Teachers’ Perceptions of a Mathematics Intervention Implemented in Australian Secondary Schools

By

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Abstract

Mathematics education achievement for secondary school students continues to be a concern at both National and International levels. Schools are grappling with suitable approaches and strategies for implementing successful mathematics programs and striving to close the achievement gaps for those students who still need to meet expectations. The purpose of this study was to review the impact of implementing an externally provided mathematics intervention program on the perceptions and attitudes of teachers towards teaching mathematics and student achievement at this level. The specific program is Getting Ready in Numeracy (GRIN). The GRIN Intervention Program is a professional learning program for primary and secondary mathematics teachers. The GRIN mathematics intervention program involves teachers working with small groups of students identified as falling behind their peers in their mathematics achievement. A qualitative case study approach was employed to investigate the experiences and perceptions of a sample of educators from Victorian secondary schools who participated in the GRIN mathematics intervention program. Data were collected through interviews conducted with eight junior secondary-year mathematics teachers and a principal, and the findings from the qualitative analysis are presented. The study indicates that teachers perceive the GRIN program in some extended form as beneficial for underperforming junior secondary students to meet their mathematical needs. The study results regarding teachers' perceptions of the implementation of the GRIN program revealed that the program does not have a significant impact on teachers' attitudes toward classroom teaching and instructional strategies. However, a positive outcome of the GRIN program is observed in the relationship between teachers and students. Teachers report a better understanding of their students, including their learning styles, abilities, and specific needs. Additionally, the study reveals that the GRIN intervention program positively impacts students' academic performance, with teachers noting improvements in students' confidence in their mathematical skills. This suggests that while the program may not directly alter teaching approaches, it contributes positively to the teacher–student dynamic and student outcomes. However, the research also identifies some challenges associated with the GRIN intervention program and other factors that may impact its successful adoption. Considering these findings, key recommendations have been determined that can assist various stakeholders, including teachers, school leaders, educators, and policymakers. Schools should progress the development of classroom environments in the domain of mathematics that create a positive and supportive atmosphere for teachers and students. The study also proposes appointing dedicated coordinators to oversee the successful implementation of future school-based mathematics interventions. These staff should work closely within government protocols so as to schedule intervention sessions that address organisational challenges that may arise. Future research with a focus on the longitudinal impact of GRIN intervention is also recommended. Additionally, the research highlights the importance of ongoing support for GRIN teachers, specifically regarding effective communication practices. Overall, the outcomes of this research provide practical insights into the complex landscape of mathematics education in Australian secondary schools and offer practical guidance for improving mathematics outcomes for all students.

Keywords: Intervention program, junior secondary school, GRIN mathematics intervention program, small groups, underperforming students.

Declaration of Authenticity

I, Thi Kim Oanh Bhatti, declare that the Doctor of Education thesis entitled Teachers' Perception of a Mathematics Intervention Implemented in Secondary Schools is no more than 60,000 words including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research and Victoria University's Higher Degree by Research Policy and Procedures.

All research procedures reported in the thesis were approved by the Victoria University Human Research Ethics Committee (VUHREC), application ID: HRE19-143 and Department of Education and Training (DET), application number 2019_004213.

Signature: [redacted] Date: 12.03.2024

Dedication

I dedicate this dissertation to my father, Tam Nguyen, who impressed upon me the value and importance of using my mind, thinking, and obtaining my degrees. His legacy lives on in my heart and always will. I also dedicate this work to my mother, who gave me the opportunity and inspired me to pursue higher education. Her love and affection stay steady. I appreciate all that she has done.

I would like to dedicate this to my family: Jatinder Bhatti, my husband of twenty-two years, and my three beautiful children, Sinjon, Javas, and Julyssa. They all watched with patience, shared my anguish and inspired me to see how individual students learn mathematics differently and allowed me to persist in completing this thesis.

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Acronyms and Abbreviations

ACARA	Australian Curriculum, Assessment and Reporting Authority
ACER	Australian Council for Educational Research
AGDE	Australian Government Department of Education
AIHW	Australian institute of health and welfare
AITSL	Australian Institute for Teaching and School Leadership
ATSI	Aboriginal and Torres Strait Islander
AUSPELD	Australian Federation of SPELD Associations
DEECD	Department of Education and Curriculum Development
DET	Department of Education and Training
DEST	Department of Education, Science and Training
EAL	English as an Additional Language
GRIN	Getting Ready in Numeracy
ICSEA	Index of Community Socio-Educational Advantage
ISP	Inclusion Support Program
KLA	Key Learning Area
MLD	Mathematics learning difficulties
MYLNS	Middle Years Literacy and Numeracy Support
NCLB	No Child Left Behind
NESB	Non-English speaking background
OECD	Organisation for Economic Co-operation and Development
PAT	Progressive Achievement Tests
PD	Professional development
PISA	Program for International Student Assessment
RTI	Response to Intervention
SEA	Socio-educational advantage
SES	Socioeconomic status
STEM	Science, technology, engineering and mathematics
TESOL	Teaching English to speakers of other languages

TIMSS	Trends in International Mathematics and Science Study
UNICEF	United Nations Children's Fund
VCAA	Victorian Curriculum and Assessment Authority
VCE	Victorian Certificate of Education
VELS	Victorian Essential Learning Standards

Glossary

Administration: An administration in an intervention program encompasses the planning, organisation, and management of all elements necessary for the program's success.

Collaboration in GRIN: Cooperation between classroom teachers and the GRIN tutors and numeracy leaders with shared goals and perceived outcomes occurs in a climate of trust.

Front-Loading: Front-Loading is an intervention program providing students with the basic pre-requisite knowledge of the language, skills and concepts required for the next topic to be taught in their mainstream classrooms.

GRIN Experience: The teachers and tutors involved in the GRIN intervention program underwent professional development to understand the program delivery and data analysis.

GRIN Priority: Where school gives time to GRIN teachers or GRIN tutors to plan and prepare learning experiences and teaching resources, meet and share with others, or GRIN training.

GRIN Intervention Program: GRIN (Getting Ready in Numeracy) is an intervention program used to help students who have fallen behind, in which tutors work with students in small groups to prepare them for upcoming mathematics classes.

GRIN tutors: GRIN tutors are professional mathematics teachers qualified to teach in secondary schools in Australia.

Junior secondary school or Middle years: In Australia, junior secondary refers to year seven to nine students aged 12 and 15.

Professional Development (PD): Professional development where all GRIN teachers and tutors attend one face-to-face day of professional learning support sessions.

Student Achievement: Student achievement in an intervention program refers to the measurable outcomes or gains in knowledge, skills, or performance that a student attains from participating in the program.

Timetabling: Timetabling is the GRIN sessions set for the GRIN students who participated in the program.

Vocabulary: Vocabulary development involves word knowledge related to mathematics terminology, learning strategies, and solving problems.

Chapter 1: Introduction

Research has shown that long-term academic success in mathematics depends on early exposure to mathematical concepts, despite the common assumption that only natural talent can lead to excellence in the subject (Muir, 2015; Zammit et al., 2002). However, the education system in Australia faces several challenges, including inequality. According to United Nations Children's Fund (UNICEF) (2018), Australia ranks in the bottom third of Organisation for Economic Co-operation and Development (OECD) countries in offering equitable access to quality education. This indicates that the education system in the country is providing unequal opportunities for students, with disparities in resources, support and educational experiences for different groups of students. It is concerning that low-achieving students come from various backgrounds. However, those from disadvantaged backgrounds, due to economic, regional, cultural and social factors among others, add complexity to the issue (The Parliament of the Commonwealth of Australia [PCA], 2020). Addressing educational inequalities requires a multifaceted approach that considers these different factors. If these issues are left unaddressed, they will persist and contribute to a widening achievement gap, particularly impacting disadvantaged students. Research indicates that these students may fall behind by up to three and a half years by the time they reach junior secondary school (Chesters & Cuervo, 2022; Dean et al., 2023; OECD, 2019; Rowe & Perry, 2022). Unfortunately, this performance disparity based on socioeconomic status begins at an early age and only widens throughout their lives (Goss & Sonnemann, 2016). International assessments such as the Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) reveal the extent of the achievement gap in mathematics related to socioeconomic status. These assessments indicate that the gap in mathematics success among fifteen-year-olds in Australia related to socioeconomic status is approximately 65%, equivalent to the difference seen among fifteen-year-olds as evaluated by the Program for International Student Assessment (OECD, 2019). Additionally, developmental disparities among Australian students from the commencement of schooling are substantial, with significant variations in mathematical achievement between students by the middle primary years.

Current educational inequalities do not remain static but instead worsen as students progress through their school years, especially in mathematics (Bonnor et al., 2021). Students who need additional help may not receive it or may have limited access or access only to substandard programs due to underfunding and insufficient resources for teachers and students (Goss &

Sonnemann, 2020; Windle & Miller, 2012). For example, some schools in low socioeconomic areas face the challenge of having too few tutoring or intervention programs for students who require additional support in mathematics (Sonnemann & Hunter, 2023). These programs may not be available outside regular class hours due to limited funds. Furthermore, teachers in disadvantaged schools may have limited opportunities for professional development in mathematics education, making it challenging to stay current on best practices and new teaching methods (Villegas-Reimers, 2003).

In the Australian secondary school system, it is customary for teachers to be assigned to specific subject areas, including mathematics. However, despite this, regular mathematics testing during this stage poses significant challenges in addressing each student's diverse learning needs, as Goos et al. (2020) noted. Consequently, classrooms in Australian schools can have students with varying academic levels, preparedness, and learning styles, as Darling-Hammond et al. (2015) highlighted. Teachers must know how to teach mathematics conceptually while meeting the requirements of all learners in the classroom. However, by the time students reach secondary school, any gaps in their previous learning are often viewed as obstacles to their current progress. In addition, this diverse learning environment can often be challenging for teachers. Studies suggest that teachers often believe students can be taught more efficiently when grouped based on similar mathematics abilities (Gamoran, 2021; Gamoran & Weinstein, 1998). Perry (2018) proposes early, targeted, and intensive support for students as soon as they fall behind and increase social integration in schools. Additionally, to improve mathematics education for underachieving students, it is crucial to consider teachers' perceptions. They play a critical role in identifying the challenges faced by these students and can collaborate to create personalised support systems. Teachers' insights can be used to evaluate and modify instructional techniques to meet the diverse needs of underachieving students better (Perry, 2018).

The present study investigated teachers' perceptions regarding the tier two Response to Intervention (RTI) strategy for a mathematics intervention program aimed at junior secondary students experiencing difficulties in their mathematics learning (Gersten et al., 2009). Tier two RTI is an advanced level of support that forms an integral component of a multi-tiered support system designed to assist students experiencing academic challenges (refer to Chapter 2). This strategy supports students who have not progressed sufficiently in the regular classroom setting. The study evaluated a specific mathematics intervention program known as 'Getting Ready in Numeracy' (GRIN) (Monash University, 2023), as the intervention program. The study was conducted on a small scale using individual, semi-structured interviews with eight teachers and a principal from three schools in Melbourne, Australia. The study's approach to selecting participants aimed to gain significant insights from those directly involved in implementing and overseeing intervention programs and support assistance. Through conducting interviews, the study was able to collect qualitative data that helped to better understand the experiences, challenges, and perceptions of the teachers who were part of the GRIN program.

This study investigated teachers' perceptions of the GRIN program's impact on student achievement. The research involved interviewing mathematics expert teachers to understand how the GRIN program influenced student achievement. This research addressed a gap in the existing literature by providing insights from teachers' perceptions (Fuchs et al., 2021; Ponte & Chapman, 2006). By understanding teachers' perceptions of this issue, schools can make more informed decisions about how best to support struggling mathematics students. Previous research revealed that teachers' perceptions about mathematics could impact their instructional practices (Beswick et al., 2006; Muhtarom et al., 2019), making their perceptions subject-specific and highly relevant in mathematics education (Prediger, 2019; Schaap et al., 2019).

This research conducted in Victorian schools provides practical insights for stakeholders and emphasises the pivotal role of teachers' perceptions in the implementation of mathematics intervention programs. Acknowledging challenges associated with these perceptions suggests a sensible approach, paving the way for targeted strategies to enhance the effectiveness of interventions in similar educational contexts. The research study recognises the potential challenges posed by certain perceptions and challenges that may arise due to a mathematical intervention. It emphasises the need for a deeper understanding of the issue. This study integrated interviews with teachers to explore their perceptions and experiences to gain insight into this matter. This approach aims to provide a comprehensive, first-hand perspective on the impact of the intervention from the educators' point of view. Through this nuanced approach, the current study provides valuable insights into how teachers' perceptions can impact the success of mathematics intervention. The study's empirical evidence sheds light on the effectiveness of mathematics intervention programs like GRIN (Getting Ready in Numeracy) and can inform future efforts to improve mathematics education. By understanding the factors that can either facilitate or hinder successful mathematics intervention efforts, we can enhance the effectiveness of intervention programs and ultimately improve mathematics education for all students (Fuchs & Fuchs, 2001; Jimerson & Haddock, 2015).

The study chose GRIN as the specific mathematics intervention program. What sets the GRIN program apart from many others is its innovative approach to "frontloading" content. Instead of withdrawing students for remedial instruction, the GRIN program aims to prepare them in advance, addressing potential gaps before they become problematic. This proactive strategy contrasts with the traditional "deficit approach," where students are often pulled out of regular classes to receive corrective instruction. The traditional deficit approach can sometimes stigmatise students, implying they need to be "fixed," which can negatively impact their self-esteem and motivation. In contrast, the GRIN program's frontloading approach seeks to empower students by equipping them with the necessary knowledge and skills ahead of time, fostering a more positive learning environment and potentially enhancing their confidence and academic success.

In this thesis, the terms “mathematics” and “numeracy” are used to refer to different yet related aspects of mathematical education. While named a numeracy intervention, the GRIN (Getting Ready in Numeracy) program primarily aims to prepare students for formal mathematics lessons by addressing their foundational mathematical skills. The program involves GRIN teachers and tutors, numeracy leaders, and numeracy coaches, each playing distinct roles in enhancing students’ mathematical and numeracy competencies. GRIN teachers and tutors are educators who directly implement the GRIN program with students, focusing on improving their mathematical skills and confidence. Numeracy leaders are responsible for integrating numeracy development across the school curriculum, ensuring all teachers contribute to enhancing students’ numeracy skills. Traditionally, a numeracy coach works directly with teachers to enhance their instructional practices in mathematics. They provide professional development, model effective teaching strategies, and offer feedback to help teachers improve their pedagogy. In this study, the role of the numeracy coach extends beyond coaching teachers. The numeracy coach also works closely with teacher aides, providing them with the training and support needed to effectively deliver the GRIN intervention program. Additionally, the numeracy coach takes on organisational responsibilities similar to those of a numeracy leader, such as coordinating the intervention program and ensuring that it aligns with the school's overall mathematics education goals.

1.1 Research study questions

The overall goal of this research project is to investigate the perceptions of teachers in a selected number of Victorian secondary schools regarding the Getting Ready in Numeracy (GRIN) mathematics support intervention program.

The main research question of the thesis is:

How is the GRIN mathematics intervention program perceived by teachers at three secondary schools in Victoria?

The sub-questions are:

1. How does the GRIN/GRIN-alike program impact teachers' perceptions of teaching mathematics?
2. What changes in student achievement have been reported by teachers since the implementation of the GRIN/GRIN-alike intervention program?

This study used a qualitative research design (Creswell & Poth, 2016; Maxwell, 2012) to explore data generated from the research questions to establish an insight into the efficacy of the GRIN mathematics intervention program, as seen through the eyes of mathematics teachers participating in the GRIN program.

1.2 Context

As a mathematics teacher with 25 years of experience, the researcher holds deep concerns about the challenges facing mathematics education in Australia. Specifically, it is troubling to see the inequities in access to quality mathematics education across different regions of the country. These disparities mean that not all students have equal opportunities to receive a high-quality mathematics education, which can have long-lasting effects on their academic and professional trajectories. Furthermore, the researcher finds it troubling that students who face difficulties with mathematics in Years 7 and 8 often do not receive the necessary support to succeed. These early years of secondary education are crucial for building a solid foundation in mathematics. Without appropriate support, struggling students may fall further behind and continue to struggle in subsequent years. Given extensive experience as a mathematics teacher, the researcher has developed a passion for understanding and supporting students who struggle with mathematics, particularly in Years 7 and 8. They recognise the significance of this stage in a student's mathematical development and believe that providing targeted support during these years can help struggling students catch up and achieve success.

The researcher has been involved in several educational initiatives that have given the researcher valuable insights into addressing the needs of struggling students. For instance, the researcher participated in the Victoria Tutor Learning Initiative and the Middle Years Literacy and Numeracy Support (MYLNS) initiative, where they gained hands-on experience in implementing strategies to support students facing mathematics challenges. Additionally, the researcher operated a tutoring business, in which they employed approaches similar to the GRIN program to teach advanced mathematical concepts to students. The researcher's experiences have fuelled the interest in investigating how schools implement the GRIN mathematics intervention program and understanding the perceptions of teachers involved in the program. Driven by a passion for understanding how schools implement the GRIN mathematics intervention program, the researcher's goal is to contribute to a better understanding of the dynamics and effectiveness of such interventions in addressing mathematics education challenges in Australian schools. The researcher believes that all students should have access to equal and high-quality education regardless of location.

As a secondary mathematics teacher, it concerns the researcher that many students who are at risk in mathematics do not receive the necessary help due to resource constraints. The limited continuity and consistency of secondary mathematics intervention programs have been identified as a source of concern, with little or no comprehensive indication of successful programs (Ludicke et al., 2019). Even though schools offer intervention programs to the most at-risk students, a group of students falling behind often receive no extra help. Without early intervention this gap will likely grow, making it difficult for students to catch up in the mainstream classroom. The researcher's commitment to conducting thorough research and gathering relevant data to provide evidence-based support for advocacy efforts is commendable. Analysing qualitative data collection will enable the researcher to highlight the impact of inadequate support on students' learning difficulties in mathematics. This research can serve as a solid foundation for advocacy work, presenting a compelling case to policymakers and educators for the need for improved resources and support in mathematics education. A recent study highlights the importance of teachers' perceptions and feedback in evaluating the success of programs, particularly with regard to early intervention in closing the achievement gap (Cavendish et al., 2020). This is an essential step in providing equitable access to quality mathematics education.

Qualitative research plays a crucial role in capturing teachers' valuable experiences and perceptions, which can help broaden our understanding of the topic. Creswell and Poth (2016) and Maxwell (2012) have indeed emphasised the significance of qualitative research in academic studies. By delving into the perceptions of the participants, the study aims to gain significant insights into how they interpret and make sense of events and behaviours and participants' overall experience with the mathematics intervention program. It is critical to note that teachers' perceptions of their students can evolve and become more nuanced as they engage in interventions designed to support struggling learners. Initially, a student may be seen as a 'low achiever' in mathematics based on past performance and standardised test scores, which could lead the teacher to perceive the student as disinterested or unmotivated in mathematics. However, studies by Jacob and Jacob (2018) and Rosholm et al. (2024) show that interventions and small-group interactions can help teachers uncover students' unique learning styles and identify specific areas where they excel. It is possible that student have a strong desire to succeed but lack foundational mathematics skills. This shift can lead to a more nuanced perception of the student as having untapped strengths and potential. This approach allows for a deeper understanding of the factors influencing students' development and learning, including environmental factors, relationships and learning opportunities.

