higher proportion of them reporting
412 lower proficiency in the English language were rating their children's performance more
413 favourably compared to the teacher's assessment. The premise that there may have been
414 potential issues with communication is also more convincing given that there was a higher
415 degree of agreement between teachers and mothers who had higher educational
416 qualifications.

417 Explicit parent-teacher conflicts often result from disagreement on the perceptions
418 of children's ability [53]. As a result, parents tended to become less involved at their
419 children's schools and teachers tended to facilitate fewer programmes involving parents
420 [54]. However, here, the disagreement in perceptions is unlikely to be explicit or shared
421 between individuals. Most Pacific cultures emphasise the importance of deference towards
422 authority figures, the teachers in this instance, which may result in Pacific students and their
423 parents not questioning teachers' views or teaching methods employed [12, 14]. It is also
424 possible that Pacific mothers have more holistic and culturally connected conception of

425 educational success than the teachers in the English-medium schools [8, 12, 55]. Indeed, as
426 there are no common national assessment standards across early primary schools within
427 New Zealand, these discrepant perceptions may remain unchallenged for years – potentially
428 disadvantaging Pacific children’s educational enterprise. A shared communicated
429 understanding of the expectations for academic achievement is vital as is the mutual respect
430 for ethnic and cultural differences. Retaining strong Pacific cultural links has been shown to
431 have positive health benefits for Pacific immigrants in New Zealand [38], and it could be
432 opined that such strong links would also lead to better educational and wellbeing outcomes
433 for children from outside the prevailing European culture.

434 Despite the lack of agreement found among each pairwise assessment, some
435 common factors were found to contribute to the concordances between the assessments.
436 Significantly higher proportions of mothers with higher educational qualifications and
437 English proficiency were found among concordant mother-teacher and child-teacher
438 assessment pairs. The importance of maternal cultural orientation in the concordance
439 patterns is also worth noting. The study highlights the benefits of closer connection to both
440 the New Zealand and Pacific cultures and the mothers who were integrated and familiar
441 with both cultures were represented more highly among concordant child-teacher pairs.
442 Higher proportions of discordant child-teacher and mother-teacher pairs observed among
443 mothers with separator or marginalisor orientation types signal potential cultural-mismatch
444 between Pacific mothers and predominantly New Zealand European teachers. The
445 importance of fluency in the English language in the concordance patterns suggests that this
446 group of mothers, largely separated from the Anglo-dominant New Zealand culture and
447 society, may have experienced difficulty obtaining adequate information with which to

448 assess their children's academic performance against more standardised and Western
449 measures. The above patterns of discordance suggest that Pacific mothers who are not
450 fluent in the English language and separated from the New Zealand culture may experience
451 cultural and language barriers to understanding their children's progress at school. The
452 home-school connection and parental involvement at schools are influenced by the
453 interactions between the family, school and communities, and the cultural values,
454 experiences and philosophies embedded within each group [54, 56, 57]. Having shared goals
455 and common practices between home and school can create a more coherent learning
456 environment for children [54, 57]. The results found in the current study emphasise the
457 need to enhance home-school communication, and encourage Pacific parents' involvement
458 at schools by fostering inclusiveness and expressing cultural responsiveness towards Pacific
459 families [8, 55].

460 Even with the practice of benchmarking each student against predetermined
461 achievement standards, there is still a potential for bias in teachers' assessments. For
462 example, in a study involving 519 American fifth and sixth graders, Mowrey and Farran
463 (2016) found that the teachers in the study tended to recalibrate their students'
464 performances in mathematics based on the students within their school rather than to the
465 national norms [58]. This had the effect of inflated ratings for culturally diverse students
466 from lower socioeconomic backgrounds. An attempt has been made in this study to gain
467 insight into this phenomenon by comparing teachers' assessments with the BPVS scores. The
468 results from the ordinal logistic regression showed that the teachers in this study provided
469 evaluations that tended to increase monotonely as the children's BPVS raw test scores
470 increased. This result validated the teacher assessment of children's oral language

471 development in a sense that the teacher assessments resembled the distribution of a
472 language assessment tool that is based on externalised and directly measurable standards.
473 However, the coefficient estimate for intraclass correlation in the BPVS raw scores within
474 each grade showed relatively poor agreement. The presence of unusual observations could
475 have influenced the analyses of squared deviations in the computation of intraclass
476 correlation coefficients. The estimated confidence interval was indeed wide in the current
477 result. The analyses of median and the interquartile ranges were reported to supplement
478 the result of the correlation estimate. The median scores, which are not strongly influenced
479 by unusual observations, show a clearer trend of monotone increases in the raw scores for
480 each increase in the grades given by the teachers.

481 Some commonly held reasons for discrepancies in multi-informant responses are
482 relatively strong within-observer effects that are often stronger than the inter-observer
483 effects [22, 59, 60] and children's behaviours being situation-specific [20, 23, 61]. Of these,
484 the relatively strong within-observer associations have been observed in studies across
485 various domains of children's behavioural studies. For example, it has been noted that the
486 lack of agreement between parent and teacher dyads on their observations of children's
487 behaviours may be due to dealing with children within disparate settings and environments
488 [20, 60, 61]. Children are thought to display a different range of emotions and behaviours
489 depending on the situation and the setting, hence allowing parents and teachers to observe
490 children's behaviours within the context of home and school [23, 60, 61]. It is also noted that
491 parents and teachers may exhibit systematic discrepancies in their observations as they may
492 have different benchmarks to compare a child to (for example, a sibling at home or other

493 students in class), and also have varying degrees of tolerance if a child displays any
494 problematic behaviours [21, 62].

495 Miller and Davis (1992) noted that one of the general findings from studies that
496 compared mothers' assessments of their children's performances with those of the
497 teachers' or the results from standardised tests among children with LDs was the tendency
498 of mothers to overestimate the children's performances [63]. Their own study of 60
499 American second and fifth graders without LDs indicated that, although both mothers and
500 teachers tended to overestimate children's cognitive abilities, the teachers tended to be
501 more accurate in terms of students' relative standing within their class. The mothers in the
502 present study perceived their children's school performance more positively than the
503 teachers. The teacher assessment tended to concord with the performance measured using
504 the standardised test implying that if the standardised assessments are taken as the gold
505 standard for judging the accuracy of an assessment, then this could lead to disaccord
506 between parental perceptions and the documented educational outcomes.

507 Patel and Stevens (2010), in their study of 179 American sixth to eighth graders (aged
508 11 to 14 years), also found discrepancies in the perceptions of children's academic abilities
509 between parents, teachers, and students [54]. Children's self-perceptions of general
510 scholastic abilities were compared to their parents' perceptions of their children's abilities in
511 mathematics and English/language arts subjects and the actual grades given by the teachers.
512 The results of bivariate linear regressions revealed that in general, as parent-student or
513 parent-teacher discrepancies in perceptions of students' academic abilities increased, the
514 parents tended to participate less in school activities and the schools facilitated less
515 opportunities for parents to get involved. These results support the argument that the

516 family-school interactions are importantly shaped by the ideas and perceptions held by
517 students, parents and teachers [57]. Establishing joint understanding of perceptions of
518 children's scholastic abilities could be an important step toward enhanced home-school
519 collaborations and parental involvement in children's education.

520 This study had a number of salient strengths, including the large data size of a policy
521 priority population, the measurement wave timing at 6-years and the availability of multiple
522 apposite variables. Moreover, the impact of maternal cultural orientation on child-teacher
523 or parent-teacher concordances, to our knowledge, has not been studied previously. This
524 study also deliberately and explicitly includes the children's perspectives. The primary basis
525 often cited by researchers for excluding children's perspectives in their studies is the lack of
526 reliability and validity in children's self-reported measures [27]. However, Murray et al.'s
527 (2008) study of child-teacher relationships among ethnic minority children in urban
528 kindergarten classrooms indicated meaningful differences between perceptions held by the
529 children and their teachers [27]. They demonstrated that these differences enhance the
530 understanding of the child-teacher relationships and, more importantly, help to identify
531 problems with over-relying on teacher's reports alone. These results, in addition to very
532 disparate perceptions of their own academic performance held by the Pacific children
533 compared to that of the mothers and teachers, warrant further research into aligning and
534 explaining the differences in student's and teacher's assessments.

535 The study is not without its limitations. The cohort of Pacific children was deliberately
536 recruited from the wider Auckland region, New Zealand's most populated city, where almost
537 two thirds of New Zealand's Pacific people reside [64]. As such caution should be exercised
538 when generalising to Pacific communities elsewhere. Our respondents had differently

539 worded response types available to them to evaluate the cohort children's performance,
540 which may weaken some of the analyses presented here. Also, unlike the teacher
541 assessments, the child and maternal questions were generic and lacked subject-specificity.
542 Ideally each respondent would have been questioned identically on each educational
543 domain of interest. However, the clear differences in self-reported assessments remain
544 notable and important. As with all studies using self-reported measures, various sources of
545 bias may impact on the findings. Not all eligible PIF study children had complete information
546 from their teachers and parents. Such missing observations could compromise internal
547 validity if the missing information importantly differs from those of the observed.

548 Notable here was that mothers without any formal qualifications were more likely to
549 have a child without a teacher's assessment. Moreover, these mothers were more likely to
550 have perceptions that were discordant and optimistic compared to the teachers. Thus the
551 underlying levels of mother-teacher discordance presented here is likely to be an
552 underestimate. Lastly, the BPVS test, like most other direct measures designed for a
553 monolingual population, is likely to suffer from cultural bias if tested on an English-as-
554 additional-language population [65, 66] or in other geographic locations.

555 Despite these limitations, the study provided novel empirical evidence for the
556 generally optimistic perceptions of academic achievement held between Pacific children
557 aged 6 years and their mothers compared to their teachers. Without national student
558 achievement testing, which occurs much later in New Zealand schools, many Pacific children
559 are at risk of being left with these disparate perceptions longer and further lagging behind
560 their peers. Literacy intervention studies involving smaller samples of Pacific students
561 suggest the efficacy of early, targeted interventions [67]. Efforts to align the student

562 perceptions with documented achievement outcomes could include early standardised
563 assessments and instigating culturally appropriate strategies and interventions to prevent
564 Pacific children from being left behind educationally, and ultimately compromising their
565 future opportunities, health and wellbeing.

566 The main findings of this study reaffirm the importance of teachers demonstrating
567 cultural responsiveness towards Pacific students and their families and enhancing
568 communication between home and school [68]. Dismantling cultural barriers experienced by
569 Pacific mothers largely separated from the New Zealand culture could encourage them to
570 initiate conversations with teachers on their children’s academic progress and be more
571 involved at schools. To this end, the initial teacher education should equip teachers with the
572 knowledge of Pacific perspectives and values by incorporating them into teacher preparation
573 programmes and materials [69, 70]. Such demonstration of Pacific cultural values by
574 teachers and schools could help improve home-school continuity for migrant Pacific children
575 and enhance their educational experience. Providing support for those families at risk of
576 cultural separation and marginalisation, empowering them to achieve higher socioeconomic
577 circumstances, and preparing teachers to be culturally responsive are important policy
578 implications from this study.

579

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Appendix C

Classification Tree Notes - Breiman et al., 1984

NOTES ON CLASSIFICATION TREES (BREIMAN ET AL., 1984)

ALICE HYUN MIN KIM

1. SOME PRELIMINARY NOTES

1.1. Classification and Regression Trees. Larger datasets and higher dimensionality brought with them some challenges in analysing the data. Classifiers are tools for exploration and making predictions.

- Trees are non-parametric algorithms - there are no assumptions made about the distributions of variables, for example, independence.
- When using a classifier to uncover the predictive structure of a problem, we are trying to understand what variables or interactions of variables derive the phenomenon.

Non-homogeneity of complex datasets and data structure meant that different relationships hold between different variables in different parts of the measurement space.

“The curse of dimensionality” (Bellman, 1961): Higher the dimensionality the sparser and more spread apart the data points. “Breiman et al., 1984: Ten points on the unit interval are not distant neighbors. But 10 points on a 10-dimensional unit rectangle are like oases in the desert.”

2. SETTING UP

2.1. A set of measurements. Define the measurements (x_1, x_2, \dots) made on a case (observation) as the *measurement vector* \mathbf{x} corresponding to the case. Take the measurement space X to be defined as containing all possible measurement vectors.

Suppose that the cases fall into J classes. Let C be the set of classes, i.e. $C = \{1, \dots, J\}$.

Definition 2.1. A classifier or classification rule is a function $d(\mathbf{x})$ defined on X so that for every \mathbf{x} , $d(\mathbf{x})$ is equal to one of the classes 1, 2, ..., J .

Or, alternatively, let A_j be a subset of X on which, $d(\mathbf{x}) = j$. That is,

$$A_j = \{\mathbf{x}; d(\mathbf{x}) = j\}.$$

The sets, A_1, \dots, A_J are disjoint and $X = \bigcup_j A_j$. The A_j form a partition of X .

2.2. Learning sample. In systematic classifier construction, past experience is summarised by a learning sample.

Definition 2.2. A learning sample consists of data $(\mathbf{x}_1, j_1), \dots, (\mathbf{x}_N, j_N)$ on N cases where $\mathbf{x}_n \in X$ and $j_n \in \{1, \dots, J\}$, $n = 1, \dots, N$. The learning sample is denoted, L .

$$L = \{(\mathbf{x}_1, j_1), \dots, (\mathbf{x}_N, j_N)\}.$$

2.3. Misclassification Costs. Given a classifier, $d(\mathbf{x})$ defined on X taking values in C , the ‘true misclassification rate’ is denoted by $R^*(d)$.

There are several ways to estimate $R^*(d)$ and hence the accuracy of a classifier. Two of the most common ways are resubstitution estimate and a V-fold Cross Validation (CV) method. Both methods require a use of a learning sample, L . Usually, d is constructed using L . If we draw another very large (virtually infinite) set of cases from the same population as L is drawn from, the proportion misclassified by d is the value of $R^*(d)$.

Define the set of $X \times C$ as a set of all couples (\mathbf{x}, j) where $\mathbf{x} \in X$ and j is a class label, $j \in C$. Let $\mathbb{P}(A, j)$ be a probability on $X \times C$, $A \subset X, j \in C$.

Definition 2.3. Take (\mathbf{X}, Y) , $\mathbf{X} \in X$, $Y \in C$, to be a new sample from the probability distribution $\mathbb{P}(A, j)$:

$$(i) \mathbb{P}(\mathbf{X} \in A, Y = j) = \mathbb{P}(A, j).$$

(ii) (\mathbf{X}, Y) is independent of L .

Then,

$$R^*(d) = \mathbb{P}(d(\mathbf{X}) \neq Y).$$

The resubstitution estimate of the true misclassification rate, denoted $R(d)$ is then,

$$R(d) = \frac{1}{N} \sum_{n=1}^N \chi(d(\mathbf{x}_n) \neq j_n).$$

where $\chi(\cdot)$ is an indicator function.