Understanding the perception of the teachers is crucial to identifying the challenges that may hinder the program's effectiveness and to better support students' learning outcomes. This approach strongly aligns with the researcher's personal teaching philosophy of continuous improvement and professional growth. By actively seeking teachers' perceptions through qualitative research methods, the researcher aims to gather beneficial insights that can inform and enhance the GRIN intervention program. The researcher intends to share the findings with the broader educational community to foster dialogue and collaboration. By disseminating the research outcomes, we can provide practical insights and knowledge that may benefit other educators, researchers, and policymakers. Sharing information and best practices can contribute to advancing mathematics intervention programs and, ultimately, support students' learning and development.

As an experienced mathematics teacher, the researcher truly believes that teachers' perceptions can offer significant insights that can help to improve mathematics intervention programs. Teachers' voices are often excluded when making school decisions, yet leveraging their insights can be instrumental in program improvement. Understanding the participants' perceptions is crucial to identifying the program's effectiveness. Teachers are on the front line of working with students. They can offer insights into practical strategies for supporting struggling students. For example, if a mathematics intervention program is not yielding the expected results, teachers can provide feedback on what aspects need improvement. Teachers' perceptions and feedback are essential for evaluating the success of programs. Teachers' profound understanding of their professional development needs can be leveraged to customise programs that address specific gaps in their skills or knowledge. Teachers can provide input on how resources are allocated within a school. This includes not only educational materials but also time and staffing. For example, if a school implements a mathematics intervention program, teachers can advise on the ideal teacher-to-student ratio to maximise effectiveness. Overall, involving teachers in decision-making processes can lead to better program implementation and outcomes. The researcher believes that listening to and valuing teachers' perceptions is crucial in improving mathematics education and providing equitable access to quality education for all students.

1.3 Significance of the study

Interventions must be implemented if students' mathematical proficiency is below the required level when they enter secondary school to ensure success in the following years (Fuchs et al., 2008). To assist students, teachers and school administrators must employ research-based interventions. Therefore, this study contributes to the information gap regarding teachers' perceptions of the experiences of implementing mathematics interventions and their impact on student achievement. This study aims to provide recommendations that can assist intervention developers, teachers, principals and school administrators in supporting students with learning difficulties in mathematics and address the needs of these students through a mathematics intervention program.

Additionally, the study discusses recommendations on how mathematics intervention programs can positively affect teachers' attitudes towards teaching mathematics and student achievement, and how educators can overcome potential barriers to implementing an intervention program. The teachers who participated in the GRIN intervention program provided significant insights into disseminating their knowledge to a broad community.

This study aims to generate knowledge and evidence regarding the implementation of intervention programs in secondary schools. By analysing teachers' perceptions and the factors that influence their participation and attitudes, this study seeks to inform the design and implementation of future intervention programs, leading to improved outcomes for junior secondary school students in mathematics learning. The findings of this study may be used to enrich education in the future.

Monash University has developed and researched the GRIN intervention program (Monash University, 2023). However, conducting additional research beyond the institution is crucial to explore its efficacy further. This dearth of external research presents an opportunity to involve independent researchers to identify potential issues, conduct a more comprehensive evaluation of the program's effectiveness, and perform an objective and unbiased assessment. Independent evaluations can help assess the outcomes of the GRIN intervention program. A more diverse range of perceptions can be incorporated by involving researchers from outside Monash University, contributing to a more thorough examination of the program's impact. These evaluations can also help identify challenges and offer insights into successful implementation strategies in various settings (Hill et al., 2023). This opportunity to involve an independent researcher presents an excellent chance to assess the transferability and generalisability of the GRIN intervention program beyond its initial development and implementation.

This study contributes to filling the research gap by identifying teacher perceptions of implementing a mathematics intervention program and its impacts in the school context and comparing it to traditional and less costly interventions. This approach provides an understanding of the practical aspects of implementing such programs and their impact on educators. Additionally, the findings explore how the program can be tailored to the school's needs and adapted to ensure successful implementation. This research may support schools and practitioners in judging the effectiveness of the intervention and how it can be tailored to their needs.

1.4 Organisation of this thesis

The thesis comprises seven chapters, with the second chapter focused on the literature review, explicitly exploring teachers' perceptions of mathematics intervention programs. This literature review serves as a crucial theoretical framework for the research, providing a comprehensive understanding of the factors that need to be considered when implementing mathematics intervention programs for underperforming students. The chapter begins by defining teacher perception in the context of mathematics intervention and then covers three primary learning theories: behaviourism, cognitivism and constructivism. These theories provide a theoretical foundation for understanding how teachers approach mathematics instruction and intervention. Next, the review focuses on the investigation of mathematics intervention in junior secondary schools in Australia and its significance, followed by an in-depth exploration of teachers' perceptions regarding mathematics learning. It outlines the teaching experiences that significantly impact teachers' knowledge, and perceptions towards mathematics and effective programs for underperforming students. The chapter concludes by describing the GRIN program, an intervention program designed, along with the limited evidence available for evaluating its efficacy, thereby providing readers with an initial understanding of the program's current study.

Chapter 3 explains the methodological aspects of the study, discussing the design, data collection and analysis in detail. Qualitative research methods were chosen to gain insights into teachers' perceptions of the program. The study conducted in-depth interviews with nine participants from three Victoria secondary schools: five mathematics teachers, three numeracy leaders and a school principal. The chapter is designed to give the reader a clear understanding of the purpose of each research phase and how it relates to the overall research questions. The section concludes by explaining the study's trustworthiness and measures taken to protect participants' rights.

Chapters 4 and 5 present the research findings. Chapter 4 provides a detailed account of the implementation of the GRIN program, addressing the main research question. It covers the practical aspects of introducing and integrating the program into the school context. This chapter discusses the steps taken to roll out the program, challenges encountered during implementation, and how these challenges were addressed. It also covers how teachers and students initially responded to the program. Chapter 5 provides an analysis of how the program influenced teachers' perceptions and attitudes towards their students, as well as the resulting impact on student achievements.

Chapter 6 contains a general discussion of the findings presented in Chapters 4 and 5. This chapter provides a comprehensive analysis and examination of the results in the context of the research questions and objectives. It aims to deepen the understanding of the implications and significance of the findings. Chapter 7 concludes the thesis by summarising the implications of the research findings for various stakeholders, discussing limitations and providing recommendations for future research and practical implementation in schools. The chapter also acknowledges the study's limitations of the research and offers suggestions for overcoming these limitations in future studies. It also identifies areas for further exploration and highlights opportunities to expand the boundaries of knowledge in mathematics education.

1.5 Summary

In the current state of school-based mathematics education in Australia, it becomes apparent that several noteworthy concerns require immediate attention (Chesters & Cuervo, 2022; Rowe & Perry, 2022). It is clear that effective intervention is necessary, and teachers will play a pivotal role in addressing these challenges. Given their extensive experience and knowledge, teachers possess beneficial insights that can significantly impact students' mathematical learning experiences. It is imperative to acknowledge and respect the voices of teachers in decision-making processes, as this is crucial for shaping effective interventions.

Notwithstanding the limited external research on the efficacy of the GRIN program, it has garnered substantial recognition and endorsement from education authorities, schools and teachers. These types of acknowledgements should be considered when evaluating the program. Additionally, it is essential to conduct further studies to determine how leaders, teachers and program tutors perceive mathematics intervention programs at the secondary school level. The goal of this thesis is to address this research gap, especially given the increasing struggles of junior secondary students with mathematics and the widening achievement gap among students in the same classroom.

In conclusion, by addressing these critical issues and actively involving teachers in the decision-making process, this thesis presents a significant exploration of the Getting Ready in Numeracy (GRIN) mathematics intervention program and evaluates its impact on both teachers and students. The research underlines the pressing need for enhancing mathematics education and recognises the pivotal role that teachers play in achieving this goal. By recognising teachers as key stakeholders and valuing their perceptions, this study contributes to the ongoing efforts to improve mathematics instruction and support student learning outcomes.

Chapter 2: Literature Review

2.1 Introduction

The research process integrates insights from relevant literature, theoretical frameworks, and practical considerations specific to mathematics education in Australia and internationally. The six key factors influencing teachers' perceptions of mathematics intervention programs were identified through a meticulous literature review and comprehensive analysis of existing studies. This involved examining definitions and applicable learning theories, providing a general overview of student achievement in school education, particularly in mathematics, and analysing characteristics of mathematics intervention within the Australian education system. Additionally, the review included a focus on teachers' perceptions of mathematics learning and intervention programs, and specific studies on the GRIN program.

The literature on definitions and general applicable learning theory defines key terms and concepts related to mathematics intervention programs and explores theoretical underpinnings of learning and instructional strategies. The general overview of student achievement in school education examines factors affecting student performance, including curriculum frameworks, teaching methodologies, assessment practices and educational policies. Specifically, the literature reviews the characteristics of mathematics intervention in the Australian education sector, highlighting the importance of interventions for junior secondary school students. It describes a mathematics classroom in Australian schools and discusses the cognitive characteristics of students with mathematics learning difficulties. This literature review explores teachers' perceptions concerning mathematics learning and teaching mathematics, as well as the impact of these perceptions on the design and implementation of mathematics intervention programs. It also highlights the importance of teachers' ongoing learning opportunities in mathematics education, factors affecting student achievement in mathematics, various mathematics intervention programs, including the GRIN program, and effective practices in Australian schools. By structuring the literature review into these sections, the chapter aims to establish a comprehensive foundation of existing knowledge and research in the field, showcasing the relevance and importance of the current study's focus.

2.2 Definitions and general applicable learning theory

2.2.1 Mathematics intervention

'Mathematics intervention' refers to targeted instructional programs and strategies created to address the specific learning needs of students struggling or experiencing mathematics difficulties (Powell et al., 2021). These interventions provide additional support, remediation or enrichment to help students enhance their mathematical understanding, skills and performance (Arpilleda, 2021; Hunt & Little, 2014).

Mathematics intervention programs can be conducted in various formats, including individualised teaching, small-group settings or as part of the regular class, or even at home (Clarke et al., 2017; Doabler et al., 2019; Fuchs et al., 2008); specialised instructional materials or resources (Arpilleda, 2021; Powell et al., 2021); technology-based interventions (Benavides-Varela et al., 2020); or a combination of these approaches (Myers et al., 2021). Research studies have shown mixed findings regarding the impact of group size on intervention outcomes. According to Fuchs et al. (2008, 2017) and Doabler et al. (2019), smaller groups offer greater individualised attention and better chances for student participation, which could lead to improved results for students with challenges in mathematics. However, contrasting findings are also present in the literature. A meta-analysis conducted by Stevens et al. (2018) has found that while small-group learning can benefit upper elementary and secondary students, it does not consistently outperform whole-class teaching in terms of efficacy. The influence of group size may vary depending on the grade level and specific intervention context. Recent research by Rojo et al. (2024) on mathematics interventions has revealed that small-group interventions are as effective as individual interventions. This aligns with the conclusions drawn from studies by Myers et al. (2023) and Clarke et al. (2017), which found there is no substantial difference in the efficacy of whole-group interventions corresponding to small-group or individual interventions.

The schools implementing mathematics interventions aim to close the achievement gap and enable students to attain proficiency in mathematics (Bjorklund-Young & Plasman, 2020). Interventions commonly target specific areas of mathematical content or skills where students are experiencing challenges, such as number sense, arithmetic operations, problem-solving, algebraic thinking or mathematical reasoning (Powell et al., 2021). According to Vera and Simon (1993), interventions should extend beyond relying solely on symbolic representation. This involves using instructional methods beyond mathematical symbols and notations, ensuring a comprehensive and experiential approach to enhance students' conceptual understanding of numerical concepts. While mathematics symbols and notation are important, teachers should also employ various instructional tactics to keep students involved and help them comprehend topics more effectively. This strategy entails implementing several teaching tactics that engage students in active and experiential learning. For example, teachers might use manipulatives, real-world examples, problem-solving tasks and collaborative activities to assist students in getting a better understanding of numerical concepts. Mathematics intervention programs are frequently evidence-based, focusing on research and best practices in math education (McKevett & Codding, 2021; Powell et al., 2021). The interventions may be conducted for a fixed duration, such as a certain number of sessions or a semester, or they may be ongoing to give continuous assistance as needed (Brodesky et al., 2022). However, mathematics intervention programs require more specific targets and expectations. According to Brodesky et al. (2022), this difficulty might cause confusion and irritation among teachers and students enrolled in the program. Furthermore, intervention programs require specialised materials and resources, which schools may need to purchase in order to properly execute them (Rittle-Johnson et al., 2020; Slavin & Lake, 2008).

The framework proposed by Willis (1998) recognises that the dimensions of mathematics and numeracy should be considered distinctively based on the age and educational stage of the students receiving support. Willis (1998) suggests that a nuanced approach is necessary to effectively address the varied needs of students at different developmental stages. This means tailoring interventions to the cognitive, emotional, and educational contexts relevant to specific age groups.

2.2.2 Defining teachers' perception of mathematics intervention

Teachers' perceptions of mathematics interventions comprise the teachers' subjective beliefs, attitudes and opinions about the program (Calderhead, 1996; Voss et al., 2013), including its goals, effectiveness, instructional strategies, materials, support systems and impact on student learning (Moliner & Alegre, 2022).

Teachers' perceptions of a mathematics intervention program can be influenced by their prior experiences, knowledge, expertise and personal perceptions about teaching and learning mathematics (Ponte & Chapman, 2006). There is evidence that the variation in teacher perceptions of mathematics intervention can be influenced by their past experiences, education and training (Rutherford, et al., 2017). These perceptions can shape their engagement and investment in the program, instructional practices and decision-making processes (Buehl & Beck, 2014). Studies have found that teachers with a mathematics degree, prior expertise with differentiated instruction and a level of comfort with technology-based tools and practices are more likely to implement intervention programs (Beswick, 2012; Beswick et al., 2012). Conversely, teachers with insufficient mathematical expertise and training may be less inclined to accept mathematics support and more resistant to changes in their teaching practices (Beijaard et al., 2000). It is critical to recognise that some teachers may lack confidence or competence in teaching mathematics, which may impact their perspective and acceptance of intervention programs. Currently, research on teacher perceptions of mathematics intervention programs is limited. However, other evidence suggests that teachers typically favour intervention in students' mathematics learning (Fuchs et al., 2021).

According to a recent poll, teachers in the United States firmly believe that intervention programs can help struggling students improve their mathematical skills (Fuchs et al., 2021). This positive attitude indicates that teachers recognise the value of focused interventions in improving student learning. However, it is crucial to remember that teachers may face various difficulties or challenges when conducting mathematics intervention programs. Limited instructional time, severe workloads and insufficient resources may all impact their desire and ability to participate fully and represent substantial hurdles to successfully implementing intervention programs (Gibbs, 2023). Addressing these possible impediments requires a supportive and sympathetic attitude from administrators and teachers. Providing teachers with the required training, professional development and resources to execute intervention programs properly can help ease fears and boost confidence (Dinham, 2017). Furthermore, developing a collaborative and inclusive school culture where teachers may share best practices and get peer support will help foster a favourable atmosphere for program implementation. According to the OECD (2019), teachers participating in professional development programs are more likely to diversify their teaching skills and cooperate with other teachers. This practice benefits both the teacher and the entire school community.

Limited research exists on teachers' perceptions of who should deliver intervention programs, marking an identified gap within the current study on teachers' perceptions of mathematics interventions. However, existing research findings are available and crucial for forming our understanding. For example, Robinson & Loeb (2021) categorised tutor types into seven broad groups: teachers (certified teachers), paraprofessionals (school staff members, service program fellows, community organisation staff), volunteers (postgraduates, community members, seniors), university students (undergraduates, graduates), private tutors, families (parents, siblings, other family members), and peers (classmates, near-peers). Their findings indicate that tutoring programs led by teachers and paraprofessionals are generally more effective, with an overall pooled effect size (ES) estimate of 0.37 standard deviations (SD) compared to nonprofessional and parent tutoring. Paid volunteers tend to be more effective than unpaid ones, with Neitzel et al. (2022) reporting a positive impact on student reading (ES = 0.10). Parent-led tutoring is about as effective as volunteer-based interventions (ES = 0.23), according to Ritter et al. (2009). Peer tutoring also shows effectiveness, with an ES of 0.22 reported by Dietrichson et al. (2017).

2.2.3 Learning theory

Learning theory is a comprehensive framework of concepts, ideas and systems that elucidates the learning process between teachers, students, and other key components involved in learning activities (Muhajirah, 2020). The fundamental aim of learning theory is to gain insights into the learning process's intricacies and describe the conditions and procedures that lead to better learning outcomes (Saunders & Wong, 2020). The literature on learning theory in mathematics reflects three primary theories: behaviourism, cognitivism and constructivism (Dilshad, 2017; Ertmer & Newby, 2013; Muhajirah, 2020). Each approach has its unique perspective, with behaviourism focusing on teacher-centred instruction, cognitivism emphasising the mental processes involved in learning, and constructivism favouring extended class time for varied activities associated with discovering and constructing knowledge. These theories offer different viewpoints on how students learn and how instruction should be designed in mathematics education.

Behaviourism, which originated with Watson (1913) and was advanced by Skinner (1984), prioritises observable behaviours above internal mental processes. Behaviourists sought to establish psychology as a science by studying behaviours that could be objectively observed and documented. They felt that a person's contacts with the outside world impact their learning. Individuals modify their conduct in reaction to the consequences of these interactions. For example, if someone is injured by touching a hot stove, they will learn not to touch it again.

The cognitive approach is another critical theory in the field of learning. Cognitive psychology, or cognitivism, emerged in the mid-twentieth century and was pioneered by influential psychologists such as Piaget (1936), who conducted extensive research on cognitive development in children and proposed a stage theory of cognitive development, outlining how children's thinking and understanding of the world evolve as they grow. Other influential psychologists, such as Miller, Neisser and Chomsky, also significantly contributed to cognitive psychology. Miller (1956) is known for their work on cognitive processes such as memory and information processing. Neisser (1960) is often credited with coining the term 'cognitive psychology' and emphasising the study of mental processes, including perception, attention and memory. Chomsky's (1965) work revolutionised the understanding of language acquisition and proposed the idea of a universal grammar.

While behaviourists focus on the external environment and observable behaviour, cognitive psychologists are interested in studying mental processes. Cognitivists argue that behaviour and learning involve more than responses to environmental stimuli. They emphasise the role of rational thought, mental processes and active participation in learning. Cognitivism emphasises the learner's active role in constructing knowledge and recognises that learning occurs through internal information processing, such as perception, memory and problem-solving. According to Bruner (1964), learning is a process in which students acquire concepts and problem-solving abilities. Thus, educators should design instruction that helps learners understand the material and transfer knowledge to new situations.

Constructivism has its roots in various philosophical and epistemological perceptions. Constructivism is a learning theory that emphasises the active construction of knowledge by the learner (Piaget, 1936). According to constructivism, learners construct their understanding of the world through interactions with the environment and social interactions. Constructivism as an educational theory shares similarities with cognitivism and stands in contrast to behaviourism. This theory recognises the importance of an individual's prior knowledge and existing mental frameworks in interpreting and making sense of new experiences and information (Saunders & Wong, 2020). In a constructivist approach, mathematics teachers provide opportunities for students to engage in hands-on activities, problem-solving tasks and collaborative learning experiences (Adeeb et al., 1999; Nilimaa, 2023). The focus is on allowing students to explore and discover mathematical concepts and develop their understanding.