We divide the cases in L into two sets, L_1 and L_2 . Then we only use L_1 to construct d . The cases in L_2 are used to estimate $R^*(d)$. Then we can define the *test sample* estimation as

$$R^{ts}(d) = \frac{1}{N_2} \sum_{(\mathbf{x}_n, j_n) \in L_2} \chi(d(\mathbf{x}_n) \neq j_n).$$

For V-fold CV estimation, the *test sample* estimator is used for each v subset of L . The estimation of $R^*(d^{(v)})$ for the test set L_v is defined as

$$R^{ts}(d^{(v)}) = \frac{1}{N_v} \sum_{(\mathbf{x}_n, j_n) \in L_v} \chi(d^{(v)}(\mathbf{x}_n \neq j_n)).$$

where $N_v \simeq N/V$ is the number of cases in L_v .

The V-fold CV estimate $R^{cv}(d)$ is then defined as

$$R^{cv}(d) = \frac{1}{V} \sum_{v=1}^V R^{ts}(d^{(v)}).$$

Comparing different estimators, the resubstitution estimate gives an overly optimistic picture of the accuracy of d . Cross-validation methods are parsimonious with data. The CV estimates tend to be conservative in the direction of overestimating misclassification costs. Larger the V , more accurate the estimate R^{CV} should be. Ideally, once use cross-validation to construct d , another cross-validation should be performed to get a less biased estimate of $R^*(T)$.

3. GROWING TREES

3.1. Prior Probabilities. We define the prior class probabilities $\pi(j) = \mathbb{P}(Y = j)$. In most cases, these are unknown. They are often estimated as the proportions N_j/N .

In a node t , let $N(t)$ be the number of class j cases in t . The proportion of the class j cases in L falling into node t is $N_j(t)/N_j$. For a given set of priors, we take

$$p(j, t) = \pi(j) \frac{N_j(t)}{N_j}$$

as the resubstitution estimate for the probability that a j class case will be in t . The resubstitution estimate of $p(t)$, the probability that any case falls into node t is

$$p(t) = \sum_j p(j, t).$$

Then the resubstitution estimate of the probability that a case is in class j given that it falls into node t is given by

$$p(j|t) = \frac{p(j, t)}{p(t)}$$

and satisfies

$$\sum_j p(j|t) = 1.$$

For $\{\pi(j)\} = \{N_j/N\}$, $p(j|t) = N_j(t)/N(t)$ so the $\{p(j|t)\}$ are the relative proportions of class j cases in node t .

3.2. Binary Splits. For binary questions $\{\text{Is } \mathbf{x} \in A?\}$, the descendant nodes of t are $t_L = t \cap A$ and $t_R = t \cap A^c$ where A^c is the complement of A in X . The set Q of binary questions generate a set S of splits s of every node t . The best split, s^* is one that maximises the *goodness of split*.

3.3. Impurity of Nodes.

Definition 3.1. An impurity function is a function ϕ defined on the set of all J -tuples of numbers (p_1, \dots, p_J) satisfying $p_j \geq 0$, $j = 1, \dots, J$, $\sum_j p_j = 1$ with the properties

- (i) ϕ is a maximum only at the point $(\frac{1}{J}, \dots, \frac{1}{J})$.
- (ii) ϕ achieves minimum only at the points $(1, 0, \dots, 0)$, $(0, 1, 0, \dots, 0)$, \dots , $(0, \dots, 1)$.
- (iii) ϕ is a symmetric function of p_1, \dots, p_J .

Definition 3.2. Given an impurity function ϕ , define the impurity measure $i(t)$ of any node t as

$$i(t) = \phi(p(1|t), p(2|t), \dots, p(J|t)).$$

If a split s of a node t sends a proportion p_R of the data cases in t to t_R and the proportion p_L to t_L , define the decrease in impurity to be

$$\Delta i(s, t) = i(t) - p_R i(t_R) - p_L i(t_L).$$

Then take the *goodness of split* Φ to be $\Delta i(s, t)$.

After doing some splitting and we arrive at a set of terminal nodes, which we will denote \tilde{T} . We set $I(t) = i(t)p(t)$ and define the *tree impurity* $I(T)$ by

$$I(T) = \sum_{t \in \tilde{T}} I(t) = \sum_{t \in \tilde{T}} i(t)p(t).$$

Then selecting the splits that maximise $\Delta i(s, t)$ (the goodness of split) is equivalent to selecting the splits that minimise the overall tree impurity $I(T)$.

3.4. Misclassification Costs. We define $C(i|j)$ the cost of misclassifying a class j object as a class i object which satisfies:

- (i) $C(i|j) \geq 0$, $i \neq j$.
- (ii) $C(i|j) = 0$, $i = j$.

Given a node t with estimated node probabilities $p(j|t)$ for $j = 1, \dots, J$, if a randomly selected object of unknown class falls into t and is classified as class i , then the estimated expected misclassification cost is

$$\sum_j C(i|j)p(j|t).$$

For tree T , the resubstitution estimate $R(T)$ is

$$R(T) = \sum_{t \in \tilde{T}} r(t)p(t) = \sum_{t \in \tilde{T}} R(T)$$

where $R(T) = r(t)p(t)$ and $r(t) = \min_i \sum_j C(i|j)p(j|t)$.

Resubstitution errors $R(T)$ will get smaller as trees get more complex. That also means, for any split of a node t into t_L and t_R ,

$$R(t) \geq R(t_L) + R(t_R).$$

3.5. Splitting Rule and Gini. The splitting of branches was carried out using a measure of impurity of nodes. The *goodness of split* was defined as the decrease in impurity $i(t)$, and the problem became one that of selecting a split, s^* such that

$$\Delta i(s^*, t) = \max_{s \in S} \Delta i(s, t).$$

The measure of impurity should satisfy the properties in Definition 3.1. For 2-class examples, these conditions mean

- (i) $\phi(0) = \phi(1) = 0$,
- (ii) $\phi(p_1) = \phi(1 - p_1)$,
- (iii) $\phi''(p_1) < 0$, $0 < p_1 < 1$.

The last additional condition of strict concavity ensures that $\phi(p_1)$ decreases faster than linearly as p_1 increases and thus purer nodes are more rewarded.

The Gini index of diversity for this 2-class example is

$$i(t) = 2p(1|t)p(2|t).$$

which is a quadratic equation with non-negative coefficients.

Once we take into account the varying misclassification costs, the estimate expected cost using the Gini becomes

$$R(T) = \sum_{i,j} C(i|j)p(i|t)p(j|t).$$

and for 2-class example:

$$R(T) = (C(2|1) + C(1|2))p(1|t)p(2|t).$$

If we use the proportion of class j cases classified as i (denoted $Q(i|j)$) and the priors $\pi(j)$ to estimate $p(i|j)$,

$$R(T) = \sum_{i,j} C(i|j)Q(i|j)\pi(j).$$

The Gini index was preferred because it was simple and easy to compute. The `rpart` package implements the generalised Gini index which takes into account the varying misclassification losses/costs. The *goodness of split* measure is also adjusted for correct classification. In addition, since the trees are grown using 10-fold CV, the resulting tree and the splits used in the construction of the tree are associated with errors that are within one standard error of the minimum 10-fold CV errors. This implies that the splits used in the resulting *goodness of split* and the *variable importance* measures are optimal in the above sense.

4. STRATEGY FOR SELECTING A GOOD TREE

4.1. Better Strategy. The authors found it more satisfying to grow a very large tree then prune it upward in the “right way” using a more accurate estimate of misclassification rate. The strategy was to initially continue to split until all terminal nodes are very small. Then selectively prune this large tree upward. They recommended using CV to pick out the subtree that has the lowest estimated misclassification rate.

For splitting the tree, they were reasonably satisfied with using the Gini index of diversity as a measure of impurity. For classification trees, the Gini takes the form

$$i(t) = \sum_{i \neq j} p(i|t)p(j|t).$$

But, they noted that pruning criteria are more important than a splitting rule.