The section outlines the differences between behaviourism, constructivism and cognitivism in learning and mathematics education. It explains how each theory offers a unique perspective on how learners acquire knowledge and skills, which impacts the design of educational experiences. By considering these different approaches, educators can design instructional strategies that cater to the diverse needs of learners, promote engagement and foster meaningful learning experiences in mathematics.

2.3 Mathematics intervention in Australian education

2.3.1 Overview issues

Teachers in Australia are inquisitive about how well teaching strategies address junior secondary students' underachievement (Hattie, 2012; Lamb et al., 2020). Underachievement among junior secondary school students is a primary concern for educators (Gonski et al., 2018; Tomlinson & Strickland, 2005). During the junior secondary education phase, which lasts from 12 to 15, teenagers experience significant physical, emotional, and cognitive changes. (Blakemore & Mills, 2014; Graham et al., 2007). Prosser (2008) claims that the emphasis on this time in education is still 'unfinished and tired' (Prosser, 2008, p. 155), implying that there is still much work to be done in improving the educational experience during this phase.

The need for pedagogical changes to enhance student learning in secondary school has been highlighted by Luke et al. (2003). According to their argument, simply focusing on integrated curriculum and authentic assessment is insufficient; an equal emphasis on pedagogy is necessary. This viewpoint aligns with a report commissioned by the Commonwealth Department of Education, Science and Training (DEST) in 2000, which emphasises the importance of pedagogical approaches to adequately complement previous efforts in integrated curriculum and authentic assessment.

In the context of mathematics learning difficulties (MLD), it is concerning that an increasing number of students in Australia fail to meet established benchmarks as they progress through school, as outlined by the Australian National Benchmark (Caldwell, 2018; Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), 2008). This issue poses a significant challenge that must be addressed within the education system. Research conducted by Willemse et al. (2022) highlights the significance of implementing effective pedagogical strategies in mathematics education to address mathematics learning difficulties (MLD). Their findings highlight the importance of early detection and intervention for learners experiencing MLDs. In junior secondary school, addressing MLD requires a multifaceted approach, as Johnson and Smith (2008) outline. This strategy entails implementing focused interventions to address the unique requirements of students with MLD. As Sharp et al. (2020) suggest, it is also critical to give teachers opportunities for professional development and encourage teamwork among educators, experts, and school administrators.

Currently, there are various intervention programs available to support students struggling with MLD. These programs can include therapy programs, small group or individual support initiatives, school-based learning challenges support programs, and more formalised intervention programs (Bouck, 2005). These interventions aim to provide targeted assistance and tailored support to students struggling with mathematics. During the junior secondary years, it is crucial to recognise early adolescents' unique social and emotional needs. Graham et al. (2007) suggest that effective teaching and learning strategies for students with MLD in this age group must account for their social and emotional demands.

Further, benchmarks are used to identify MLD in Australia. The benchmarks for mathematics proficiency at different grade levels are the requirements and expectations for students. It is crucial to remember that because Australian education is distributed, the details of these criteria may differ between states and territories (Caldwell, 2018). Improvements in education were established by the Australian Curriculum, Assessment, and Reporting Authority (ACARA, 2012), including school choice, flexible spending, reflective methods of teaching and educator accountability. However, ACARA granted individual states and territories the autonomy to develop standards that reflect their unique educational contexts (Savage & O'Connor, 2015). As a result, each state and territory is responsible for developing and implementing its own mathematics standards, often through negotiation.

The Australian state curriculum development initiatives can be influenced by various factors, including political pressures and external examinations such as the National Assessment Program – Literacy and Numeracy (NAPLAN) and the Program for International Student Assessment (PISA). These assessments collect data on student performance and determine where students stand with respect to standards to enhance student outcomes (Australian Institute of Health and Welfare [AIHW], 2023; Georgiou, 2023; Morris, 2011). In addition, national assessments and international surveys are used to track and evaluate the education system, which helps assess student achievement and inform educational policies and practices. When addressing mathematics education and student outcomes, educators and stakeholders must take into account the specific benchmarks and standards relevant to their jurisdiction due to Australia's diverse educational landscape, where each state and territory has its own standards and assessments (Caldwell, 2018). Common tests to ascertain overall student achievement levels are NAPLAN and PISA. Progressive Achievement Tests (PAT) is another form of assessment used by schools to assess individual student achievement in various subjects and identify areas where additional support or challenge is needed (Caldwell & Hawe, 2016; Cowie et al., 2021).

State-led educational standards were adopted in Australia to promote collaborative conversations between states, allowing them to establish shared beliefs, evaluate assessment measures, determine resource needs and analyse policies (Madunić, 2021). Each state and territory has created numeracy education plans and initiatives to improve student achievement. For example, the Australian Capital Territory (ACT) government delivered the Literacy and Numeracy Strategy 2009–2013, which mandated that all ACT public schools include numeracy targets and strategies in their school plans. This plan attempted to bridge the achievement gap by recognising the considerable impact of excellent teaching and school leadership on students' reading and numeracy achievements (ACT Government, 2009). From Years 3 through 10, it emphasises teaching customised to individual requirements to acquire increasingly complex numeracy abilities and knowledge. Similarly, the Middle Years Numeracy Research Project in Victoria (1999–2000) suggested that a whole-school approach to numeracy improvement, supported by effective leadership, was critical for attaining success in numeracy results (Siemon et al., 2001).

However, despite these efforts, evidence-based research reveals that numeracy interventions or programs have unpredictable results. Each program faces inherent challenges that need to be addressed. Many Australian students continue to struggle with numeracy skills (Bentley & Savage, 2017), and existing pedagogical efforts frequently fall short of overcoming the learning difficulties experienced by these individuals. In order to tackle this issue, it is important to better understand how teachers perceive mathematics intervention programs contributing to successful implementation (Prediger et al., 2023). Investing in teachers' perceptions and experiences can provide constructive insights into which strategies are effective and which are not (Van Geel et al., 2022). Ultimately, this can help identify the best approaches to supporting students' mathematical development at junior secondary levels.

2.3.2 Why a mathematics intervention program in junior secondary years?

The struggle with mathematics learning among students persists beyond primary school and into the junior secondary years despite the presence of effective classroom teaching and early intervention programs in some cases (Ingvarson et al., 2014; Louden et al., 2000; Purdie et al., 2011). A significant number of students have progressed through the educational system, including up to the VCE (Victorian Certificate of Education), without addressing their fundamental difficulties in mathematics (Sullivan & Gunningham, 2011). These students require substantial support to reach the expected levels of mathematical proficiency. Without targeted assistance, they will continue falling further behind their mathematics peers (Sullivan & Gunningham, 2011). The lack of guidance and support can result in these students missing out on the broader benefits of the curriculum (Stephens, 2009).

Madunić (2021) emphasises the challenge of creating a nurturing and supportive environment for students, particularly in pursuing excellence in mathematics, within the Australian education system. Students who constantly need to improve in mathematics during the junior secondary years of schooling are often neglected (Van & Elkins, 2004). Negative attitudes towards secondary schooling, including mathematics, are developed by many students during the first year of secondary school (Deieso & Fraser, 2019; Ryan et al., 2021). Disengagement is associated with a lack of success in the critical junior secondary years (Cole, 2006; Holmes, 2022; Norton, 2017). Overcoming challenges related to improving mathematics proficiency in these students can be difficult due to factors such as lack of motivation, disruptive behaviour, poor attendance or even leaving the school (Cole, 2006). One reason for this, highlighted by Fitzmaurice et al. (2021), is that a distinct lack of resources and support makes it difficult for teachers to effectively demonstrate the real-world relevance of mathematics, which in turn impacts student motivation and engagement with the subject.

According to Louden et al. (2000), it is vital to acknowledge that students' struggles in learning mathematics might jeopardise their educational progress, particularly during their junior secondary years. These difficulties may have a negative impact on student's progress in school and overall performance. Additionally, Mahuteau and Mavromaras (2014) state that students who achieve poorly in mathematics and have a negative attitude towards education are more likely to drop out. Studies conducted in Australian schools further support this notion. Students' low achievement and negative attitudes towards mathematics have been identified as factors that may contribute to student's decision to drop out by the end of Year 10 (Department of Education, Employment and Workplace Relations [DEEWR], 2009; Wilson & Mack, 2014). Researchers have discovered a clear link between poor mathematical skills, difficulties with learning, and struggles in other curriculum areas (Stephens, 2009; Tout, 2020).

Moreover, some students may leave school without the foundational skills required for success in the workforce and further education and training (Commonwealth of Australia [AU], 2018). Research has identified various reasons students need to catch up in mathematics learning. In

Australia, the transition to secondary school between the ages of 11 and 12 is characterised by physiological, psychological and social changes associated with adolescence (Downs, 2003; Ganeson & Ehrich, 2009; Moroney & Stocks, 2005). The evidence shows that difficult transitions during this period can lead to disengagement, negative attitudes towards school, reduced self-confidence and decreased motivation, particularly in mathematics education (Anson, 2021; Collie et al., 2019).

Furthermore, in contemporary Australian classrooms there is an increasing diversity of achievement levels among students, posing significant challenges for teachers (Goss & Hunter, 2015; Goss & Sonnemann, 2016). For example, a single Year 7 class may comprise students performing at a various level, ranging from Year 2 or 3 mathematics skills to Year 8 or 9 proficiency. Significant inequalities in mathematics achievement and attitudes among students become evident in the junior secondary years of schooling (Thompson, 2019; Thomson et al., 2016).

Given the wide range of abilities and needs within classrooms, class teachers often find it challenging to provide adequate support to students who have fallen behind in mathematics during regular daily teaching (Sullivan & Gunningham, 2011). As a result, it becomes crucial to explore intervention programs that can effectively assist students with mathematics difficulties. The Victorian Department of Education and Training (DET) (2017) has recognised the urgency of this matter, emphasising the need for collaborative efforts to support literacy and numeracy learning for students across Victoria. The data from the Australian National Benchmark (AU, 2008; MCEETYA, 2008) support the claim that a significant number of students in Australia struggle with mathematics, with an increase in the percentage of students who do not meet established benchmarks as they progress from Year 3 to Year 7. Notably, the proportion of students falling below the 'low' benchmark in mathematics remained consistent between 1995 and 2015 (Russo & Hopkins, 2017, p. 18).

In Australian schools, the implementation of support programs in mathematics is a common practice. The term 'mathematics interventions' encompasses a range of programs, strategies or initiatives that education sectors, schools and systems have implemented or are considering implementing to enhance student outcomes in mathematics (Meiers et al., 2013). The focus is on implementing measures to improve students' mathematical proficiency and performance. However, the efficacy and priority of these mathematics interventions can vary between schools and educational systems (Hattie, 2012; OCED, 2018). One significant aspect of this variability is allocating funding and attention to mathematics interventions among different schools. Advocating for an equitable distribution of resources becomes imperative to ensure that targeted interventions and sufficient funding are accessible to support student learning effectively (Forman et al., 2009; MacDonald et al., 2023). This emphasis on equitable resource allocation is especially crucial for students from disadvantaged socioeconomic backgrounds, as they may encounter additional challenges that require specific and targeted support.

2.3.3 Cognitive characteristics of mathematics learning difficulties students

The term 'learning difficulties' encompasses a wide range of challenges students face in academic achievement, including those who consistently underachieve and perform poorly in learning and those with diagnosed mathematics disabilities (Australian Federation of SPELD Associations [AUSPELD], 2014). This study focuses on students who have learning difficulties in mathematics and are performing below the average standard in their junior secondary years. Identifying low-achieving students has become more important due to mandated testing requirements in many educational systems, including in Victoria (Cormack & Comber, 2013). These testing methods, further discussed in section 2.5.1 of the thesis, play a role in measuring student achievement and identifying those who may require additional support.

Acknowledging the diversity and individuality of secondary students with mathematics learning difficulties is crucial. Every individual has unique challenges and prior learning experiences (Marks et al., 2021). Each student's 'story' includes underlying factors that contribute to their learning difficulties, and addressing these factors requires a personalised and comprehensive approach (Jones et al., 1997). By understanding the diverse nature of students with learning difficulties and acknowledging their individual needs, educators and researchers can develop targeted interventions and support systems that cater to their specific requirements (Woodcock & Hardy, 2023). This recognition of individuality is essential for providing practical assistance and improving educational outcomes for students with learning difficulties in mathematics.

Nonetheless, there are similarities in how students with learning difficulties approach mathematics problems and procedures in their junior years. Recent studies have shown that functional and working memory processes, including those used in mathematics, are important underlying factors for learning challenges (Ashcraft, 2019; Muñez et al., 2022). Holding and modifying information in one's mind while completing a job is known as working memory. Working memory deficits in students with learning disabilities may hinder their ability to process and retain mathematical material efficiently. Students who struggle in mathematics may also have issues with executive functions, including memory and attention (Keeler & Swanson, 2001). Executive functions are essential for organising, preparing and supervising one's thoughts and activities. Obstacles in these domains may impede students' acquisition of and involvement in mathematics (Swanson & Beebe-Frankenberger, 2004). Another cognitive characteristic unique to students who struggle with math is phonological processing, the capacity to identify and work with linguistic sounds. A student's comprehension and proficiency with the numerical and symbolic components of mathematics may be impacted by difficulties with phonological processing (Fuchs et al., 2014). These cognitive traits add to the problems faced by students who struggle with math learning. Understanding these underlying causes can help create focused interventions and teaching methods to assist these students as they progress through their mathematics education.

Furthermore, students who struggle with mathematics often face higher levels of mathematics anxiety and lower self-efficacy. Mathematics anxiety can hinder their performance and engagement in mathematics, while poor self-efficacy can lead to a lack of confidence in completing mathematical tasks successfully (Rubinsten & Tannock, 2010). Hence, addressing the cognitive aspects, reducing mathematics anxiety and enhancing self-efficacy are crucial components in supporting students with learning difficulties in mathematics and promoting their overall mathematical achievement. Research has shown that targeted interventions aimed at these aspects can lead to success and improved engagement in mathematics for students with learning difficulties (Westwood, 2003).

2.3.4 Mindset and mathematics in students' achievement

The body of studies shows that a student's perspective significantly influences how well they succeed in science and mathematics (Dweck, 2014; Bedford, 2017; Bostwick et al., 2017). Instead of depending only on talent, the research supports the premise that students' performance is mainly determined by their hard work, perseverance, intentional practice, opportunities, and a supportive environment. According to Dweck (2016), those with a growth mindset—believing intelligence and skills can be acquired—are more likely to succeed and prosper. On the other hand, people who have a fixed mindset think that their abilities and intelligence are unalterable and fixed (Dweck, 2010).

The introduction of mindset theory into Australian classrooms has drawn attention to the potential benefits of fostering a growth mindset among students (Boylan et al., 2018). Mindset theory, popularised by psychologist Carol Dweck, suggests that individuals who believe in the malleability of intelligence and abilities (i.e., growth mindset) are more likely to embrace challenges, persist in the face of setbacks and, ultimately, achieve higher levels of success. The concept of a growth mindset, as described by Dweck (2016), emphasises the belief that intelligence and abilities can be developed through effort and perseverance. This mindset encourages individuals to embrace challenges, learn from mistakes and persist in the face of obstacles.

The idea that individuals can reach higher levels of achievement through effort and dedication aligns with the belief that everyone has untapped potential. According to Dweck (2016), some of the most successful individuals in history did not exhibit initial signs of exceptional talent. It is through persistence, hard work and a belief in their ability to improve that they were able to reach remarkable heights. Perkins-Gough (2013) also supports the notion that initial talent or ability does not determine ultimate success. The individuals who continue to strive, learn and adapt often become the best or brightest. This further emphasises the importance of creating opportunities for underperforming students and providing them with the support and resources needed to develop their abilities (Fleischman & Heppen, 2009).

Numerous investigations have examined the effects of development and fixed mindsets on academic performance. According to Hwang et al. (2019), fixed mindsets did not affect the mathematical achievement of high-achieving fixed mindset students, but they did for low-achieving students. This implies that people who believe their shortcomings are unavoidable may have fixed mindsets, which can be detrimental. Interventions can be targeted at low-achieving students who face difficulties and setbacks to address fixed mindsets and promote a growth mindset. According to Ziegler and Stoeger (2010), these students can benefit greatly from interventions that discourage them from thinking of their aptitude for mathematics as a fixed attribute. Through questioning the notion of fixed talents and highlighting the possibility of development and enhancement, interventions might assist students in overcoming challenges and striving for success in the classroom. Other researchers, such as Yilmaz (2022), Boylan et al. (2018), Yeager and Dweck (2020) and Dweck (2015), provide detailed discussions and research findings on this topic.

A study by Boylan et al. (2018) in Australian classrooms finds a clear correlation between having a growth mindset and a variety of beneficial student outcomes and behaviours in early childhood. These may include increased motivation, engagement, resilience and academic performance. This suggests that promoting a growth mindset among students can positively impact their learning and development. However, it is important to note that mindset theory and its implementation in classrooms are not without challenges. The Education Week Research Center paper by Yettick et al. (2016) addresses some fundamental fallacies that may hinder the success of utilising a growth mindset with students. These fallacies include misconceptions about the simplicity of fostering a growth mindset and the assumption that praising effort will lead to desired outcomes.

There is evidence to support the theory that helping students develop a growth mindset has a positive effect on their academic performance. According to Yeager et al. (2016) and Paunesku et al. (2015), interventions can assist students in overcoming obstacles, enhancing their performance, and optimising their learning outcomes by fostering the belief in their capacity for growth and development. Effective classroom use of mindset theory necessitates a complete strategy beyond rhetoric. As Buzzetto-Hollywood et al. (2019) state, it entails giving students targeted techniques, constructive criticism and encouragement to advance their learning abilities and convictions. To assist students in developing a growth mindset, teachers can provide a welcoming and inclusive learning environment, offer focused interventions, and help students see the relationship between effort, learning and success (Sonnemann & Hunter, 2023).

In summary, the adoption of mindset theory in Australian schools underscores the possible advantages of helping students develop a growth mindset. Educators and teachers have noted positive correlations between a growth mindset and a number of desired student outcomes.

2.4 Teacher' perceptions of mathematics learning

This section outlines teachers' perceptions of implementing mathematics intervention programs. Teachers' perceptions and practices are critical aspects that need to be considered when implementing any educational program or intervention, including a mathematics intervention program (OECD, 2018). The Organisation for Economic Co-operation and Development (2018) recognises the significance of teachers' attitudes and their role in implementing change in educational settings. In the educational setting, change is an inevitable constant that teachers must adapt to. However, implementing change can be challenging, particularly when it comes to teachers' attitudes (Boyd & Ash, 2018; Meirink et al., 2009). The complex nature of change involves various factors, and understanding and addressing teachers' perceptions is essential for successful implementation (Maass et al., 2019). By examining teachers' perceptions towards change, researchers and educators can gain insights into the factors that facilitate or hinder the adoption of new practices or interventions (Guskey, 2002). This knowledge can then inform strategies to effectively support teachers during the change process and promote successful implementation.

2.4.1 Teachers' perceptions in teaching mathematics

Investigating teachers' perceptions in the context of mathematics education is a crucial and ongoing area of research. It offers constructive insights into improving instructional practices and can inform professional development initiatives (Cross, 2009). By identifying the areas in which teachers may need additional support or training, educators and policymakers can work towards fostering more effective teaching practices and enhancing mathematics education (Wilson & Cooney, 2002). This, in turn, leads to better learning experiences for students and creates a cohesive and impactful learning environment.

Studies by Ahmed and Malik (2019) and Ahmad et al. (2013) have investigated the influence of psychological empowerment and psychological well-being on teachers' performance, exploring the role of psychological well-being as a mediator between psychological empowerment and performance. This cross-sectional study employed convenience sampling, gathering responses from 261 secondary school teachers through a survey questionnaire. It was found that teachers' perceptions towards their profession play a significant role in determining their performance and, ultimately, their effect on students. Teachers with a good perception towards their profession are likelier to perform effectively and positively impact their students. According to Tella (2007) and Ukobizaba et al. (2020), motivation and achievement in teaching mathematics can contribute to shaping a teacher's perception towards their profession. Hannula et al. (2016) and Middleton and Spanias (1999) have researched motivation for accomplishment in mathematics, which supports this idea.

Additionally, teacher perceptions and practices play a crucial role in the quality of teaching, including mathematics instruction (Beswick, 2018; Ingram et al., 2020). Research has shown that teachers' perceptions about their self-confidence in teaching mathematics can impact their instructional practices and student outcomes (Russo et al., 2020; Stipek et al., 2001). When teachers feel confident in their abilities to teach mathematics, they are more likely to approach the subject enthusiastically and provide effective instruction. Russo et al. (2020) and Stipek et al. (2001) explore the relationship between teachers' enjoyment of teaching mathematics, their attitudes towards student struggle, and their time teaching mathematics. In a comprehensive survey, primary educators shared their attitudes and behaviours concerning mathematics instruction. The outcomes of these studies indicate that teachers' enjoyment of teaching mathematics has significant implications for the quality and quantity of mathematics instruction students receive. Notably, there was substantial coherence among teachers' perceptions, and these perceptions consistently influenced their practices. Furthermore, teachers' self-confidence as mathematics instructors demonstrated a significant association with their students' self-confidence as mathematical learners.

Furthermore, teachers' willingness to take risks when teaching can result in innovative and engaging instructional practices that improve student learning (Trigwell, 2012). Being willing to attempt new concepts and instructional methods contributes to greater student engagement and knowledge of mathematical subjects. However, it has been found that not all teachers are open to changes or new approaches when it comes to assessment methods. A study conducted by Watt in 2005, which involved 60 mathematics teachers from 11 secondary schools located in metropolitan Sydney, aimed to examine the assessment methods used by these educators and their attitudes towards alternative assessment techniques. The study found that teachers with less teaching experience were more likely to have positive attitudes towards new alternative assessment methods. This implies that teachers who have been teaching for a more extended period may prefer traditional assessment methods and be less willing to try innovative approaches.

The result has significant implications for both educational practice and professional growth. Teachers with less experience may be more willing to attempt new and innovative evaluation approaches, leading to greater diversity and effectiveness in measuring students' learning outcomes. Teachers with greater experience, on the other hand, may benefit from tailored professional development opportunities to learn about and practice various assessment methodologies. Furthermore, the study's emphasis on teachers of mathematics is particularly significant, as mathematics is a topic that frequently needs a variety of evaluation techniques to capture students' comprehension of complex ideas and problem-solving abilities. Understanding teachers' attitudes towards assessment allows educational leaders and policymakers to develop interventions and support systems that encourage the implementation of effective assessment procedures that are appropriate for the requirements of teachers and students.

A study conducted by Archambault et al. (2012) offers beneficial insights into the role of teachers' perceptions in predicting adolescents' cognitive engagement and achievement in mathematics. Utilising hierarchical linear modelling and longitudinal analysis, the researchers examined a sample of 79 mathematics teachers and 1,364 secondary school students from 33 schools in disadvantaged communities in Québec, Canada. The study's results directly influence teachers' self-reported perceptions about their students' academic experience. This study emphasises the need to address teachers' perceptions in schools, especially in settings with disadvantaged student populations. By encouraging teachers to adopt a positive and focused development mindset, educators may enhance student outcomes and reduce performance gaps.

Low motivation levels have challenged the pedagogical landscape in Australia among students studying mathematics. Wilson and Mack, (2014) contend that this is primarily due to the absence of mandatory requirements for mathematics in upper secondary education. The curriculum and mathematics education requirements vary across states and territories in Australia. While mathematics is often required in lower secondary school (Years 7–10), it is optional in upper secondary education (Years 11–12). This implies that students can decide whether or not to continue studying mathematics beyond the required level. The absence of mandatory requirements for mathematics in upper secondary education can have implications for student motivation. Some students may perceive mathematics as too challenging or as irrelevant to their future goals and may choose to opt out of studying the subject. This can result in a decline in motivation levels among those who continue studying mathematics, as they may perceive it as a subject they are 'forced' to take rather than one they are genuinely interested in, which needs a mainstream focus for secondary students. Consequently, there is a dearth of formal intervention programs or practices specifically targeting junior secondary school students in mathematics. This policy vacuum may lead to students' unfavourable attitudes towards studying mathematics, which can affect teachers' perceptions and opinions about their abilities to positively impact students' mathematics learning. Understanding teachers' attitudes and their influence on student accomplishment is critical for improving teacher preparation and professional development.

Buehl and Beck's (2014) study provides valuable insights into how teachers' perceptions regarding student abilities impact their instructional decisions and practices. The researchers discovered that teachers have various expectations and use different teaching strategies depending on their perceptions about their students' academic abilities. The resulting disparities in instructional approaches based on perceived student ability indicate that teachers may unintentionally limit low-achieving students' learning opportunities and intellectual engagement. Traditional approaches to such students may not be in their best interests, since they may impede their development and academic success. According to Dweck (2016), teachers with fixed mindsets think that intelligence is a fixed attribute and that students have an intrinsic capacity that cannot be improved. Teachers with a growth mindset, on the other hand, think that intellect can be acquired through hard work and study. Understanding the significance of teachers' perceptions in affecting instructional practices and student results can assist educators and policymakers in implementing tailored interventions to promote teachers' ongoing growth while also improving student motivation and success.

Martin (2006) investigated the relationship between teachers' perceptions of student motivation and engagement and the influence on their satisfaction and confidence in teaching. The study sample comprised 1,019 teachers from diverse schools across Australia, underscoring the significance of teachers' perceptions of teaching and their students' involvement in the learning process. The study identifies various dimensions of student motivation and engagement aspects, including adaptive cognitive, adaptive behavioural, impeding and maladaptive dimensions. Although the observed effect sizes were minimal, intriguing patterns emerged. Male teachers tended to report higher student motivation and engagement levels than their female counterparts. Furthermore, primary school teachers had significantly higher levels of student motivation and engagement than high school teachers, with moderate effect sizes. The study also reveals that adaptive dimensions of student motivation and engagement were more strongly linked to teachers' enjoyment and confidence in teaching than impeding and maladaptive dimensions. Among the adaptive dimensions, students' mastery orientation was the most influential factor in teachers' enjoyment of teaching. In contrast, students' persistence and planning were the strongest correlates of teachers' confidence in teaching. These associations were more noticeable among male teachers and were not significantly affected by the number of years of teaching experience.

Beswick (2008) emphasises the need for more research on teachers' perceptions towards students who struggle with mathematics. Understanding teacher perceptions regarding these students is crucial to designing successful interventions and support systems. Moreover, when implementing intervention programs, it is necessary to consider teachers' perceptions. A study conducted by Beswick et al. (2006) in Tasmania sheds light on an important issue concerning teachers' confidence in the mathematics curriculum and ability to teach the subject effectively.

For example, Fitzmaurice and Hayes (2020) investigated a study on preservice teachers' understanding of factorisation, a topic not explicitly covered in their teacher education program. According to their findings, a large percentage of preservice teachers, i.e. 86.7%, relied on their previous knowledge from secondary school to complete the questionnaire. However, many of these participants' procedural knowledge was not linked to a broader conceptual understanding, indicating a gap in their experience. These studies have demonstrated that teachers' learning and engagement with mathematics topics are vital to their professional development.

Teachers' lack of confidence in their mathematics knowledge and abilities can have a detrimental impact on both their teaching methods and students' learning outcomes. Improving teachers' understanding of mathematics content is critical for increasing their confidence and competence while teaching mathematics (Norton, 2019). By strengthening their understanding of mathematical concepts and procedures, teachers can develop a more profound pedagogical knowledge and better support their students' learning (Prediger et al., 2023). Addressing teachers' perceptions and offering professional learning opportunities are vital to improving mathematics teaching (Jaworski et al., 2017). Furthermore, challenging teachers' negative ideas or preconceptions about students' abilities based on socioeconomic background is crucial. Research has shown that teacher expectations significantly impact students' educational results, and it is essential to promote high expectations for all students, regardless of socioeconomic background (Dinham, 2017).

2.5 Student achievement

New developments in mathematics curricula have significantly impacted how mathematics is taught in Australian classrooms. An early study claimed that the schools make almost no difference to student achievement (Coleman, 1966); what students could achieve was mainly predetermined by personal characteristics, socioeconomic background and location. However, this thinking has changed over time. In the mid-1960s, education in Australia sought to bridge the gap by offering students from more deprived areas the opportunity to study the same range of subjects as those from high socioeconomic status schools (Teese & Polesel, 2003; Leathwood & Hutchings, 2006). As research continued into effective schools and successful teaching, studies demonstrated entrenched performance gaps between students, especially in large secondary schools (Chesters & Cuervo, 2022; PISA, 2018; Rowe & Perry, 2022). The variation in student achievement within a single school was often more significant than the difference in average success between schools.

Marzano (2011) and Hattie (2003) used meta-analysis approaches to investigate valuable insights into the elements that influence teaching effectiveness and student success. These studies examined a broad body of literature to discover the aspects most impacting student learning achievements. The findings highlight the significance of the teacher–student connection and how it influences student engagement and learning outcomes. These studies indicate a wide range of elements that contribute to student performance, including students, their family environment, schools, administrators, classmates, and instructors (Hattie, 2003; Marzano, 2011).

Furthermore, research has indicated that teachers who build good relationships with students are better equipped to address their developmental, emotional and intellectual requirements. Such relationships foster student engagement, motivation and well-being (Osher et al., 2008). A study by Quin (2017) examined the association between teacher–student relationships and indicators of adolescent students' engagement in school. The researchers thoroughly searched seven different databases, resulting in 46 published studies (including 13 longitudinal studies) being included in the analysis. The findings indicate positive teacher–student relationships are linked to increased student engagement and academic achievement. According to Quin (2017), teachers who prioritise building positive relationships with their students create classroom environments that are better suited for learning and help meet students' developmental, emotional and academic needs.

Today, a constructivist approach dominates the Australian mainstream classroom, emphasising concepts rather than procedures (Zyngier, 2017). However, the success of constructivism and similar progressive educational theories has been observed primarily among students from privileged backgrounds, benefiting from outstanding teachers, engaged parents, and affluent home environments (Aggarwal, 2014; Hirsch, 2009). A study by Auwarter and Aruguete (2008) indicated that teachers perceived students from low socioeconomic status backgrounds as having less promising futures than their counterparts from high socioeconomic status backgrounds. A large body of research suggests that the constructivist method may have a detrimental influence on teachers if they do not receive proper direction (Kirschner et al., 2006; Mayer, 2004). However, Kuhlthau et al. (2015) found that a guided enquiry approach benefited all students, including those with learning difficulties, those at risk of dropping out, and English as an Additional Language (EAL) learners. Todd et al. (2005) endorse this, arguing that a guided enquiry method, where students learn how to study in an information-rich environment, is critically needed. Considerable research suggests that disadvantaged students, lacking such resources, benefit more from an explicit teaching method (Becker & Luthar, 2002; Hanushek, 1997; Parcel et al., 2010). As noted by Graham et al. (2007, p.3),

> clear teaching of important skills, information and appropriate strategies – involves showing, telling, using think-aloud protocols and self-talk, as well as modelling and demonstrating by both teacher and peers so that a systematic and structured approach to teaching the desired content leads students towards mastery and success. Explicit teaching also requires that the objectives and the purpose of the intended content are made clear to students and that they are provided with regular opportunities for purposeful feedback.

Furthermore, and contrary to popular belief, student achievement is not solely affected by genes, family and sociocultural background. The quality of teaching and learning provision, including evidence-based instructional leadership, substantially impacts student performance (Dinham, 2005, 2008; Hattie, 2003, 2005, 2007), and varies and changes over time.

Mathematics interventions in the junior secondary years have been neglected in the Australian education system (VanKraayenoord & Elkins, 2004). Recently, federal and state governments have become interested and brought mathematics into the foreground (Lingard, 2010; VanKraayenoord & Elkins, 2004). The government's financial responsibility is to determine the curricula and provide more Accreditation of Teacher Education Programs and Professional Standards for Teachers (AISTL, 2018).

Mathematics teaching and learning demands are higher today than ever (DET Melbourne, 2016). The National Research Council and Mathematics Learning Study Committee (2001) emphasise the importance of basing improvements in students' mathematics learning on scientific evidence and that teaching approaches' effectiveness be systematically evaluated. According to the Report of the Review to Achieve Education Excellence in Australian Schools (AU, 2018), it is suggested that Australia should review and revise its model for school education. The report highlights the need to move away from working within constraints limiting flexibility in curriculum delivery, reporting and assessment systems, and tools primarily focusing on periodic performance evaluations. Instead, the recommendation is to adopt a model that continuously diagnoses students' learning needs and progress. However, this is hindered by a lack of research-based evidence on effective educational practices and the absence of readily available classroom applications for teachers (AU, 2018).

While Australia has recently placed more emphasis on secondary schooling, numerous studies have found that alienation and disengagement contribute to underachievement among many middle-school students (Luke et al., 2003). As a result, numerous state and territory governments and educational institutions have developed and introduced middle-school concepts and programs. During the middle years, there is a distinct emphasis on the requirement for a specific ‘pedagogy’ and a ‘language for pedagogy.’ This approach allocates less attention to adolescents’ social and developmental needs and interests and emphasises delivering quality teaching and learning (Dinham & Rowe, 2008).

The research indicates active and ongoing reform in Australia’s upper primary and lower secondary school systems, driven by concerns for early adolescents and their educational experiences. These reforms aim to address various challenges faced by this age group, including the transition from primary to secondary school, increasing disengagement and alienation, and difficulties with mathematics (Luke et al., 2003). Additionally, there is a focus on addressing stalled or declining student achievement in the middle years and persistent challenges in mathematics education during this phase. This is especially pertinent for students in target groups, including those from non-English speaking backgrounds, rural students from low socioeconomic status backgrounds, Aboriginal and Torres Strait Islander students, and students with learning difficulties (Carrington & Elkins, 2002).

Researchers have recently confirmed that teachers can significantly impact student educational success, more so than most other school variables (Dinham, 2017). Numerous international studies consistently demonstrate that teachers influence student outcomes through the positive impact of teachers’ mathematical content and pedagogical knowledge (Barber & Mourshed, 2007; Hill et al., 2008). Improving teacher quality has become a key educational objective in the 21st century. The belief is that enhancing teachers’ quality will substantially influence student achievement, particularly in low socioeconomic status (SES) school communities (Akiba & LeTendre, 2009; Boyd et al., 2009; Queensland Annual report [QLD], 2009)

According to Woods et al. (2014), quality teaching can contribute to achieving social justice in education. Teacher quality is directly related to being 'highly qualified,' as the No Child Left Behind (NCLB) legislation requires. The NCLB mandate states that every classroom should have a teacher qualified to teach in their subject area and capable of increasing students' mathematical competency while closing the achievement gap between advantaged and disadvantaged students. With the Minister’s Review of Teacher Education, the focus on attracting and developing quality teachers at a federal level has sharpened (Pyne, 2014). Furthermore, classroom social context and peer interactions can influence students' learning and test-taking behaviour. The composition of classmates and the classroom environment can impact students' academic achievement. Ketonen and Hotulainen (2019) conducted a study investigating the effects of the classroom context on students' achievement patterns. Their findings suggest that the classroom context is associated with students' achievement, particularly for the lowest-achieving students.

A large body of literature on quality teaching has primarily focused on whole-class instruction. However, interventions in Tier II (small-group instruction) are often led by individuals other than the classroom teacher, such as another teacher or a paraprofessional. This study aims to explore the quality of teaching provided by both classroom teachers and non-classroom teachers in these small-group settings.

According to Dinham (2017, pp. 20-23), there are four fundamentals of student achievement.

1. A central focus on students, both as learners and people: Knowing your students as learners and individuals is important to be an effective teacher. Building good teacher–student relationships and balancing academic responsibilities with personal well-being are critical for increasing student engagement, motivation, and accomplishment. Hattie (2012) found that student-centred teaching has an effect size of 0.54, indicating a moderate positive impact on student learning outcomes. Similarly, teacher-to-student feedback has an effect size of 0.75, signifying a strong positive impact on student achievement.

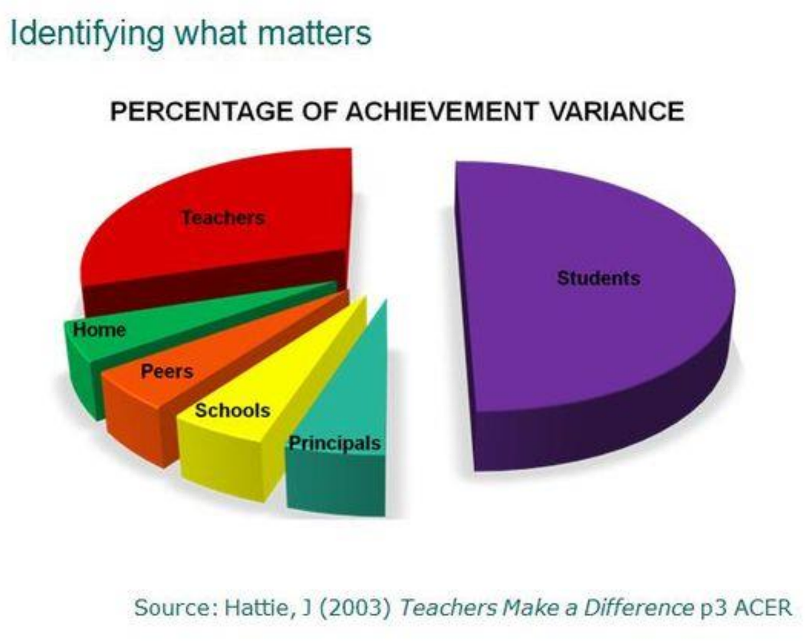
2. Professional learning: Professional learning is an effective tool for teacher development and school improvement. It is stated that any change introduced in a school or educational system must be supported with relevant and practical professional learning opportunities to ensure its successful implementation. Schools may improve their teachers' knowledge and abilities by focusing on continual professional development and support, resulting in better teaching methods and student results. Hattie (2012) finds that the impact size for professional development is 0.51.