4.2. Minimal Cost-Complexity Pruning. To prune a tree upward until you reach a reasonable subtree, a measure of tree complexity and some stopping criteria are needed. So a complex and big tree is penalised by using a complexity parameter $\alpha \geq 0$, $\alpha \in \mathbb{R}$.

Let T_{max} be a large, complex tree.

For any subtree $T \preceq T_{max}$, define its complexity as $|\tilde{T}|$, that is, the number of terminal nodes in T .

Define the cost-complexity measure $R_\alpha(T)$ as

$$R_\alpha(T) = R(T) + \alpha|\tilde{T}|.$$

Now given, α , find the subtree $T(\alpha) \preceq T_{max}$ that minimises $R_\alpha(T)$:

$$R_\alpha(T(\alpha)) = \min_{T \preceq T_{max}} R_\alpha(T).$$

The algorithm continues to prune out branches if the resubstitution misclassification error of the sub-branch and the branch is equal to give or take some constant α . Trees were pruned more for larger α (the penalty for complex trees).

4.3. Cross-Validation for Pruning. Step-by-step:

- (i) $Q^*(i|j) = \mathbb{P}(d(\tilde{\mathbf{x}}) = i|Y = j)$ and $\mathbb{P}(d(\tilde{\mathbf{x}}) = i|Y = j) = \frac{N_{ij}}{N_j}$. For CV, $N_{ij} = \sum_v N_{ij}^{(v)}$. $Q^*(i|j)$ is the probability that a case in j is classified into i by d .

- (ii) $R^*(j) = \sum_i C(i|j)Q^*(i|j)$ is the expected cost of misclassification for class j item.
- (iii) $R^*(d) = \sum_j R^*(j)\pi(j)$ is the expected cost of misclassification by d .
- (iv) Using the $Q^*(i|j)$ from CV, $R_{(T(\alpha))}^{CV} = \frac{1}{N} \sum_{i,j} C(i|j)N_{ij}$.
- (v) Let $R^{CV}(T_k) = R^{CV}(T(\alpha_k))$.
- (vi) Select the tree T_{k_0} such that $R^{CV}(T_{k_0}) = \min_k R^{CV}(T_k)$.

Typically, as a tree is pruned upward, the estimated misclassification rate decreases slowly then reaches a gradual minimum then rapidly increases as the number of terminal nodes becomes small. This is due to the trade-off between bias and variance.

Appendix D

Phase Two Paper Publication



ORIGINAL ARTICLE

Integrating health, education and culture in predicting Pacific children's English receptive vocabulary at 6 years: A classification tree approach

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Aim: Pacific children fare poorly on health and educational outcomes, including literacy. Early interventions are considered critical in reducing educational disparities. A prediction model was constructed to analyse the factors associated with Pacific children's English receptive vocabulary, an important component of English language development.

Methods: A birth cohort study of Pacific children was used to construct a classification tree model and predict the proportions of Pacific children who performed strongly in a standardised test of English receptive vocabulary at 6 years of age ($n = 1019$). Classification trees were constructed using 10-fold cross-validation (CV) and pruned using the one-standard-error rule. Prediction errors were directly estimated using leave-one-out CV.

Results: Analyses of misclassification errors from the pruned model gave false negative and positive rates of 19 and 19% from re-substitution and 54 and 21% from leave-one-out CV estimation, respectively. Of the predictors, maternal acculturation, small birthweight and performance in early developmental screening test at 4 years of age were found to have the highest goodness of split.

Conclusions: The cultural environment to which Pacific children were exposed in early childhood, indicated by the maternal acculturation, was more crucial in distinguishing children with strong English-receptive vocabulary skills than socio-economic or prenatal conditions. This highlights the importance of integrating the cultural environment into designing measures for facilitating Pacific children's language development.

Key words: acculturation; decision trees; forecasting; Pacific people; vocabulary.

What is already known on this topic

- 1 Educational and health outcomes are bi-directional and positively associated.
- 2 There are persistent disparities in children's educational and health outcomes in most developed countries, and Pacific children are among those worst affected in New Zealand.
- 3 Pacific children's early language and literacy skills, assessed using conventional literacy school measures, were found to be lower on average than the overall student population, highlighting the need for early interventions.

What this paper adds

- 1 Cultural environment was incorporated into a prediction model for Pacific children's English-receptive vocabulary at 6 years of age, and the results emphasise the importance of maternal cultural orientation in distinguishing children with strong English-receptive vocabulary skills from those who scored below the age-appropriate range.
- 2 This suggests the need for cultural considerations when attempting to study Pacific children's language outcomes and when designing and implementing strategies for reducing disparities.
- 3 Classification trees were constructed, and their performances were analysed, indicating their potential utility and limitations in predicting educational outcomes.

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Educational and health outcomes are considered inextricably linked and bi-directional.¹ In fact, enhancing equity in educational attainment is seen as one of the most important ways to tackle disparities in health outcomes.² Moreover, a radical shift of focus in life sciences research towards social, behavioural and environmental determinants of health is suggested to truly serve people's health and well-being.³

Educational disadvantages and ethnic differences in achievement results have been observed in Australia (AU) and New Zealand (NZ), particularly among the indigenous and Pacific populations.^{1,4} Empirical research on the achievement gap has affirmed the important associations between family/neighbourhood socio-economic backgrounds and educational outcomes.^{4–6} However, a comprehensive review of Pacific education research commissioned by the Ministry of Education – te Tāhuhu o te Mātauranga – demonstrated that no research has explicitly investigated the association between health, cultural orientation and educational outcomes in informing Pacific children's learning outcomes in NZ.⁷ For indigenous and Pacific communities in AU and NZ, health is not confined to the physical domain but is an embodiment of physical, mental, social and spiritual domains that indicates a general state of well-being at both the individual and community levels.^{8,9} This suggests that a more integrated and holistic approach could be taken to enhance health and educational outcomes for these populations.¹

Early language and literacy skills are intertwined, and the interplay between vocabulary, oral narrative skills and reading comprehension continues into adolescence.¹⁰ Kindergarten receptive vocabulary skills were significantly associated with word reading and comprehension at grades 2–10 for both typically developing and language-impaired participants from a longitudinal study.¹¹ Reading comprehension being the best single predictor of academic achievement,¹² age-appropriate development of vocabulary and language skills is essential for a student's academic success.

The general consensus is that there are substantial individual differences in children's receptive vocabulary development, and the variation is often attributed to differences in environmental and family factors.^{6,13,14} Hart and Risley's close examination of the daily interactions in 42 American children and their families over 3 years demonstrated that there were meaningful differences in the average amount of language experiences provided to children depending on the families' socio-economic backgrounds.¹⁵ However, they also found that, on an individual level, it was the actual language experiences and the length of time the parents spent talking to the children, and not the socio-economic environment, that had impact on children's vocabulary growth. An investigation into long-term interplay between language and literacy skills among 58 children in NZ also found links between maternal language profiles and those of the children.¹⁰ Maternal receptive vocabulary, measured when children were aged 3 years, had significant positive and concurrent correlations with the children's receptive vocabulary and a longer-term positive effect on reading comprehension at age 16 years.¹⁰

Higher maternal education consistently acted as a protective factor in children's receptive vocabulary development in several separate studies involving different cohorts.^{12–14,16,17} Interestingly, paternal incomplete secondary education and not the maternal education was a significant risk factor for later onset of impairment in receptive vocabulary among 1914 monolingual English-speaking participants in Queensland, AU.¹⁸ However, the measure for paternal education also had a substantial correlation with maternal education and was subsequently not included in their later study.¹⁹ In a study of 61 low-income African American and Hispanic American children who participated in Early Head Start, high-quality father-child and mother-child linguistic

interactions were found to increase children's interest in reading, thus indirectly promoting the acquisition of receptive vocabulary skills.¹⁷ Their results suggest that fathers may play an important and unique role in children's language development, and both parents should be involved in interventions.