3. Leadership: Leadership is crucial to improving teaching and learning in schools. Research calls into question the traditional view of leadership as being limited to official roles such as school principals and acknowledges that any teacher may apply it. Teachers display leadership abilities by carrying out duties, helping colleagues, and participating in school events. It is vital to emphasise that certain types of leadership, such as instructional leadership, have a greater immediate and significant influence on student learning than others, such as transformational leadership. Principals and school leaders practice instructional leadership to improve teaching techniques and student learning results. On the other hand, transformational leadership is frequently focused on inspiring and motivating personnel by projecting a vision for the school's future. Practical and successful leadership is essential for creating a positive school culture, promoting teacher development, and enhancing student learning outcomes. Hattie (2012) shows an impact size 0.39 for principals and school leaders.

4. Quality teaching: Quality teaching is essential for generating excellent student learning outcomes. It includes two main components: the characteristics of the teacher and the efficiency of their instructional techniques. Efforts to increase teacher quality and guarantee equal access to high-quality instruction are critical to improving educational results for all students. Hattie (2012) estimates an impact size of 0.48 for teaching quality.

In a similar vein, Hattie (2003) illustrates student achievement in a pie-chart (see Figure 2.1) showing the relative influences of the percentage of achievement variance.

Figure 2.1 Contributors to student achievement variance



2.5.1 Student achievement measurement

Student achievement is often equated with performance on standardised tests. The Melbourne Declaration on Educational Goals for Young Australians clearly defines and expects student accomplishment in Australia. The proclamation highlights the relevance of knowledge and seeks to offer every young Australian the chance to become a successful learner, a confident and creative individual, and an engaged and informed citizen (Barr et al., 2008). It is a shared responsibility of all governments to invest in reforms that provide every young Australian with a real opportunity to achieve these goals, as outlined by Barr et al. (2008).

However, an intriguing challenge arises from teachers' often unfavourable attitudes toward curriculum changes, as illuminated by the research conducted by Kajander et al. (2008). Despite the alignment of these tests with the curriculum, teachers prefer traditional evaluation methodologies over alternative assessment approaches, as highlighted in studies by Kajander et al. (2008) and Watt (2005). This resistance to change within the educational landscape presents a complex dynamic that impacts teaching satisfaction and attitudes (Manathunga et al*.,* 2019). Teachers may believe traditional assessments are more valid measures of student aptitude and be less willing to embrace innovative methods. According to Watt (2005), many teachers prefer traditional testing techniques over alternative assessment approaches when measuring student skills. This tendency may come from a liking for the familiar, but it can also be a barrier to adopting significant changes in the educational system. It is critical to address any unfavourable attitudes towards change in the schools.

Evaluating students' literacy and numeracy skills can be a stressful process that causes concern and anxiety among educators and students alike. However, many educators view diagnostic tools as incredibly helpful for uncovering, identifying and highlighting specific areas of weakness and strength in students' abilities, whether as individuals or as a group (Forster, 2009). These assessments help educators develop interventions and provide learning support where necessary. In Victoria, there are various settings where student learning is assessed for grades one through ten, and three commonly used tests described below.

1. Progressive Achievement Test for Mathematics (PAT-M): This popular evaluation tool tests students' mathematics abilities and knowledge. The test assesses students' mathematics abilities and gives insights into their strengths and areas where they may need additional support.

PAT-M is a computer-adaptive test for students in Years 2–10. It is a tool for assessment developed by the Australian Council for Educational Research (ACER) and has been in use since 1973; the fourth version was published in 2008. PAT-M can be given at any time, although it is usually given twice a year, as a pre-test and a post-test at the beginning and end of the school year. One of the primary benefits of PAT-M is its capacity to produce questions based on individual students' levels. As a computerised adaptive assessment, one of the primary benefits of PAT-M is its capacity to produce questions based on individual students' levels. As a computerised adaptive assessment, one of the primary benefits of PAT-M is its capacity to produce questions based on individual students' levels. This adaptive feature allows the test to assess students across various abilities effectively (Freshworks, 2018).

Using PAT-M assessments to inform teaching decisions yields various benefits for students' mathematical learning. The findings from PAT-M assessments empower teachers to make well-informed decisions regarding the most suitable teaching materials, methods, and programs for their students, as emphasised in the research conducted by Caldwell and Hawe (2016), Darr et al. (2005), and Ljungdahl and Prescott (2009). This approach is valuable in providing schools and teachers with essential information, which when combined with other data, aids in analysing, planning, and designing programs and teaching techniques that enhance students' mathematical learning (Joyce, 2006). Moreover, by administering tests multiple times, schools can track students' development and growth over time.

Furthermore, by comparing growth rates, schools may assess the efficacy of various teaching techniques and interventions. All three applications of PAT data are critical to good teaching and learning (Masters, 2016). Moreover, the comprehensive tables provided by PAT-M make it easy to compare the placement of test questions with the curriculum outcomes of each state and territory, ensuring alignment with educational standards. This makes it an invaluable resource for educators and parents alike. However, schools face challenges and limitations in effectively utilising data from progressive achievement tests like PAT-M to create evidence-based programs that address students' learning needs. It is important to recognise that these challenges exist and have been documented in the literature. Researchers such as Black and Wiliam (2018), Kralj et al. (2022), and Forster (2009) have documented these challenges. One of the challenges identified is the reliance on formal standardised exams, which may not accurately assess and capture the information provided by progressive achievement tests. This can lead to a lack of understanding and utilisation of the valuable data generated through these assessments (Dixon & Williams, 2002; Parr & Timperley, 2008). As a result, they have been unable to create adequate evidence-based programs that address the cohort, group, and individual learning requirements identified in such assessments (Parr & Timperley, 2008).

2. On-Demand Testing: On-demand testing, also known as flexible or continuous testing, refers to assessments that can be administered to students at any time during the school year.

These assessments allow educators to gather information on students' skills, progress and understanding as needed rather than being restricted to a specific testing window.

The Victorian Curriculum and Assessment Authority (VCAA) provides schools with an online resource called on-demand testing. This platform offers a variety of assessment options for students in reading and numeracy from the Victorian Essential Learning Standards (VELS) levels 2 to 6. The primary objective of this testing is to collect information about student performance, individually and as a group. Teachers can choose from various tests in on-demand testing that cater to their specific needs. These testing processes include traditional linear tests, progress tests, and computer-adaptive tests, which all be completed online. On-demand testing is a versatile tool that may be utilised in many ways to benefit both teachers and students. It can help the teacher assess the student's knowledge before starting a new topic or conduct post-tests at the end of a topic. It can also be used to evaluate new intake students, identify individual students' strengths and weaknesses and validate teacher judgements.

Using on-demand testing, teachers can generate reports that provide insights into progress and areas of improvement for students. Furthermore, these reports may contain recommendations to assist teachers in effectively analysing the data and improving their teaching strategies. However, according to Pendergast and Swain (2013), combining other classroom evaluations with on-demand tests is crucial to obtaining a complete picture of a student's performance. In line with this view, like any other assessment tool a single on-demand test cannot provide a conclusive overview of a student's abilities in any subject area. The tests are meant to be used with a combination of other classroom evaluations and should not be used independently (VCAA, 2017). Additionally, the standard score for on-demand testing does not fully reflect the achievement of the Victorian Curriculum Achievement Standards. It is therefore inappropriate to utilise the on-demand scores to reflect mastery of an Achievement Standard (VCAA, 2017).

3. National Assessment Program – Literacy and Numeracy (NAPLAN): NAPLAN is a nationwide assessment program conducted yearly in Australia and assesses students' skills in literacy and numeracy in Years 3, 5, 7 and 9. The test results offer valuable insights into the performance of individual students, schools, and the nation.

NAPLAN is a significant national assessment program that provides crucial data on Australian students' literacy and numeracy skills (Jackson, 2022). The information garnered from this program is instrumental in gaining a comprehensive understanding of educational outcomes, which can inform policies and interventions to enhance student learning and improvement (ACARA, 2021). Additionally, to ensure consistent tracking and reporting of student achievement, a 10-band scale has been created for all levels of participation, designed to monitor student progress and simplify reporting during the school year (ACARA, 2023b).

It is imperative to note that while NAPLAN results are an essential indicator of student performance, they should be considered as one perspective and not the whole story, as argued by Pendergast and Swain (2013). Schools should focus on utilising the available data and feedback to improve their practices while having national guidance or vision for how assessment results can inform classroom practice (Goss et al., 2015).

Since 2008, NAPLAN has assessed all Australian students' reading and numeracy abilities in Years 3, 5, 7 and 9. The test includes numerous domains, including reading, writing, and language standards, including spelling, grammar, punctuation and numeracy (ACARA, 2023b). To ensure fairness and consistency throughout the assessment process, each year level has a primary test form and a secure equating form. The student's individual scores are given for each domain and year level and reported against six achievement bands specific to their year level. These bands help determine their performance relative to the expected outcomes for their year level. Apart from the primary and secure equating forms used to ensure fairness and consistency in the assessment process, NAPLAN compares national benchmarks and standards. The individual student scores are reported against six achievement bands specific to their year level and compared to the national average, the middle 60% of Australian students, and the national minimum standards (ACARA, 2023a). This broader context helps to provide a better understanding of a student's performance.

Assessments such as PAT-M, On-Demand, and NAPLAN can be useful in evaluating student progress and achievement. However, it is crucial to use these assessments effectively and with appropriate support and guidance and to recognise that they are one aspect of the evaluation process (Pendergast & Swain, 2013). These evaluations give significant data that educators and policymakers may utilise to make informed choices regarding educational interventions and changes, according to ACARA (2023a; 2023b). However, it is important to remember that these assessments are not the only way to measure student development and should not be the general teaching emphasis. To offer a well-rounded education that prepares students for success in all parts of life, educators should use various evaluation methods and consider each student's unique needs.

2.5.2 Approaches and intervention programs for supporting students experiencing difficulty in mathematics

Research has shown that low-achieving students may lose confidence in their abilities and acquire a negative attitude towards learning and school (Gervasoni, 2004). A lack of self-efficacy makes students believe they cannot succeed profoundly affects academic performance (Diener & Dweck, 1980). This demonstrates that student self-esteem or self-concept can impact on student learning. One result is that the gap between these students' abilities and those of other students widens. The classroom teacher's regular learning experiences only allow moderate to high-achieving students to engage fully and benefit (Goss & Sonnemann, 2016). Ginsburg (1997) concludes that when mathematics becomes more challenging, students with mathematics learning difficulties experience repeated failure and may develop strong sensitivities, which causes them to lag behind their peers in schoolwork. According to Cole (2006), poor self-esteem and pessimistic perceptions of oneself as a learner can harm students' motivation and engagement in learning. These negative self-perceptions can lead to various consequences, including reduced motivation, avoidance of risk-taking in learning, passive disengagement from the curriculum, and behaviour problems.

Australian researchers have emphasised the importance of mathematics instruction, which encompasses knowledge, skills and strategies for mathematical thinking. For example, Hurst (2007) has suggested that education in mathematical thinking strategies should be undertaken so that students can efficiently process basic facts. This comment highlights that students should not solely rely on memorisation but should develop problem-solving strategies to approach mathematical problems. Elkins (2002) argues that underperforming students also require the ability to read and apply the language of mathematics to interpret everyday contexts. Additionally, underperforming students may benefit from using various strategies and developing number sense to solve mathematical problems effectively. Elkins (2007) notes that there has been a shift away from the content delivery model for all, or what has been called the 'I Do We Do You Do model' (Killian, 2015), to a focus on conceptual understanding supported by constructivist teaching approaches. Educators should aim to help students understand mathematics' underlying concepts and principles rather than just memorising procedures. Long's (2014) study identifies four critical components for successful intervention programs targeting students who underperform in mathematics. These components include 'building prior knowledge of language, concepts, and skills to prepare students for mainstream mathematics lessons; increasing fluency with basic number facts; encouraging a growth mindset; and developing responsible learning behaviours through metacognitive strategies' (Long, 2014, p. 421). Sherman et al. (2005; 2019) argue against providing tedious and uninspiring activities for students with learning difficulties, advocating for engaging and meaningful approaches.

To close the learning gap, educators need to have a clear understanding of their intended learning outcomes, as the National Council of Teachers of Mathematics (NCTM) (NCTM, 2007) emphasises. Various mathematics intervention programs, such as small group and individual support, school-based learning difficulty support programs, and formal intervention programs, aim to challenge and support students in acquiring new knowledge (Bouck, 2005). Graham et al. (2007) researched the significance of considering social and emotional demands when designing effective teaching and learning reinforcement for underperforming students in the junior secondary years of schooling. They find that creating a supportive and caring environment for learning was essential, particularly for students with learning difficulties who may already have an external locus of control. Students need to feel confident in making mistakes, discussing topics and asking questions to encourage engagement and achievement (Fisher et al., 2020). However, educators face a dilemma as this would require only teaching part of the class, while a fully individualised mathematics program or multiple groups are likely to present organisational challenges.

2.6 Mathematics intervention programs and the GRIN program

This section outlines the most popular mathematics intervention programs and extra-curricular support available to students in Victoria secondary schools who may need additional help with their studies. Overview One of GRIN's most popular intervention programs provides a comprehensive overview of how the program is implemented in Victorian schools. This program aims to provide targeted support to students struggling with mathematics, assisting them in developing the required skills.

2.6.1 Mathematics intervention programs and extra-curricular support in Australian Schools

Several professional researchers, such as Ardoin et al. (2005), Lembke et al. (2010), and Reutebuch (2008), have contributed to a better understanding of successful mathematics treatments. These studies demonstrated that introducing Response to Intervention (RTI) at various levels can increase students' mathematics ability. The RTI model is a well-established framework that has gained global recognition and adoption, based on research conducted by prominent educators and researchers in the United States. Gersten et al. (2009, p. 4) explain that 'RTI is an early detection, prevention, and support system that identifies struggling students and aids them before they fall behind'. The Response to Intervention (RTI) paradigm consists of three levels of interventions, each of which becomes increasingly intense. As described by Ehren and Visscher (2008) and Jillson (2008), this multi-step approach encompasses Tier 1, which delivers standard mathematics instruction to all students. Tier 2 provides supplementary small-group mathematics instruction to enhance targeted proficiencies in mathematics. Finally, Tier 3 typically involves one-on-one tutoring and a customized combination of instructional interventions (Fuchs et al., 2008).

Johnson and Smith (2008) argue that educators in the RTI model aim to help students achieve their full potential and successfully meet state grade-level standards. However, Prewett et al. (2012) raise concerns about the effectiveness of using the elementary model of RTI in secondary schools. They point out that practitioners in secondary school settings may face challenges and confusion regarding the logistical structure of RTI, which can hinder the implementation of screening, progress monitoring, and intervention processes. Kovaleski (2007) emphasises that several issues need addressing to implement RTI approaches successfully. Effective implementation requires practical instruction and strong leadership, with schools adapting to provide a mix of validating instructional strategies. Teacher training in measuring student capabilities is essential (Fisher et al., 2015), and parents should be kept informed about these new procedures and made partners in the process (Klotz & Canter, 2007).

Tier 2 interventions in the RTI process are widely utilised in Australian schools for students who are at risk of failing to meet required reading or numeracy levels. These interventions are intended to give more targeted and intense assistance to meet these students' unique learning requirements. One of the most effective strategies is small-group intervention, which usually involves one teacher or professional educator working with a small group of two to five students. This smaller group size enables more concentrated and individualised instruction, since the teacher can provide specific assistance and closely monitor each student's development. Small-group interventions can take place in a separate classroom or designated workspace, creating a more favourable learning environment that allows students to grow and achieve.

Only a few Australian-based studies in mathematics have investigated the effectiveness of a small-group intervention (Jacob & Jacob, 2018). These studies demonstrate that small-group interventions might be useful in enhancing students' learning outcomes. Furthermore, such interventions might help to enhance interpersonal and communication skills. The research conducted by Meiers et al. (2013) supports the effectiveness of small-group interventions in enhancing students' learning outcomes. This implies that tailored instruction and assistance in a small-group environment can help students improve their arithmetic skills.

Furthermore, Rosholm et al. (2024) investigated the deployment of small-group interventions in Australia and New Zealand and discovered evidence of their beneficial effects. Their study takes into account the perceptions of school authorities, teachers, and students, resulting in a thorough knowledge of the advantages of small-group interventions. Woods-McConney et al. (2011) investigated students' attitudes towards working in small groups. It demonstrates that students had generally favourable perceptions towards small-group work and associated it with higher levels of enjoyment than individual exercises. This indicates that small-group instruction can create a more engaging and interactive learning environment for students.

Many secondary schools in Victoria offer extra-curricular mathematics support and programs to students struggling with the subject. These offerings aim to provide customised instruction, additional assistance and a supportive environment for students needing extra mathematics help. Several popular mathematics intervention programs and extra-curricular support options are available to students who require additional study help. The following is a broad summary of some of the programs and extracurricular assistance alternatives available in Victoria secondary schools.

Maths Pathway: Maths Pathway is a personalised learning program designed to meet the unique needs of each learner. It employs diagnostic evaluations to discover knowledge gaps and provide a tailored learning pathway for each learner.

Homework Clubs: Homework clubs are after-school programs where students can receive additional support with their mathematics homework and assignments. These clubs offer a supportive environment where students can work on their math tasks, seek guidance from teachers or peers, and clarify concepts that they find challenging.

Peer Tutoring Programs: Peer tutoring programs match students who thrive in mathematics with those who struggle. The tutors give one-on-one or small-group assistance, explaining topics, showing problem-solving tactics, and advising their peers.

Maths Competitions and Olympiads: Participation in mathematics competitions and Olympiads can offer students extra-curricular support and enrichment opportunities. Victoria secondary schools often encourage students to participate in math competitions and olympiads. These competitions promote problem-solving skills, logical reasoning, and mathematical creativity. They provide opportunities for students to challenge themselves, gain confidence and showcase their mathematical abilities.

Mathspace: Mathspace is an online platform that provides personalised mathematics learning experiences for students. It provides a variety of interactive mathematics tasks, tests, and teaching tools that are curriculum-aligned. Mathspace employs adaptive technology to deliver quick feedback and personalise the learning experience to meet each student's requirements.

The following two mathematics intervention programs, QuickSmart and GRIN, are designed to provide specialised support to students with mathematics difficulties. These programs often involve structured interventions, trained personnel, and a focus on enhancing students' mathematical skills and comprehension. The present study focused on teachers' perception of the GRIN program and a comprehensive overview of the GRIN intervention program and its background are in Section 2.6.2.

QuickSmart: QuickSmart has been used in Australian schools since 2001. The QuickSmart mathematics intervention approach improved students' mathematical understanding, skills and knowledge (Graham et al., 2007). QuickSmart was developed with the National Centre for Science, Information and Communication Technology, and Mathematics Education for Rural and Regional Australia at the University of New England.

QuickSmart is an essential academic skills program designed for persistently low-achieving students in the lower secondary years of schooling, and the ambition is to improve the automaticity of basic skills to improve higher-order processes, such as problem-solving and comprehension, as measured by standardised tests (Graham et al., 2007). The QuickSmart instructional program consists of three structures: teacher or teacher-aide-directed, 30-minute, small-group lessons weekly for approximately 26–30 weeks. The QuickSmart programmatic intervention was conducted in a broad range of Australian schools. Research by Pegg et al. (2005) has analysed the use of QuickSmart among students aged 11–13, who demonstrated consistently low achievement in mathematics. They find that the students improved in time response to several facts and maintained performance gain after the intervention was completed.