Being born a small infant (<2500 g) was a significant risk factor for receptive vocabulary development in the Longitudinal Study of Australian Children (LSAC) cohort, as was having four or more siblings.^{6,16} Similarly, a gestational period of less than 36 weeks and Apgar scores of ≤5 at 5 min after birth were associated with lower receptive vocabulary at 5 years of age.¹² Children's non-verbal intelligence quotient scores had a significant effect on receptive vocabulary growth between ages 4 and 21 years of age for both specific language-impaired and unaffected children.¹⁴

Children born to older mothers tended to have greater receptive vocabulary skills.^{13,20} Being a teenage parent, on the other hand, exposed children to the risk of delay in receptive vocabulary development in a birth cohort of 4019 children aged 5 years.¹² Such an association was also observed among LSAC cohort, but the effect did not remain once adjusted for other factors.⁶ The impact of changes in family structure and composition during early childhood on the receptive vocabulary growth into adulthood was also investigated using data from the Ottawa Language Study.¹³ They found some unique variance of model explained by family separation in early childhood, and children from separated households had lower receptive vocabulary than children from intact families, a difference that carried through to adulthood. Their cohort comprised primarily of English-speaking Canadian Caucasians, which made their results difficult to generalise to more ethnically and culturally diverse populations.

Although ethnic identities and non-English-speaking background were included in some models,^{6,12,16} none of the above studies explicitly investigated the association between cultural orientation and children's receptive vocabulary. Hart and Risley noted the importance of cultural background in children's language acquisition, which was not specifically explored in their study. *'Meanings and standards are established by the culture, and subtle interactional factors shape and socialize children to think and act like members of their own [cultural] groups'*.^{15(p.11)} Despite the evidence of educational disadvantages of ethnic minority groups in developed Western countries,²¹ to date, no research has studied the impact of cultural orientation on immigrant children's early language acquisition using a large cohort study that utilised quantitative methodology and multiple environmental factors. Understanding what contributes to individual differences in vocabulary acquisition is important as it predicts children's later academic outcomes.¹⁴ The need to understand this among Pacific children is especially urgent within the NZ context in order to reverse their educational inequality and burden.²²

The aim of this work was to study the factors associated with Pacific children's English receptive vocabulary by constructing a prediction model integrating various dimensions of children's early development. The results were then interpreted to analyse the common characteristics of Pacific children who scored within or above the age-appropriate range in a standardised test of English receptive vocabulary compared to those who scored below this range.

Methods

Study design and participants

A retrospective cohort study was performed using data from the Pacific Islands Families (PIF) study, a contemporary longitudinal birth cohort study of Pacific children growing up in NZ.²³ Data from the measurement waves from birth to 6 years of age (6-years) were analysed. The eligibility criteria included one or both parents identifying with Pacific ethnicity and being permanent residents in NZ. Mothers who gave birth between 15 March and 17 December 2000 at a tertiary birthing unit in Auckland, NZ, were invited to participate. Consent was sought from mothers to make home visitations at 6 weeks' postpartum. The maternal interviews were conducted at the participants' family homes, while most children were interviewed at school after written consent was obtained from their mothers and the children assented to being interviewed. Ethical approval for the PIF study was obtained from the Auckland Branch of the National Ethics Committee and the Health and Disability Ethics Committee. Detailed information on the recruitment and retention of participants appears in the cohort profile publications.^{23,24}

Response measurement

Cohort children's English receptive vocabulary at 6 years of age, measured using the British Picture Vocabulary Scale (BPVS),²⁵ was used as the outcome variable in a classification tree prediction model. In the absence of receptive vocabulary assessments that have been designed and normed for the NZ population, the BPVS is one of the tools available to language and learning specialists.²⁶ Children's scores on the BPVS at 6 years of age were standardised using a British population norm and categorised into 'at-risk' (of low English receptive vocabulary) for scores <85 (cut-off value for the age-expected range) and 'age-appropriate' receptive vocabulary for scores ≥85 (Table S1, Supporting Information).²⁵

Potential predictors

A broad-based set of potential predictors was considered for the analysis. These included variables related to birth outcomes, the home literacy and cultural environment, children's emotional and behavioural development, maternal mental health, parental behaviours and socio-economic background.

Baseline socio-demographic information was obtained through maternal interviews at 6 weeks' postpartum. This included maternal age at childbirth in years, ethnic identities, the highest level of educational attainment, social marital status, household income and maternal perceptions of household crowding.

Cultural orientation was measured using maternal acculturation derived from Berry's bi-directional modelling framework²⁷ and the General Ethnicity Questionnaire (GEQ).²⁸ The GEQ was adapted to the dominant NZ European and Pacific cultural settings.²⁹ Mothers were categorised into four acculturation types: 'integration' (strong alignment with both cultures), 'assimilation' (strong NZ, weak Pacific), 'separation' (weak NZ, strong Pacific) and 'marginalisation' (weak alignment with both cultures). Maternal self-reported fluency in English was also analysed along with the length of mothers' stay in NZ.

Birth-related variables included mothers' parity (number of pregnancies with 24+ weeks of gestational period), child's gender, small birthweight (<2500 g) for gestational age and gender with a separate category for preterm births (<37 weeks) (small for gestational age (SGA)), alcohol consumption and tobacco smoking during pregnancy.

The General Health Questionnaire (GHQ-12)³⁰ was administered to mothers at 1 year to screen for any minor psychiatric disorders.³¹ Parenting practice was analysed in terms of nurturance and discipline using a modified version of the Parent Behaviour Checklist (PBC)³² at 2 years. The scores were categorised into quartiles, with the upper quartile representing a greater extent of behaviour on each scale. Mothers' self-reported frequency of story reading to children at 1 year was included.

Children's early development was monitored with the Australian Developmental Screening Test (ADST)³³ at 2 years (ADST-2 year) and 4 years (ADST-4 year). Performances on the tests were categorised as 'no delay', 'monitor' (possible minor delay, re-screen in 2–3 months) and 'assessment required'.

Maternal reports of externalising (aggressive and disruptive) and internalising (depressed and withdrawn) problem behaviours at 6 years of age were measured using the Child Behaviour Checklist (CBCL)³⁴ and these were included in the analysis (Table S2, Supporting Information).³⁵

Statistical analysis

A classification tree model³⁶ was fitted using the BPVS as a response variable. Differences in the proportions between the children with the BPVS scores and those without were tested using two-tailed Fisher's exact tests.^{37,38}

Misclassification errors calculated from the full, pruned and 'leave-one-out' (L1O) cross-validation (CV) models were considered for model selection. The full model was constructed using an arbitrarily small complexity parameter (CP), which was then pruned using the CP found from a separate 10-fold CV and one-standard-error (1-SE) rule.

The final pruned model was illustrated using a dendrogram. A dotplot was used for the variable importance score, measured by the sum of goodness of split associated with each time the variable was used as the primary or surrogate splitting criterion. The loss associated with misclassifying 'at-risk' children as being at the 'age-appropriate' level (L_{12}) and the converse loss (L_{21}) were analysed. There were no known values for the loss parameters. An *a priori* decision was made to use $L_{12} = 10$ and $L_{21} = 1$ for the initial model building. However, the relative loss of $L_{12}:L_{21}$ was varied in additional analyses to study its impact on the misclassification errors.

Results

At baseline, 1376 mothers and their 1398 children (22 twins) participated in the study. At the 6-year measurement wave, 1001 maternal and 1019 child interviews were completed (retention rates of 72.7 and 72.9%, respectively). Randomly removing one child from each twin birth to avoid within-family collinearity bias left 1001 mother-child pairs. Models were constructed using 877 (88%) children with BPVS scores. The raw test scores ranged from 18 to 104, with mean = 49.4 and standard deviation (SD) = 11.4. These corresponded to age-standardised mean = 100

Table 1 Characteristics of mothers (*n* = 877) and children (*n* = 877) with British Picture Vocabulary Scale (BPVS) scores (included in the analysis) and those without and the *P* values from the test of conditional independence

Characteristics	With BPVS, <i>n</i> (%)	Without BPVS, <i>n</i> (%)	Fisher's test <i>P</i> value
Prenatal and birth outcomes (baseline):			
Maternal age, years			0.05
<20	65 (7.4)	8 (6.5)	
20–24	201 (22.9)	40 (32.3)	
25–29	242 (27.6)	36 (29.0)	
30–34	213 (24.3)	16 (12.9)	
35–39	124 (14.2)	19 (15.3)	
40+	31 (3.5)	5 (4.0)	
Parity			0.01
1	209 (24.2)	42 (34.7)	
2–4	494 (57.2)	67 (55.4)	
5+	160 (18.5)	12 (9.9)	
Smoking (tobacco) during pregnancy			0.82
True	204 (23.4)	30 (24.2)	
False	667 (76.6)	94 (75.8)	
Alcohol consumption during pregnancy			0.87
Never	832 (95.4)	119 (96.0)	
Monthly or less	26 (3.0)	4 (3.2)	
2+ drinks a month	14 (1.6)	1 (0.8)	
Child's gender			0.77
Female	430 (49.0)	59 (47.6)	
Male	447 (51.0)	65 (52.4)	
SGA			0.88
Preterm	74 (8.6)	9 (7.4)	
No	721 (83.7)	104 (86.0)	
Yes	66 (7.7)	8 (6.6)	
Early home environment			
GHQ-12 (1-year)			0.64
No	724 (87.7)	93 (86.1)	
Yes	102 (12.3)	15 (13.9)	
Story reading (1-year)			0.47
Never	76 (9.2)	10 (9.2)	
Several times a year	3 (0.4)	0 (0)	
Several times a month	20 (2.4)	2 (1.8)	
Once a week	62 (7.5)	3 (2.8)	
About three times a week	278 (33.6)	43 (39.4)	
Everyday	389 (47.0)	51 (46.8)	
PBC			
PBC-discipline (2-year)			0.12
Within 0–25 percentile	254 (31.3)	32 (32.0)	
Within 26–50 percentile	180 (22.2)	18 (18.0)	
Within 51–75 percentile	164 (20.2)	30 (30.0)	
Within 76–100 percentile	213 (26.3)	20 (20.0)	
PBC-nurturance (2-year)			0.39
Within 0–25 percentile	227 (28.0)	35 (34.7)	
Within 26–50 percentile	187 (23.1)	21 (20.8)	
Within 51–75 percentile	212 (26.2)	28 (27.7)	
Within 76–100 percentile	184 (22.7)	17 (16.8)	
Early development index			
ADST (2-year)			0.05
Assessment required	275 (36.7)	44 (45.4)	
Monitor	57 (7.6)	2 (2.1)	
No delay	417 (55.7)	51 (52.6)	

Table 1 (Continued)

Characteristics	With BPVS, <i>n</i> (%)	Without BPVS, <i>n</i> (%)	Fisher's test <i>P</i> value
ADST (4-year)			0.96
Assessment required	340 (54.5)	30 (53.6)	
Monitor	16 (2.6)	1 (1.8)	
No delay	268 (42.9)	25 (44.6)	
Behavioural development			
CBCL-internalising (6-year)			0.29
Age-appropriate	731 (83.4)	108 (87.8)	
Borderline	71 (8.1)	5 (4.1)	
Clinical	75 (8.6)	10 (8.1)	
CBCL-externalising (6-year)			0.02
Age-appropriate	609 (69.4)	100 (81.3)	
Borderline	132 (15.1)	13 (10.6)	
Clinical	136 (15.5)	10 (8.1)	
Cultural environment (baseline)			
Maternal ethnicity			0.14
Samoan	406 (46.3)	57 (46.0)	
Cook Islands Māori	154 (17.6)	20 (16.1)	
Tongan	196 (22.3)	22 (17.7)	
Other Pacific	61 (7.0)	17 (13.7)	
Non-Pacific	60 (6.8)	8 (6.5)	
Maternal English fluency			0.55
Not fluent	332 (37.9)	43 (34.7)	
Fluent	545 (62.1)	81 (65.3)	
Maternal acculturation			0.35
Assimilation	276 (31.8)	40 (32.8)	
Separation	282 (32.5)	32 (26.2)	
Integration	161 (18.5)	22 (18.0)	
Marginalisation	150 (17.3)	28 (23.0)	
Length of mothers' stay in New Zealand			0.85
New Zealand born	296 (33.8)	45 (36.3)	
Pacific Islands born – 10+ years in New Zealand	330 (37.7)	44 (35.5)	
Pacific Islands born – <10 years in New Zealand	249 (28.5)	35 (28.2)	
Socio-economic background (baseline)			
Household income			0.51
<20k	287 (33.9)	44 (37.9)	
20k–40k	455 (53.8)	56 (48.3)	
>40k	104 (12.3)	16 (13.8)	
Household crowding			0.05
No	599 (68.3)	98 (79.0)	
Somewhat	208 (23.7)	19 (15.3)	
Greatly	70 (8.0)	7 (5.6)	
Maternal education			0.63
No formal qualification	326 (37.2)	45 (36.3)	
Secondary	317 (36.1)	41 (33.1)	
Post-secondary	234 (26.7)	38 (30.6)	
Social marital status			0.42
Married	517 (59.0)	67 (54.0)	
In <i>de facto</i> partnership	201 (22.9)	29 (23.4)	
Not partnered	159 (18.1)	28 (22.6)	

The baseline missing/don't know/decline to respond responses *n* (%): maternal age: 1 (0.1); parity: 17 (1.2); smoking during pregnancy: 6 (0.4); alcohol consumption during pregnancy: 5 (0.4); small for gestational age (SGA): 19 (1.4); maternal acculturation: 10 (0.7); length of mothers' stay in New Zealand: 2 (0.1); and household income: 39 (2.8). At subsequent measurement waves, General Health Questionnaire (GHQ) (1 year): 67 (5.5); Story reading (1 year): 64 (5.2); Parent Behaviour Checklist (PBC)-discipline (2 years): 90 (7.9); PBC-nurturance (2 years): 90 (7.9); Australian Developmental Screening Test (ADST) (2 years): 155 (13.5); ADST (4 years): 321 (30.6); Child Behaviour Checklist (CBCL)-internalising (6 years): 1 (0.1); and CBCL-externalising (6 years): 1 (0.1).

Table 2 Predicted and actual classifications of children using classification tree models

Model type	Predicted/Actual (%)				Misclassification†
	At-risk/At-risk	At-risk/Age-appropriate	Age-appropriate/At-risk	Age-appropriate/Age-appropriate	
<i>L</i> ₁₂ = 10, <i>L</i> ₂₁ = 1					
Full model (CP = 0)	66 (8)	193 (22)	1 (–)	617 (70)	(0.01, 0.24)
Pruned (CP = 0.007)	54 (6)	156 (18)	13 (1)	654 (75)	(0.19, 0.19)
L1O CV (CP = 0.007)	31 (4)	173 (20)	36 (4)	637 (73)	(0.54, 0.21)
<i>L</i> ₁₂ = 20, <i>L</i> ₂₁ = 1					
Full model (CP = 0)	67 (8)	208 (24)	0 (–)	602 (69)	(0.00, 0.26)
Pruned (CP = 0.005)	66 (8)	217 (25)	1 (–)	593 (68)	(0.01, 0.27)
L1O CV (CP = 0.005)	36 (4)	239 (27)	31 (4)	571 (65)	(0.46, 0.30)

†Misclassification: ('At-risk to age-appropriate', 'age-appropriate to at-risk'). CP, complexity parameter; CV, cross-validation.