The QuickSmart mathematics program has been the research focus of Graham et al. (2007) and Graham and Pegg (2013). The former study involved 12 middle-school students with learning difficulties, while the latter focused on Indigenous middle-school students who completed the QuickSmart numeracy program. Both studies show that the QuickSmart program positively influences academic growth and achievement gaps for students with learning disabilities, including Indigenous students. The program has been observed to improve response speed, accuracy and general mathematics knowledge (Graham et al., 2007). However, it is crucial to continue monitoring individual students' needs and addressing areas such as mathematics learning to ensure ongoing success (Regan & Jesse, 2019).

The research indicates active and ongoing reform in Australia's upper primary and lower secondary years of schooling. Concerns about early adolescents' experience of the transition from primary to secondary school, increasing disengagement and alienation, particularly among at-risk students, stalled or declining student achievement in the middle years, continuing difficulties with numeracy in the middle years, especially for students in target groups such as non-English speaking background (NESB) students, rural students from low socioeconomic status backgrounds (SES), Aboriginal and Torres Strait Islander (ATSI) students, students with learning difficulties (Carrington, 2002).

2.6.2 Overview of GRIN intervention program

Getting Ready in Numeracy (GRIN) was created by Monash University's Faculty of Education. GRIN is a relatively new numeracy intervention program primarily used in Victorian primary and secondary schools (Monash University, 2023). The GRIN Intervention Program is a professional development program for mathematics teachers and tutors, aiming to equip them with strategies and tools to address students' challenges in learning mathematics. The GRIN program is intended to prepare students for mathematical difficulties, providing support in addition to and prior to regular mathematics lessons.

Table 2.1 summarises the GRIN model (Monash University, 2023):

Table 2.1 The resource requirements of implementing GRIN

IMPLEMENTATION AREA	GRIN
Origin	Victoria
Developer	Monash University
Licence fee	Required
Cost	$4000 for 4 GRIN tutors trained and $800 for each extra after that
Classroom modification	Possibly required for small-group withdrawal
Site equipment and materials requirement	Education support (ES) Staff, Teacher or numeracy specialist to run the program
Time per session and period running program	Sessions can run before or after school or in recess and lunch breaks or student's withdrawal from the class and is conducted prior to the mathematics lesson. Withdraw students from a range of different subject areas. The GRIN sessions with a small group of 2–3 students for ideally 2–3 times a week of 15–25 minutes over about 6 months or longer if required.
General classroom Instructors/Tutors/ Improvement Teachers	All GRIN teachers and tutors attend one day of professional learning. GRIN manuals and templates are provided to assist with the delivery and data analysis of the program. GRIN teachers and tutors attend a further two half-day professional learning support sessions.
Other personnel inputs	Not required
Aim	Student confidence and pre-exposure to lesson concepts
Outcomes	Compare with non-GRIN students. Using the mean gain of a VELS level. -limited quantitative data -little qualitative data

The GRIN program, as described by Sullivan and Gunningham (2011), aims to enhance students' skills and understanding of mathematics by introducing them to important mathematical concepts prior to their regular mathematics lessons. This preparatory approach ensures that students are adequately equipped and feel confident in actively participating in their upcoming mathematics class. Sullivan and Gunningham (2011) argue that without such assistance, many students with recognised mathematical difficulties may struggle to construct new knowledge and understanding from their classroom learning experiences. Long (2014) describes GRIN as essential for building students' self-efficacy. The program's design is grounded in reducing stress on working memory (Bransford et al., 2003; Pegg, 2010), based on the assumption that students have limited working memory capacity. The GRIN intervention program focuses on familiarising students with key material before their mainstream classroom. It minimises the need to process too much information later to prevent memory overload with the new concepts introduced (Tzur, 2008).

2.6.3 GRIN implementation

Since 2010, GRIN has been implemented in over 30 schools across Victoria, including primary and secondary. GRIN targets students in Years 2–11 who have fallen far behind in their numeracy skills. Approximately 10% of the students in these schools have been reached by the GRIN program.

In 2012, Monash University implemented the GRIN mathematics intervention program with adult Indigenous and Torres Strait Islander students with the aim of supporting these students in transitioning to tertiary study and completing 12-year mathematics equivalent studies. According to the initiative coordinator, allowing students to establish a foundation in mathematics before joining the class has instilled a transformative impact on their attitude towards the subject and overall academic performance (AU, 2014). This pedagogical approach significantly mitigated students' anxieties and fears, consequently generating a much more positive outlook towards the subject and bolstering their confidence and self-assurance. Notably, the change in approach has led them to become the first-ever cohort of students to confidently pass the math test, achieving distinction averages (AU, 2014).

According to Kalogeropoulos et al. (2019a), three different but essential elements are involved in the GRIN-related technical learning curriculum:

1. Teachers prepare lesson sequences with specific objectives that reflect the complexity of the student's previous mathematical knowledge.
2. The teacher explains to the mentor the aims of the lessons ahead.

3. The tutor prepares training sessions that include three elements to prepare students for subsequent learning: guided fluent practice, language development, and familiarisation with key preconditions.

There is a double advantage in learning prerequisite concepts in the tutoring session and the mathematics class.

2.6.4 GRIN outcome

Previous research by the program developers from primary and secondary schools shows that the GRIN program has demonstrated effectiveness in improving student academic performance, particularly for secondary students. In a GRIN secondary school study in 2010, 45 tutored students were compared to 254 non-tutored students. The tutored students at one school outperformed the rest by approximately one full year, while the other tutored improved by around one-fifth a year (AU, 2014).

Similarly, in another study conducted in 2011, 21 tutored students and 228 non-tutored students from three secondary schools were compared. The average gain of tutored students was 0.45 VELS level, whereas non-tutored students had a slight decrease of −0.04 VELS level. This indicates that tutored students improved by nearly half a VELS level, while non-tutored students experienced a slight decline. Tutored students outperformed the other students by a full year (AU, 2014).

There is limited evidence available for evaluating the efficacy of the GRIN program, particularly in the context of Year 3 students in primary schools. The 2010 GRIN experiment conducted with Year 3 students from four primary schools, as referenced in Sullivan and Gunningham (2011), did not provide compelling evidence of the program's effect on student achievement. The study compared the average gains in VELS levels between participating students and those who did not participate.

The outcomes of this experiment presented a varied picture. On average, students who received GRIN tutoring in two schools demonstrated greater gains in VELS levels than those who did not. In one school, the mean improvements were identical for tutored and untutored students, but in another, students who did not get tutoring outperformed their tutored peers. Notably, the number of GRIN students at each school was relatively modest, ranging between 11 and 22. Moreover, the researchers' approach to comparing the initial capacities of tutored and untutored students at the start of the intervention needs clarification, as it could impact the interpretation of the results. Given the limited evidence and mixed findings from this particular study, it is important to approach the efficacy of the GRIN program with caution when it comes to Year 3 students in primary schools. Notably, the GRIN program developers researched primary and secondary schools, demonstrating positive outcomes for the secondary level. Nonetheless, it is critical to recognise that this study was done on a limited scale, and that more research and larger-scale studies are required to acquire a more thorough understanding of the program's influence on student accomplishment in this environment.

Another study from the GRIN intervention by Kalogeropoulos et al. (2019a) shows that the GRIN program has positive outcomes, such as increased student engagement and the development of a growth mindset, as well as challenges that must be addressed for successful implementation, such as communication, coordination, student enrolment, and teacher collaboration. Kalogeropoulos et al. (2019a) acknowledge that the GRIN program implemented in 2012 for Aboriginal and Torres Strait Islander students at Monash University was remarkably successful. The program had positive outcomes for this specific student population, and the study highlights that the GRIN program facilitated the flow of conventional experiences from other students. This indicates that the program helped create a sense of continuity and connection with the broader academic experiences of students, promoting a more holistic educational environment. However, resolving the practical problems mentioned, such as location and scheduling, is crucial for the success of the GRIN program within the school context. Addressing these challenges ensures smooth implementation and maximises the benefits for students.

The GRIN program also recognises that classrooms are social settings. This prepares students for social connectedness, suggesting that prior knowledge can increase their confidence and involvement in class discussions (Sullivan & Gunningham, 2011). Outcomes claimed include improved results in mathematics assessments such as the VCAA on-demand test (Long, 2014). Regarding the impact on student achievement, it is reported that a deeper understanding of the mathematical content being taught, and the willingness of assisted students to engage, contributed to improved mathematics learning results at various levels and situations (AU, 2014). This finding emphasises the importance of addressing these factors for enhancing student achievement in mathematics.

Notwithstanding the above, the Department of Education (2009) notes that there is minimal evidence available to determine the program’s impact on student outcomes. Additionally, it observes that the GRIN program is localised and has yet to gain widespread recognition or research attention. It is clear that the current research evidence for the efficacy of the GRIN program is insufficient, and there are significant limitations in understanding its effectiveness. Therefore, further research is necessary to bridge the knowledge gap and fully comprehend the GRIN program's implementation and impact, which this research aims to address.

2.7 Summary

As educators continue to explore ways to help students overcome challenges in mathematics, it is crucial to focus on targeted interventions and support. The literature on mathematics interventions in Australian education highlights the importance of such interventions, particularly for junior secondary school students (Thomson, 2021). Numerous research initiatives and reports have emphasised the need for effective interventions in teaching mathematics at this educational level (Brodesky et al., 2022; Stevens et al., 2018; Thomson et al., 2019). During the junior secondary years, students' education is critical, and providing appropriate support during this time is essential to address any learning difficulties and ensure their success in mathematics (Myers et al., 2021).

Teachers' perceptions of mathematics learning and intervention programs are critical in promoting student achievement (Moliner & Alegre, 2022). Understanding teachers' perceptions and their development is crucial for enhancing teacher preparation and ongoing professional development (Voss et al., 2013). By better understanding these perceptions and their impact on student achievement, educators can create more student-centred teaching practices and support their students' progress.

Furthermore, the success of the intervention can be attributed to factors such as growth mindset (Yilmaz, 2022; Boylan et al., 2018; Yeager & Dweck, 2020; Dweck, 2015), effective teaching practices (Wilson & Cooney, 2002), teacher confidence (Russo et al., 2020; Stipek et al., 2001), and small-group instruction (Woods-McConney et al., 2011).

Chapter 3: Methodology

3.1 Introduction

This chapter provides an overview of the theoretical and methodological foundations of the study. It starts by explaining the use of a qualitative case study approach to investigate the perceptions and experiences of teachers from Victorian secondary schools participating in a mathematics intervention program. Section 3.2 delves into the research design and approach to the theoretical paradigms. The constructivist research paradigm is identified as the epistemological foundation for the study, providing a basis for the practical and outcome-focused method of inquiry using a design-based research methodology. The chapter establishes links between the techniques employed in the study and the design-based research approach. Section 3.3 discusses the appropriateness of qualitative research for this study, presenting the methodological decisions and background that justify the choice of qualitative methods. The use of semi-structured interviews as the primary data collection method is explained in detail in section 3.4, outlining the interview process. Section 3.5 provides a comprehensive summary of the Ethical considerations and data analysis protocol, which are fundamental to the integrity of this study.

Sections 3.6 and 3.7 provide comprehensive accounts of the study populations and the data collection methods employed across three schools. These sections focus on how mathematics leaders and teachers collaborated to develop and implement strategies to improve student numeracy outcomes. Section 3.8 organises and analyses the data collected through interviews with school leaders and teachers, examining the impact of these initiatives on their respective fields and identifying the factors that facilitated or hindered their success. Section 3.9 of the chapter presents the criteria for ensuring the study's quality, trustworthiness and alignment. It highlights the measures taken to maintain the rigour and credibility of the research. The data storage strategies are discussed in section 3.10, detailing the steps taken to protect the privacy and confidentiality of the study participants. Section 3.11 outlines the limitations of methodology method. Finally, section 3.12 concludes the chapter by summarising the main points discussed.

3.2 Research design and approach theoretical paradigm

The following section delineates the research methodology employed to investigate the research questions posed in this study.

The main research question of this thesis is:

RQ: How is the GRIN mathematics intervention program perceived by teachers at secondary schools in Victoria?

The sub questions are:

SQ1: How does the GRIN program impact teachers' perceptions of teaching mathematics?

SQ2: What changes in student achievement have been reported by teachers since the implementation of the GRIN intervention program?

The current study adopts an interpretivist perception, one of four prominent perceptions on social reality (the others being positivist, critical, and postmodern approaches) (Burrell & Morgan, 2017; Gephart, 2013; 2004; Neuman, 2006). The interpretivist perception focused on understanding the experiences and perceptions of teachers engaged in the mathematics intervention program. This framework highlights the significance of meaningful social action and acknowledges that social phenomena are constructed through individual and collective interpretations and meanings (Neuman, 2006). The researcher recognises knowledge's subjectivity and context dependency by embracing the interpretive perspective. This facilitates the exploration of diverse perceptions and understandings, particularly in studying complex social phenomena like implementing an intervention program in educational settings.

The study employed the interpretivist approach to investigate into the social and cultural aspects influencing teachers' perceptions and experiences of the mathematics intervention program. This perspective recognises that participants' experiences are shaped by their distinct contexts, backgrounds, and interactions, seeking to comprehend these experiences within their social setting (Pervin & Mokhtar, 2020). By acknowledging the importance of different interpretations and meanings, the researcher was able to gain a deeper understanding of teachers' perceptions on implementing the program. The interpretivist approach provided a suitable framework for this research study, enabling the exploration of teachers' subjective experiences and socially constructed meanings involved in the mathematics intervention program, contributing to a richer understanding of the social phenomena under investigation.

Furthermore, the constructivist paradigm was chosen as the approach for this study. This paradigm focuses on how individuals construct their reality, including how teachers and leaders experience supporting student achievement in mathematics using the GRIN intervention program. Constructivists argue that truth is internal and subjective, based on one's perspective.

This paradigm acknowledges the subjective nature of human meaning-making while recognising the potential for some degree of objectivity (Pilarska, 2021). The researcher's decision to adopt a constructivist perspective in the study is informed by the belief that it can offer several advantages. One key advantage was able to establish a connection and cooperation with the participants, as emphasised by Searle (1995). This approach created a conducive environment for participants to share their stories and experiences (Crabtree, 1999), which allowed a deeper understanding of their perceptions and insights. The qualitative nature of constructivism aligns with the goal of gaining insights beyond quantitative data, allowing for a richer exploration of the participants' perceptions (Lather, 1992; Robottom & Hart, 1993).

By adopting a constructivist perspective, the researcher analysed individual responses in-depth, identifying patterns, themes, and conditions that influenced the implementation of the intervention. This approach promotes a more holistic understanding of the pedagogical paradigms and human behaviours involved, providing valuable insights that can inform educational practices and decision-making. Moreover, the constructivist perspective encourages an open-minded data collection and analysis approach. It recognises the co-construction of knowledge between the researcher and participants, highlighting the importance of multiple perceptions and interpretations (Denicolo et al., 2016). This approach fosters a collaborative and inclusive research process, allowing for the integration of diverse viewpoints and facilitating a deeper exploration of the research topic.

3.3 Methodological decisions and background

Since the study looked at lived experience and did not necessarily compare outcomes against an objective measure or standard, qualitative research methods were used; these are well suited to exploring lived experiences, perceptions and understandings of participants in a particular context (Guest et al., 2013). In the context of the study on the perceptions of teachers who have participated in the GRIN mathematics intervention program, qualitative research methodologies can provide rich and extensive information that goes beyond objective measures or standards. Additionally, the research seeks to understand whether the GRIN intervention helps students overcome their mathematics learning difficulties and reach the expected learning level. The study intends to explore the underlying causes for any changes in teacher behaviours and attitudes towards students and student achievement.

Qualitative research provides an in-depth examination of the factors that impact teachers' perceptions of students and each other. The research can acquire a thorough knowledge of the dynamics and influences inside the mathematics intervention program by studying the stories, meanings, negotiations, roles, development of curriculum, and policy formation. Seidman (2006) claims that qualitative research has not been the dominant approach in the history of educational research. However, qualitative methodologies are now well-established primary modes of inquiry in the social sciences and applied fields, including education (Marshall & Rossman, 2014). In qualitative research, participants are purposefully selected to provide information-rich data for analysis and, ultimately, to meet the study's objective. Data collected through interviews, observations, focus groups and artefacts are often examined inductively to allow findings to arise spontaneously (Tavakol & Zeinaloo, 2004).

Considering the nature of the study, which focuses on examining teachers' perceptions of a mathematics intervention program at three schools, a case study methodology is the most suitable option. Case studies allow for an in-depth exploration of a specific phenomenon within a particular context, providing rich and detailed descriptions of the experiences and perceptions of participants (Lodico et al., 2010; Rashid et al., 2019). It seeks to explore the research phenomena from various perceptions, revealing different aspects of the phenomena of interest (Baxter & Jack, 2008). This aligns with the study objective of understanding the effectiveness, benefits, and drawbacks of the intervention program through the lens of teachers.

The case study methodology investigated real-time phenomena within their naturally occurring environments. It recognises the importance of context in understanding and interpreting the phenomena, acknowledging that the context can significantly influence the research outcomes (Kaarbo & Beasley, 1999). The case study methodology contains important qualitative information on the specific research issues that this approach may help address and the data sources typically employed. A case study process entails the researcher describing the conduct. This information was derived through interviews and other sources, such as observation, which gives information for future research (Crowe et al., 2011).

This study collects, analyses and interprets data using a case study inquiry approach guided by a phenomenological theoretical viewpoint. This approach is influenced by the perceptions of Yin (2003), Eisenhardt (1989), Stake (1995, 2013), and Merriam (1988), who argue that qualitative inquiry methods, such as case studies, allow for a deep understanding of the meanings embedded in the ideas, words, and actions of individuals closely related to the topic being investigated (Yin, 2009, 2015). Case study research enables the researcher to comprehensively explore and gain insights into the phenomenon, content, and culture under exploration (Merriam & Tisdell, 2015). The objective is to acquire holistic, descriptive, and explanatory insights into the situation and context, specifically focusing on how different schools address challenges and issues (Suter, 2012).

In case studies, the researcher plays an important role in the interpretive process in producing, influencing and co-constructing the research data, analysis, and findings. Case study research is often considered a transparadigmatic and transdisciplinary heuristic, meaning it transcends disciplinary boundaries and can draw upon multiple theoretical perceptions (Van Wynsberghe & Khan, 2007). This flexibility enables researchers to employ interpretive data analysis methods that focus on understanding the meanings and interpretations generated from the ideas, words and actions of the research informants.

Indeed, qualitative methods, such as case studies, can be valuable when exploring aspects that are not well-known or understood (Strauss & Corbin, 1990). The use of thick, rich and in-depth descriptions in qualitative research allows for a deeper immersion in the research context, enabling the reader to comprehensively understand the situation being studied (Merriam, 1988). One of the advantages of qualitative methodology is its inductive nature, which means that the research design and sampling procedures can be adjusted and modified based on emerging data (Guest et al., 2013, p.4). This flexibility allows the researcher to adapt their approach and focus on specific aspects or areas that become relevant as the study progresses. This iterative data collection and analysis process helps ensure that the research captures the richness and complexity of the phenomenon under investigation. Qualitative research also allows for open-ended questioning, which enables the researcher to gather additional information and insights from participants. By exploring emerging data and asking probing questions, the researcher can uncover new themes, patterns and perceptions, contributing to a more comprehensive understanding of the research topic (Creswell, 2003). This approach enhances the credibility and robustness of the study results, allowing for a thorough exploration of the data and generating meaningful findings (Guest et al., 2013).