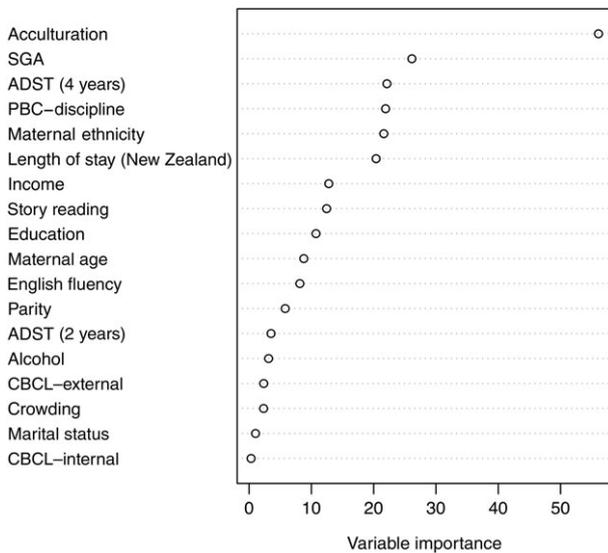


Fig. 1 Variable importance in a classification tree with *L*₁₂:*L*₂₁ = 10:1 and complexity parameter (CP) = 0.007. ADST, Australian Developmental Screening Test; CBCL, Child Behaviour Checklist; PBC, Parent Behaviour Checklist; SGA, small for gestational age.

and SD = 11.3 with a range of 68–155. A total of 67 (8%) children scored below the age-expected range. The proportions of missing/unknown/declined responses to particular interview questions ranged from 0 to 29% across predictors at 6 years. The results of Fisher's exact tests showed differential proportions between the children with and without BPVS scores for maternal age (*P* = 0.05), parity (*P* = 0.01), ADST-2 year (*P* = 0.05), CBCL-externalising (*P* = 0.02) and perception of household crowding (*P* = 0.05). The demographic information for the children and mothers is summarised in Table 1.

Growing and pruning the classification tree

A full model (CP = 0) was created using all the predictor variables in Table 1. Applying the 1-SE rule to the estimated 10-fold CV errors for each CP suggested a pruned tree with 18 terminal

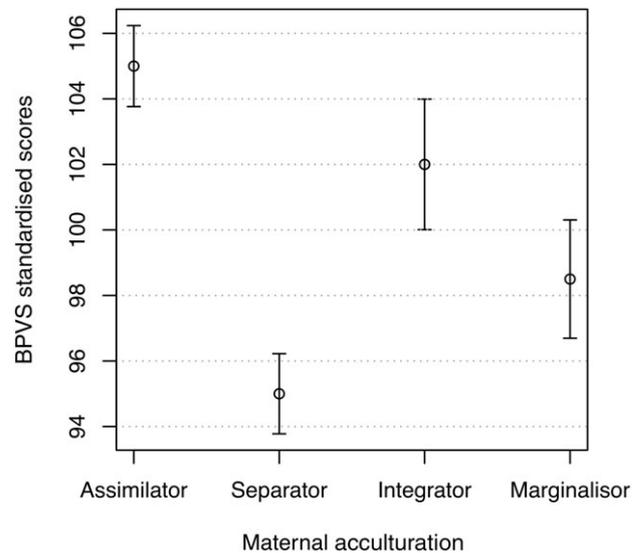


Fig. 2 Median British Picture Vocabulary Scale (BPVS) scores with 95% confidence bands for maternal acculturation.

nodes and CP = 0.007. L1O-CV was performed to directly estimate prediction errors. The resulting classification tables are shown in Table 2.

The full model shows strong sensitivity (>98%). However, it misclassified 24% of children as being 'at-risk' when they performed at an 'age-appropriate' level in the BPVS. The pruned model has lower sensitivity and false negative and positive rates of (0.19, 0.19). The L1O-CV prediction errors show even lower sensitivity.

Variable importance

The variables used in constructing the pruned model are listed in the order of importance and are illustrated using a dotplot in Figure 1.

For the pruned model, maternal acculturation was found to be the predominant splitting variable. A dotplot of the median BPVS

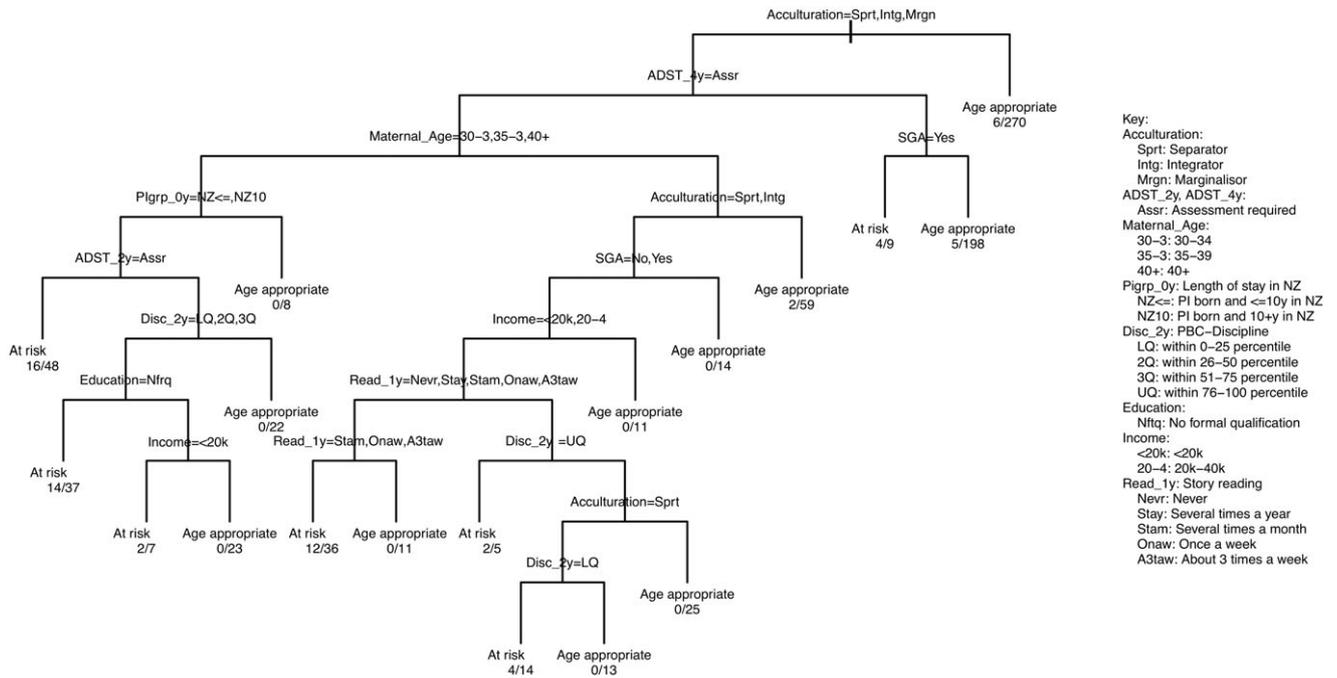


Fig. 3 Dendrogram of a classification tree pruned to 18 terminal nodes with $L_{12}:L_{21} = 10:1$ and $CP = 0.007$.