The case study was conducted as part of a more extensive interpretive study to explore the experiences and perceptions of eight mathematics teachers and a principal who participated in a mathematical intervention program. The focus of the study was to understand the teachers' perceptions of a teaching strategy designed to support junior secondary students struggling with mathematics learning.

In this research, the case study methodology serves the purpose of theory development and comparing teachers' diverse perceptions or constructs. Case studies have been extensively employed in organizational studies and across the social sciences, including the field of education (Hartley, 2004, p. 323). One of this approach's usual pitfalls is attempting to resolve a broad query or subject (Baxter & Jack, 2008). To mitigate this, the researcher established boundaries by determining inclusion and exclusion criteria to avoid such pitfalls (Robinson, 2014). This helped ensure that the study remained focused and manageable in scope.

Using a case study methodology to investigate the effects of mathematics interventions across three diverse schools reflects a deliberate and thoughtful approach. The three schools involved in a mathematics intervention program were carefully selected to understand the specific interventions implemented comprehensively. The intention was to obtain detailed descriptions of the specific mathematics interventions implemented and assess their impact on school achievement through the lens of the participating teachers.

3.4 Interview research inquiry

Investigating teachers' perceptions of the GRIN program's impact on student achievement involves gathering qualitative data that reflects the teachers' views on how the program influences student outcomes. The measures used for assessing the impact on student achievement in this thesis included open-ended questions designed to explore areas such as: changes in students' attitudes towards mathematics, observed improvements in class participation, and any noticeable increase in confidence and readiness to learn.

In this study, selecting semi-structured interviews as a method for collecting qualitative, open-ended data is appropriate. Merriam (1988) supports the suitability of semi-structured interviews for qualitative research, and Ruslin et al. (2022) also highlight the effectiveness of this method for investigating experiences and perceptions of teachers' intervention programs. The researcher carefully planned the qualitative interview questions to align with the research questions and thesis, which aimed to investigate the teachers' perceptions of the mathematics intervention program. The semi-structured interviews allowed the participants to share their experiences and perceptions while ensuring that the interview covered specific topics relevant to the study (Roulston & Choi, 2018).

Interview schedule design

Because the study aimed to investigate participants' thoughts, feelings and beliefs regarding their experience with the GRIN mathematics intervention, it allowed the participants to take the lead in the dialogue, thus encouraging them to open up about sensitive issues. According to DiCicco-Bloom and Crabtree (2006), semi-structured interviews are an excellent technique for exploring emerging issues. Interview data described differences in collective beliefs, values and descriptions of school practice and individual teacher qualities that foster school cultures. Participants were questioned for up to 50 minutes during the data collection phase, and their answers were used to fill gaps in the study research questions.

Indeed, interviewing is acknowledged as a powerful method for gaining insight into educational and social issues. By conducting interviews, researchers can directly interact with individuals whose lives reflect the issues under investigation, allowing for a deeper understanding of their experiences, perceptions, and insights (Van der Mescht, 2004). The interviews aimed to reveal the phenomena of experiences as they occur, providing valuable insights into the complex phenomenon of the GRIN mathematics program (Firestone, 1987). The interviews followed an interview protocol, which included a checklist and a background interview structure, guiding the researcher and ensuring important areas were covered during the interview process (refer to Appendices D). Participants were provided with a detailed explanation of the procedure, their voluntary participation and right to withdraw at any time (refer to Appendix C) were respected and they were treated 'fairly and respectfully in the research process' (Brooks et al., 2014, p. 102).

The COVID-19 pandemic significantly impacted the data collection process for this study. Due to the restrictions and safety concerns imposed by the pandemic, a combination of face-to-face and online interviews were conducted with the participants, which allowed for direct interaction and in-depth exploration of the topics. This format facilitated a deeper understanding of the participant's perceptions and experiences related to the GRIN program. The open-ended nature of the interview questions provided an opportunity for the participants to share their thoughts, feelings and insights freely without being constrained by predetermined response options. The interviews occurred once for each participant. The interviews were conducted in Term 4, 2020 and Term 2 in 2021, when the school is not so busy.

In-depth interviews were conducted with eight mathematics teachers and a principal, including three numeracy leaders. Involving multiple participants from different roles within the school provides diverse perceptions and insights into the research topic. The duration of the interviews varied but was typically around an hour. The reflective nature of the interview process allowed participants to recollect and detail their experiences, contributing to a deeper understanding of the phenomenon.

The structure and focus of interview questions

The researcher developed the interview questions through a meticulous literature review, ensuring a comprehensive coverage of the intervention program's aspects. This approach guaranteed that the interviews addressed various facets of the participant's involvement in the mathematics intervention program. By grounding the interview questions in existing research, the study aimed to assess the impact of the intervention program on teachers' perceptions of how the program influenced teaching practices and student outcomes.

The interview questions focused on understanding the current workload and schedule alignment of teachers with the implementation of the GRIN program. By exploring these aspects, the study aimed to gain insights into how the program fits into teachers' existing responsibilities and how it impacts their workload and schedule; to understand how the resources and support available at the schools' current work situation that may contribute to the successful implementation of the GRIN program; and to identify the level of support and collaboration among the teachers and superiors in relation to the GRIN program and identify any specific challenges or areas of improvement that the teachers have identified. Finally, the researcher wanted to determine the specific factors that teachers believe could influence the effectiveness and sustainability of the GRIN program or any changes or adjustments that teachers feel would be beneficial.

A thorough and comprehensive literature review significantly shaped the formulation of the interview questions for this study. Prior research meticulously identified six key factors that strongly influence teachers' perceptions of mathematics intervention programs. These six factors, drawn from the existing literature, served as a robust conceptual framework for developing the interview protocol used in the current study. The interview questions were intentionally structured to systematically explore the teachers' perceptions across these six topical areas: the GRIN Program, Current Work Situation, GRIN Collaborative, Classroom Teaching Situation, Participants' Perception of the GRIN Program Outcome, and Professional Development. This comprehensive coverage ensured that the interview addressed various aspects related to the participant's involvement in the mathematics intervention program.

Under these six topics there were 38 sub-questions. These sub-questions were used as probes to gather more detailed information based on the participants' responses. The use of semi-structured interviews provided flexibility in the questioning process, allowing the interviewer to adapt and follow up on interesting points raised by the participants (Adams, 2015). This approach is particularly useful when exploring personal and sensitive issues, as it allows for a deeper understanding of participants' thoughts, feelings, and beliefs regarding the GRIN intervention program.

In addition to the numbered questions, follow-up questions were used to further explore interesting or significant issues raised by the participants in their responses. These follow-up questions aimed to delve deeper into specific points, seek clarification or encourage participants to provide more details about their experiences. For example, the researcher could ask, 'Can you tell me more about what you mean by that?' This type of probing question helps to elicit further elaboration and provides a more comprehensive understanding of the participants' perceptions. While the interview questions were organised around central themes, the interviewer had the flexibility to explore additional areas or follow unexpected leads that emerged during the conversation. This adaptability ensured that the data collection remained focused on the central themes while allowing for a more holistic exploration of the participants' experiences and perceptions.

Interview settings

Furthermore, the researcher organised a supportive environment by meeting the participants in person or online at their workplace, in order to provide a familiar and comfortable setting that encouraged participants to share their experiences more freely. According to Marshall and Rossman (2014), the environment is vital for asking focused questions, promoting discussion and reconciling differing beliefs and points of view. This supportive environment contributed to the richness and depth of the data collected during the interviews.

Meeting participants at their workplace also offered the advantage of convenience and accessibility, as they were likely to be more available and engaged in the interview process in a familiar setting. Additionally, being in their work environment may have facilitated discussions related to their experiences and practices as mathematics teachers and leaders.

For the interviews, the researcher used audio recording; this has the advantage that the interview report is more accurate than taking handwritten notes (Myers & Newman, 2007).

These voice recordings were analysed, and the notes stored using only a coded reference which is stored securely and accessible only to the researcher and the supervisors.

3.5 Ethical considerations for data analysis

The research study focuses on human beings. Therefore, the researcher has a fundamental ethical obligation to protect the rights and welfare of the participants. This responsibility is rooted in the principles of respect for persons, beneficence, and justice (McMillan & Schumacher, 2010). Before the data collection stage, the researcher received approvals from the Victoria University Human Research Ethics Committee and the Victorian Government Department of Education and Curriculum Development (DEECD). These approvals indicate that this research design and procedures have been reviewed and deemed ethically sound by the relevant authorities.

Due to the interruption of the COVID-19 pandemic, the DEECD allowed a 12-month extension for conducting interviews with the study participants, extending the timeline until 25 November 2021. This flexibility allowed for adjustments to account for unforeseen circumstances and ensured the research could be conducted with the participants' well-being in mind. The data collection period was thus set to cover a two-year timeframe, from November 2019 to 25 November 2021. The majority of interviews took place between October 2020 and May 2021, indicating the specific window during which participant engagement occurred.

While the study is considered low risk because the participants are adults, it is still necessary to gain their informed permission. Ensuring that participants are fully aware of the study's purpose, procedures, potential risks and benefits, and their rights as research participants is crucial for ethical research conduct. A two-page document describing the research in plain language and an informed consent page (refer to Appendix C) were provided. This page outlined how responses were de-identified, securely managed, and archived, and any participant could opt out of the program at any time. Any information previously obtained from participants who chose to opt out was appropriately destroyed. By seeking informed consent, the researcher prioritises transparency and respect for the autonomy of the individuals involved (NEAC, 2021).

The researcher contacted the principals of 13 secondary schools in Victoria participating in the GRIN program and the Department of Education schools and colleges in Victoria, requesting permission to recruit teachers and tutors for the study. Permission was sought via email (refer to Appendix A). The research investigation's goal and the benefits of data collection were clearly explained (see Ethical Considerations section). Information letters and consent forms for participants were distributed via email with the principals' permission. Based on their principal's recommendation, the researcher distributed information sheets and consent forms (Appendices B and C) to teachers and school leaders. Those who accepted the invitation were asked to provide their contact information, and a mutually convenient time for the interview was established. Participants' signed consent forms were returned directly to the researcher before the commencement of the interview.

A few concerns have influenced the ethical procedures for doing this research. The case study between the schools may be viewed negatively by the participants. To minimise this potential perception, the researcher emailed participants to clearly explain the project scope before participating. Furthermore, participants who volunteered to participate in any aspect of the study had the procedures thoroughly explained to them. This step demonstrates the researcher's commitment to transparency and informed consent. Participants were made aware of the study's processes, including the interview format, and were free to withdraw from the study at any time. This approach respects their autonomy and empowers them to make choices that align with their comfort and well-being.

The present study examined the potential psychological risks associated with participant interviews. Specifically, the study focused on the stress participants might experience if they unintentionally disclosed personal beliefs and thoughts about mathematics intervention programs and the consequences of such a disclosure. To minimise any potential discomfort or distress, the interviewer sensitively posed questions. Participants were explicitly informed of their right to refuse or withdraw from the interview before, during, or after its completion, ensuring that they maintained control over their boundaries and that their psychological well-being was prioritised. Additionally, the interview questions were structured compassionately to reduce potential distress from the interview procedure. Finally, the interview audio recording was carefully assessed to determine the risks and gains associated with the study. The results of the study indicate that the gains were clear and measurable.

This study considered several ethical considerations regarding power dynamics between the researcher and the research participant. The teachers who participated in this study were given the flexibility to voice their opinions on the themes covered. However, if a particular issue was sensitive, the responder could choose not to respond or discuss it privately. The interviews were conducted privately, ensuring confidentiality and creating a safe space for participants to share their experiences. The researcher treated the participants fairly and respectfully throughout the entire research process, as emphasised by Brooks et al. (2014, p. 102). As a mathematics teacher, the researcher shared their professional background with the participants, allowing for a certain level of reciprocity in the interviews. This reciprocity, as described by Maiter et al. (2008), involves an 'expectation of return that takes place between people with a social bond, which is strengthened by the exchange' (Maiter et al., 2008, p. 307). The participants and the researcher shared a common understanding of the challenges faced in intervention programs and facilitated meaningful and insightful discussions during the interviews. This shared perspective can enhance rapport and trust between the participants and the researcher, contributing to a more fruitful exchange of information.

In this study, the ethical guidelines were strictly followed to re-identify participants. This means that all individually identifiable or re-identifiable data, such as audio transcripts of interviews, have had all identifiers removed and replaced with pseudonyms. Although there may not have been complete control over the actions of others, all research procedures were guaranteed to be conducted per established rules and regulations in all circumstances. According to Lodico et al. (2010), there is an ethical obligation to protect participants and the profession throughout the study process. Each participant was provided with a letter of agreement outlining their rights and how harm to them would be minimised. Finally, the information gathered was used ethically and responsibly.

3.6 Participant selection and recruitment

The study was conducted with participants from two school systems in Victoria, the private and government systems. The focus of the study was to investigate the perceptions of junior secondary school mathematics teachers and school leaders responsible for implementing the GRIN Intervention Program to support students outside of class.

The selection of schools was initially made by conducting a Google search from the Monash University website, which served as a resource for information about the GRIN Intervention Program and provided articles and participant testimonials from schools that had implemented the program. Additionally, the Victoria Department of Education's websites were consulted to identify schools that had successfully applied for the GRIN program. Word of mouth from school principals and teachers' colleagues also played a role.

To establish contact with potential participants for the study, the researcher took the following steps:

1. Contacting School Principals: The researcher contacted school principals to seek permission to interview teachers involved in the GRIN Intervention Program. This initial contact was crucial to gain access to the participants and ensure that the study was conducted with the necessary approvals.
2. Recommendations from School Principals: Based on the recommendations received from the school principals, the researcher identified specific teachers who were actively involved in the GRIN Intervention Program. These recommendations served as a valuable source of information for selecting suitable participants.
3. Sending Invitation Emails: The researcher sent personalised invitation emails to the identified participants, explaining the purpose of the study and requesting their participation. The emails included details about the study's objectives, the interview process and the expected time commitment.
4. Participant Response and Contact Details: Participants who accepted the invitation to participate in the study provided their contact details to the researcher. This information was essential for scheduling the interviews and ensuring effective communication between me and the participants.
5. Mutual Agreement on Interview Time: Once contact details were exchanged, the participants and the researcher agreed upon a suitable time for the interview. This ensured that the interviews could be conducted at a convenient time for both parties.

Following this approach, after 18 schools were contacted, the researcher successfully established contact with the potential participants and initiated the interview process for the study. Nine participants, representing three schools, were selected for the interviews. The participant group included eight teachers – five mathematics teachers teaching at the junior secondary level, three numeracy leaders overseeing the program – and one principal. These participants were actively involved in implementing and delivering the GRIN Intervention Program.

The participants' roles and assignments within the GRIN Intervention Program varied across the schools. Two junior mathematics teachers from school A were assigned to the support program, while two numeracy mathematics teachers from school B were assigned to the program. School C had two external mathematics teachers assigned explicitly to the intervention program. By selecting participants from different schools and including a variety of roles and perceptions, the study aimed to capture a diverse range of experiences and perceptions related to the GRIN Intervention Program

The following pseudonyms have been assigned to the schools and participants in this study: GRIN tutor T1A, GRIN tutor T2A, and GRIN Numeracy Leader L1A, all of whom are from the same secondary school A. Also from secondary school B are GRIN tutor T3B, GRIN tutor T4B, and GRIN Numeracy Leader L2B. There is also a GRIN tutor T5B, a GRIN tutor (T6C), who is also a numeracy leader, and a principal (PC) from the same secondary school (School C). As a summary in the table below:

Table 3.1 Breakdown of interview participants by school and category

School	Grin teacher	Numeracy leader	Principal	Total
School A	2 (T1A, T2A)	1 (L1A)	0	3
School B	2 (T3B, T4B)	1 (L2B)	0	3
School C	1 (T5C)	1 (T6C)	1 (PC)	3

During the research interview, not all of these schools were running the GRIN mathematical intervention program; however, all had previously run the GRIN program, with some taking time off from the GRIN program while students were learning online. Furthermore, all participants were math-trained graduates with bachelor's degrees in teaching specialising in mathematics, except for School C's principal, who is not a math-trained graduate. The session below contains information on three schools and their GRIN strategy.

3.7 The schools and participants' backgrounds and their GRIN implementation

School A is an independent school in a rural area of Victoria. The school has an enrolment of more than 1100 students from three campuses extending from Early Learning Centres to Year 12, with 99 teaching staff. School A has fewer than 50 students who are Indigenous or who speak a language other than English (EAL) at home. The two teachers who participated in the research study were from the senior campus, which serves students in Years 7 to 12. The two GRIN teachers were skilled and experienced math teachers who have participated in several numeracy interventions; however, T1A had greater expertise in GRIN mathematics intervention than T2A, who was new to the program. The third participant from school A was a pathway teacher (LA1) who assisted struggling students studying across all campuses. Due to the COVID-19 pandemic lockdown in 2020, the school moved to online learning and was not running the GRIN program at the time of the interview. The student background Index of

Community Socio-Educational Advantage (ICSEA) was 1094, slightly higher than the Victorian average ICSEA score of 1000 (the higher the ICSEA value, the greater the educational advantage of this school's students; ACARA, 2016). In terms of socio-educational advantage (SEA) distribution in school distribution, 4% of students were in the bottom quartile compared to an average of 25% for Australian schools.

GRIN Background: The study aimed to investigate participants' thoughts, feelings and beliefs regarding their experience with the GRIN mathematics intervention, allowing the participants to take the lead in the dialogue. Interview data described differences in collective beliefs, values, and descriptions of school practice and individual teachers who foster school cultures. Participants were questioned for up to 50 minutes during the data collection phase, and their answers were used to fill gaps in the study research questions.

School A was involved in the GRIN trial when it was first established, and several numeracy leaders had received GRIN training. GRIN was operational on the senior and junior campuses. The deputy leaders' team has been designing and implementing the GRIN at the senior campus in recent years. Teachers sometimes undertake GRIN tutoring to cover their teaching loads without GRIN training. However, more priorities were set at the junior school (primary school levels), where the school leaders assist teachers by coaching and mentoring GRIN approaches and strategies. Teachers working in GRIN are given time to plan and collaborate. The GRIN program at senior was implemented at the school to assist students in Years 7 and 8 performing at or below grade level. This program attempts to provide access to small-group tutoring for students with low levels of mathematics success. GRIN lessons were held three times each week for 20 minutes each.

School B is a public school in Victoria's metropolitan area. School B is a multi-campus school with two campuses for students in Years 7–10 and a Year 11–12 campus. It has a student population of 2232, 201 equivalent full-time teaching staff, 70 Education Support Staff and seven Principal class personnel. The students are predominantly Vietnamese, Chinese and Indian. English as an Addition Language (EAL) is taught at all campuses. The three teachers who participated in the research study were from the junior campuses serving students in Years 7 to 10. One was a numeracy leader in charge of designing and implementing the GRIN, and the other two GRIN teachers were numeracy teachers assigned to special teaching students with mathematics learning difficulties. The student background ICSEA score was 959, lower than the national average of 1000.