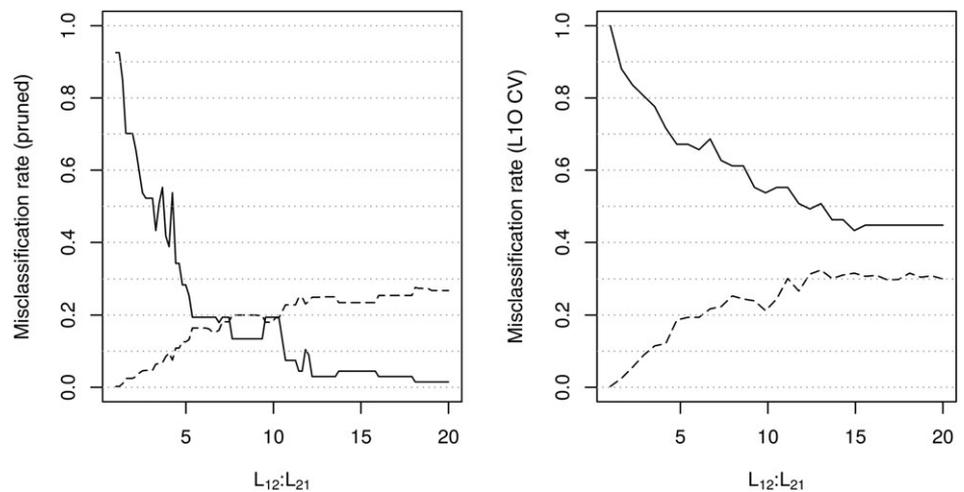


Fig. 4 Misclassification rates for classification trees pruned with complexity parameter = 0.007 and leave-one-out-cross-validation prediction errors for different $L_{12}:L_{21}$ ratios. (—), At-risk to age-appropriate misclassification; (-----), age-appropriate to at-risk misclassification.

scores, along with the 95% confidence interval (CI) for each acculturation group, is shown in Figure 2.

Compared to other groups, the children of mothers with a separator profile had a median score of 95 (CI = 94, 96) which was significantly lower than the rest. The children with assimilated mothers scored the highest median of 105 (CI = 104, 106).

Predicting outcomes at the terminal nodes

The pruned tree is depicted in Figure 3. The acculturation was the splitting variable at the initial node. The nodes show the splitting criteria for the left branch. For example, at the initial node,

those with mothers whose acculturation characterisations are either separators, integrators or marginalisors (acculturation = sprt, intg, mrgn) move down the left branch to the next splitting node. This process is continued until each observation reaches a terminal node.

At the terminal nodes, the predicted outcome class is given along with the actual number of children for each class. At the left most terminal node, 16 children were actually classified as being ‘at-risk’ and 48 as being ‘age-appropriate’. The predicted outcome class for the terminal node is ‘at-risk’ because a higher loss is assigned to misclassifying ‘at-risk’ children as being ‘age-appropriate’.

Varying the loss parameter

The L_{12} loss was varied while retaining $L_{21} = 1$ for the pruned tree ($CP = 0.007$). The prediction errors for corresponding $L_{12}:L_{21}$ were then estimated directly using the LIO-CV method. The resulting errors from both analyses are graphed in Figure 4.

Both plots show the trade-off between two types of misclassifications. For the pruned tree, the sensitivity of the model was above 90% for $L_{12} = 10+$, and for further exploration, full, pruned, and LIO-CV trees were grown for $L_{12} = 20$. These results are presented in Table 2. The 'at-risk to age-appropriate' misclassification errors from the LIO-CV analysis taper initially but reach a plateau after $L_{12} = 15+$.

Discussion

This study shows that the cultural environment to which Pacific children were exposed in early childhood plays an important role in distinguishing children with strong English receptive vocabulary skills from those who scored below the age-appropriate range in the BPVS test. This was evident in the importance of maternal acculturation and the length of mother's stay in NZ in predicting the BPVS scores.

The superior performance of children with mothers who are assimilated into the dominant European culture is perhaps not surprising. However, the children whose mothers were integrated into both cultures also performed more strongly compared to those who were separated from the NZ culture. Differences in phonemic awareness among children entering first grade have been attributed to environmental influences such as rich exposure to English language at home and cultural and second-language differences of ethnic minority children.³⁹ The current analysis demonstrates that children whose mothers are familiar with European NZ culture and the English language may have some advantage in attaining the English receptive vocabulary skills over children less exposed to the dominant culture. This analysis, however, does not extend to predicting children's receptive vocabulary in their Pacific languages. Where the main language of instruction is English, as is the case in most NZ schools, this could explain some of the disparities in language and academic outcomes between Pacific and European children at 6 years of age.^{40,41}

Maternal behaviours such as smoking and alcohol consumption during pregnancy were not as important as SGA, but these behaviours may have had a negative impact on healthy fetal development and birthweight.^{42,43} These results were similar to that of LSAC cohort where low birthweight contributed to lower initial receptive vocabulary at 4 years of age, but both maternal smoking and alcohol consumption exerted smaller effects.⁶ Surprisingly, preterm births were not indicative of low BPVS scores. This may be due to the closer monitoring of very preterm children who are more likely to be referred than the control children when any developmental delay is suspected.⁴⁴ Early development at 4 years of age, measured using ADST-4 year, was important for age-appropriate receptive vocabulary among Pacific children, a result that parallels that of the LSAC cohort where low performance on school readiness measures was associated with lower initial receptive vocabulary.^{6,16} Maternal education, household

income and frequency of story reading all had a moderate impact here, again consistent with the results of the LSAC study.⁶

The choice of loss parameters played an important role in model selection and performance. It may be of value to compute more reliable measures of the relative cost of not identifying children who are at risk of having low English receptive vocabulary skills to the cost of performing additional screening on children who are within the age-appropriate range.

The analytical approach taken here was strengthened by the availability of measures that are well established and are known to have strong psychometric properties. Distinctive to this study is the inclusion of maternal acculturation measured using the GEQ with high reliability for this cohort, and the association between acculturation and the BPVS results thus demonstrated is internationally novel. To our knowledge, the application of the classification tree method, the performance of which was tested using LIO-CV, is unprecedented in the context of predicting receptive vocabulary. The method has a particular strength of allowing the use of all observations, including those with missing values for some predictors and the predictors that are highly correlated.³⁶

There are important limitations to this study. Despite using a multitude of apposite predictors, the model did not identify over half of the children who scored below the age-appropriate range in the BPVS. The measure of the response variable, BPVS, is a British-normed, Western measure of children's receptive vocabulary and may not be the best instrument to use for Pacific children.^{45,46} The comparison of children with BPVS scores and those without demonstrated some differential proportions in predictors, indicating that some important children of interest might be missing from the analyses. The BPVS measures only one aspect of language acquisition, and our analysis would have been strengthened by a broader range of language measures.¹⁰ Paternal-specific factors were not included in the analysis, although fathers may play a unique role in children's receptive vocabulary development.¹⁷

Conclusions

The task of predicting receptive vocabulary among children is a challenging one as evidenced in this study. However, the study also emphasised the importance of cultural environment and other factors such as healthy birthweight that could help protect children against early language difficulties. The association between health, culture and educational outcomes suggests health be considered an inclusive concept,⁴⁷ and a more holistic and culturally responsive approach is needed to improve the outcomes for Pacific children. Educators and clinicians gaining a greater understanding of how children's language, literacy, and, more broadly, health and well-being outcomes relate to families and their cultural ties and providing culturally appropriate support to those families at risk of cultural separation and marginalisation are important implications of this study.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Additional information on the response variable.

Table S2. Additional information on selected predictors.