Regarding SEA, 52% of students were in the bottom quarter, compared to an average of 25% for Australian schools. In 2020, 59% of students spoke a language other than English, and one per cent were Indigenous. Because of the difficulty in implementing the GRIN program in a school context, the school decided to stop running it; this is explained in detail in the findings section.

GRIN Background: The GRIN program was introduced to School B when their school's NAPLAN and online testing data showed that students' performance in numeracy was low. The GRIN program was chosen as the intervention program for Years 7 and 8 to address students' difficulties when learning mathematics. The school chose students who were only slightly behind, as there were too many students who were very far behind for the school to catch up. Selected students were taken out of class twice a week at recess, lunchtime, and after school to participate in a group of three students for 20-minute tutoring sessions. These sessions gave the students a head start on the math topic in the subsequent lessons. The tutor session aimed to provide students with a solid foundation in the mathematical principles and terminology to help them excel in the subject.

School C is a medium-sized Year 7–12 government school in Melbourne's suburbs. The school now has approximately 700 students enrolled with 76 teaching staff. The school has a substantial number of diverse students, including a significant EAL student population and over 65 cultural groups represented. The student background ICSEA was 976, slightly lower than the national average of 1000.

Regarding SEA, 43% of students were in the bottom quartile, compared to an average of 25% in Australian schools. The school has a reporting system that informs parents and guardians of their child's progress every five weeks. The interviews were conducted with a principal, a numeracy leader (numeracy coach) and a GRIN tutor. School C's principal (PC) prioritised the program in the school environment, ensuring that all parents, teachers and students had a positive attitude and were on board with the program. During the COVID-19 pandemic lockdown in 2020, School C continued implementing the GRIN program as the school transitioned to online learning. In 2021, the school took advantage of a government-funded tutoring program by investing more in the GRIN program and employing two more GRIN tutors.

School C was selected to participate in this study based on a referral from a principal at another secondary school to the researcher. The principal expressed an interest in implementing the

GRIN program and sought further insight into its processes. Consequently, the principal visited School C to learn about the successful implementation of a similar intervention program. Impressed by the positive results at School C, the principal suggested that the researcher explore the program there.

The innovative aspect of School C's program lies in its "frontloading" content. Delving into the experiences and perceptions of numeracy coaches and other participants at School C yields a significant understanding of the Front-Loading program and its alignment with the GRIN program's objectives.

Intervention Background: School C used a coaching strategy to improve Front-Loading tutor competency. The coach was employed to support the tutors by monitoring and providing feedback on lesson delivery on a regular basis. The numeracy coach also collaborated with teachers and tutors to plan the learning intentions for the upcoming lessons and develop strategies to ensure students' mathematical improvement. In addition, the school implemented a number of programs to support students at or below grade level to improve their learning, as well as an 'enhancement program' for students above grade level.

At the start of every topic in Years 7, 8, and 9, the students are pre-tested using a combination of formal assessment strategies. This establishes each student's learning needs at the commencement of a topic. Students then participate in numeracy to extend their existing knowledge. This means that students are taught from their identified level of knowledge and understanding. The students who were just a little bit behind – maybe six to 12 months behind or curriculum levels level three, level four – will come out of class, often in groups of three or four, on a withdrawal program with a qualified mathematics teacher in the school, often a teacher who teaches the same year level of student to do the GRIN program. The students get extra support around that topic, particularly around the language and the modelling, and the teacher will recap.

A summary of the schools' profiles is shown in the table below.

Table 3.2 School/student background

SCHOOL	STUDENTS ENROLMENTS	ICSEA	BOTTOM QUARTER	TEACHING STAFF	EAL	INDIGENOUS STUDENTS
School A	1005	1094	4%	99	5%	1 %
School B	2232	959	52%	201	59%	1 %
School C	690	976	43%	76	55%	7%

Source: myschool website, 2020.

It should be noted that the three programs referred to as GRIN are based on the initiative and structure derived from the GRIN program, even though School C's program differs in certain respects. However, participants referred to it as GRIN because the intervention's framework and structure originated from the GRIN program.

3.8 Data analysis

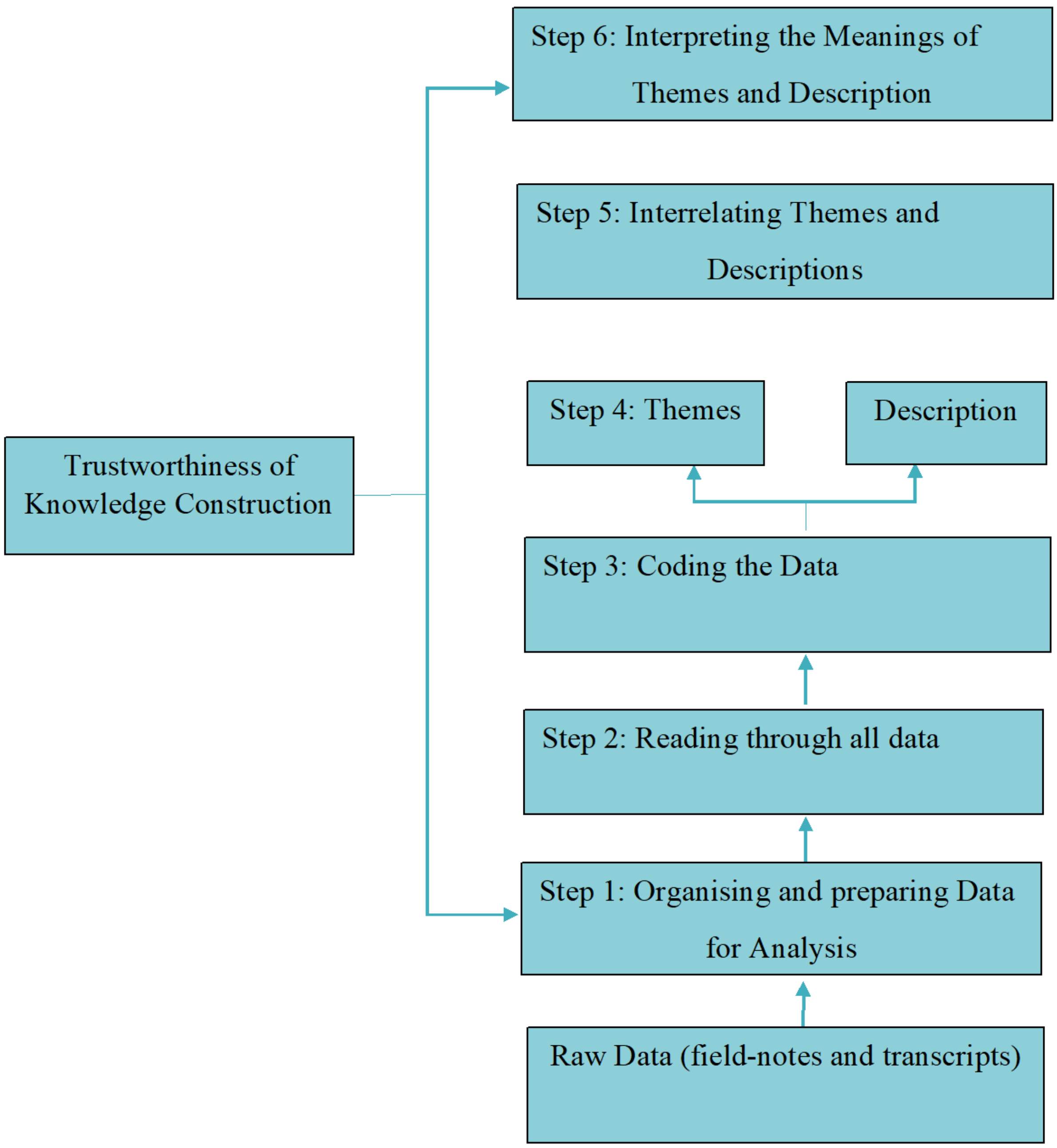
The study aimed to explore teacher perceptions of the GRIN mathematics intervention in secondary schools. In line with this aim, the study question intended to collect comprehensive and unique data that was analysed using inductive reasoning and holistic analysis (Khan, 2014). Creswell (2003) defines research methods as explicit descriptions of procedures involving collecting data to be analysed. The analysis begins with a process of organising data, though the procedure varies according to the approach underlying the research. For example, immersion (Miller & Crabtree, 1999) requires closely inspecting the data, extracting themes, making analogies and developing theoretical notions. The researcher uses data collection to generate an emerging understanding of the research questions being asked in order to attain the aims and expected outcomes.

Crotty (2020) emphasises the importance of illustrating the types of procedures used, how these methods are used, and the context and place in which these methods are used. Furthermore, Crotty emphasises the importance of depicting the types of actual activities, such as (1) uncovering themes and recognising or interpreting their meanings; (2) how these themes emerge and how they are recognised; and (3) the actual actions taken in response to the emergent themes.

The subsequent steps involve modes of interview analysis (Kvale & Brinkmann, 2009), categorisation and coding (Richards, 2003), and cross-case analysis (Bruce et al., 2011). As Creswell (2003) outlined, data analysis in qualitative research encompasses preparing and organising the data for analysis, condensing the data into themes, and presenting the findings through figures, tables, or a discussion.

The data analysis for this study was structured, coded, and interpreted using the analysis process based on Creswell's (2009) Data Analysis in Qualitative Research flowchart, as depicted in Figure 3.1. This flowchart outlines a comprehensive set of phases that guide the researcher from organising and coding the data to interpreting it, ultimately leading to the conclusion of the interview process.

Figure 3.1 Process of analysis based on Creswell (2009, p. 185)



The interview data analysis was facilitated by NVivo 12, a qualitative data analysis software application that assists with data management and organisation (Paulus et al., 2017). During the initial qualitative analysis, the researcher listened to the audio recordings of eight participants' interviews and examined the field notes taken for one participant. The analysis involved carefully reading the interview transcripts and recording impressions of the participant's responses to the interview questions. The researcher then created a list of relevant points highlighting the teacher's experience with the mathematics intervention program.

To ensure accuracy and consistency, the researcher paid attention to the statements made by each participant and defined words or thoughts, which were all comparable weighted insignificance. They did not contradict one another, establishing emergent expressions from each transcript and backing them up with evidence from the transcripts. The phrase would be removed if it could not be supported.

This analytical approach was applied separately to the nine interviews, ensuring a comprehensive and consistent data analysis. Through this process, the researcher gained valuable insights into the teachers' experiences and perceptions on the mathematical intervention program. The data from the participant interviews were transcribed at the initial stages of data analysis, and pseudonyms were assigned to the schools and participants, as mentioned above.

Step 1 is organising and preparing data for analysis. For this step, the researcher went back to the interview guide to organise the data by identifying and differentiating between the questions/topics attempting to answer and those merely mentioned as significant in the interview guide. The researcher organised all the data from the transcript into NVivo12, allowing them to go through each topic to pick out concepts and themes (see the example in Table 3.4).

Table 3.3 An example of an interview question organised from the transcript

	TEACHER VOICE	NUMERACY LEADER VOICE	PRINCIPAL VOICE
Topic 1: GRIN PROGRAM			
QUESTION 4: Which focus group of students should be involved in the GRIN/Front loading program?	T1A & T2A been told by administrator. • Students that were in level four at Maths', at standard, just a little bit below. (T1A) • they're not the very weakest students (T2A) • Students with their maths level was very low than an average (T3B) • looked at PAT M data and chosen kids that stand on, around two or three. (T4B) • Based On Demand testing and PAT testing at the beginning of the year. Groups who are a group of about 12 to 18 months behind (T5C)	• those who will benefit from pre teaching (L1A) • lot of our pathway students were involved (L1A) • students who need to consolidate their foundations of our fundamental math skills (L1A) • At training they suggest aiming at those kids that with just a bit below the level.... But we take kids that were maybe a bit lower than was their ideal (L2B) • it's based on their PAT maths data (L1A, T6C) • students at around two or three levels (T6C) • it is based on data. We're looking for students who are roughly about a year, maybe 18 months below (T6C)	It is formative assessments, whether it's an application task or analysis. Depend on every topic tested assessed, the students who are below standard were selected (P1C)

This method was used for the six topics and 38 questions (see Appendix D). Not all questions were addressed to all participants; an abbreviation is used at the end of each question to indicate which participants were to be asked which questions (see Appendix D for further information).

Step 2 involves reading through all the data. After organising the data in step 1, the researcher reviewed all the data in the NVivo12 chart numerous times. This process enables the researcher to acquire a general impression of the information and thoughts expressed by the participants. At this stage, the researcher proceeds to the next step: identifying and organising ideas and concepts into categories.

Step 3 is coding the data. At this step, the researcher did preliminary coding to find and organise ideas and concepts by picking words/topics that identify and differentiate across questions/topics in the interview and looking for developing themes (Adu, 2019; O'Connor & Gibson, 2003). In this initial inductive reasoning technique, data were systematically compared and contrasted with emergent patterns and categories from the literature and empirical data as a lens for the study (Miles & Huberman, 1994). An example from the focus group of students targeted (data used to identify/ how the school selected)

> 'Students that were in level four at maths', at standard, just a little bit below. They're not the very weakest students. At training they suggest aiming at those kids that are just a bit below the level…. But we take kids that were maybe a bit lower than was their ideal…'

Next was secondary coding. As Creswell (2009) describes, secondary coding is an important step in the data analysis. It involves further refining the initial coding by identifying words, concepts, and ideas frequently used or stand out in the data. This process allows for a deeper understanding of the data and helps to derive meaning from it. During secondary coding, the researcher examines the coded data and looks for recurring words, concepts, or ideas that have emerged across different interviews or data sources. These recurring elements are then organised into codes or categories, representing higher-level themes or concepts.

Table 3.4 Example of categories of the data

Question/Topic	Responses	Categories
Background of GRIN students (criteria use to select GRIN students)		
How does the student select into the program?	Students that were in level four at Maths, at standard, just a little bit below. Looked at PAT M data and chosen kids that stand on, around two or three	Target Students Data used for selecting student.

Step 4 involved using the data to create overarching themes, with the researcher using coding to describe the analysis. Each response category has one or more related themes contributing to the data's meaning. Different categories can be merged into a single overarching category. Then, the researcher came up with a limited number of topics or categories. This shows that the researcher had compiled a list of statements concerning the practices' current experiences. For example, one of the themes that emerged from the student selection data above is that this participant confirmed that GRIN students are specifically selected. The theme of Target Students emerges from the responses.

Step 5, which involves interrelating themes and descriptions, is essential to the data analysis. In this step, the researcher considers how the identified themes and descriptions can be expressed or communicated effectively to convey the analysis findings

Step 6, the final stage, involves interpreting the meanings of themes and descriptions. In applying this process to individual interviews, both textural and structural descriptions were utilised. Textural descriptions, as outlined by Moustakas (1994), convey what was experienced. In contrast, structural descriptions elaborate on when and how specific experiences occurred, especially in the later stages when the interviews were transcribed, categorised, and entered directly into the NVivo software (Morse & Richards, 2002). Systematic cross-matching of information further strengthened the interpretations of the data in relation to the literature reviewed and the theoretical framework employed as a lens for the study.

After completing the individual analysis, these statements were then followed by the development of initial themes (Williams & Moser, 2019), with over 30 coding functions whereby participants' responses were highlighted and coded. These codes were clustered and reviewed to create tentative category names, which were filtered into five themes and 13 subthemes (see Table 4.1 in the next chapter).

3.9 Trustworthiness

The researcher is a mathematics teacher at one of the secondary schools chosen for the study. To ensure the trustworthiness of the research study, the researcher took steps to address these potential biases and demonstrate a commitment to rigorous and reliable research. As Maxwell (2008) highlighted, focusing on personal desires in data collection and analysis without thorough consideration can lead to a defective and biased study or erroneous findings. Therefore, the researcher meticulously grounded the study's findings in trustworthiness, dependability, transferability, and confirmability (Lincoln & Guba, 1985; Mertler, 2016) to demonstrate a commitment to rigorous and reliable research.

The researcher's initial consideration in determining trustworthiness was credibility, as it fundamentally requires correlating the study's findings with reality to validate their truth (Statistics Solutions, 2017). Interviews and document analysis were employed as methods to enhance the credibility of the research. This was done to ensure that the emerging findings aligned with reality and accurately represented the participants' perceptions, per the guidelines set forth by Creswell and Creswell (2017) and Merriam and Tisdell (2015). Furthermore, member checking was employed to scrutinise the data and interpretations to ensure that the findings were accurately portrayed, as recommended by Johnson et al. (2020). Member checking is defined by Creswell and Creswell (2017) as a conversation between the researcher and an informant to evaluate the interpretation and reliability of data obtained. Member checking also enables the participant to extend further to attain accuracy for answers provided during interviews. By involving participants in this feedback loop, the researcher enhanced the credibility and trustworthiness of the study.

According to Johnson and Christensen (2019), the researcher must be aware of its potential impact on the credibility of the study research. According to them, researcher bias can occur when 'personal views and perspectives affect how data are interpreted, and the research is conducted' (Johnson & Christensen, 2019, p. 249). Being conscious of this risk allows the researcher to actively mitigate bias and maintain a more objective stance throughout the research process.

Transferability is crucial for demonstrating the applicability of this study's findings to other contexts or settings, such as similar settings, populations or phenomena (Merriam & Tisdell, 2015), as the study took place at private and public secondary schools in Victoria. Qualitative analysis involves providing thorough descriptions and rich details, making it possible for other researchers to assess the relevance and potential transferability of this study's findings to similar situations or populations (Lincoln & Guba, 1985; Statistics Solutions, 2017).

This study applied confirmability theory; confirmability is 'the degree of neutrality in the research study's findings' (Statistics Solutions, 2017, p. 4). In other words, the conclusions drawn were based solely on the participants' responses and not influenced by any personal objectives or biases. This requires ensuring that bias does not influence perceptions of what research participants say in order to fit a particular narrative (Statistics Solutions, 2017). To ensure confirmability, the researcher provided an audit trail illustrating each data analysis step to provide a rationale for the decisions made. Furthermore, careful documentation and information rechecking ensure consistency throughout the study (Statistics Solutions, 2017) and ensuring that the data comes from the participants and not the researcher aids in eliminating bias in the study (Pandey & Patnaik, 2014). Finally, the researcher aimed to ensure that data analysis was dependable. This means that other researchers should be able to repeat the study and get consistent findings (Statistics Solutions, 2017). Dependability is concerned with the stability and consistency of the data over time and the conditions under which the study was conducted (Elo et al., 2014).

A study of a phenomenon experienced by a student may be very similar over time. However, conditions will change in a study of an intervention program instituted at a school. By keeping an audit trail, conducting peer debriefings and involving independent individuals in analysing and examining the research process, the researcher established the dependability of the study. This trail provides transparency and allows for the replication of the study by other researchers, ensuring consistency and repeatability (Statistics Solutions, 2017). This includes the researcher rereading and double-checking transcripts, comparing data to codes, and seeking confirmation from supervisors to further contribute to the dependability of the findings. Throughout the coding process, the researcher compared data to the codes to confirm their intended description used them. Additionally, the researcher sought confirmation from researcher supervisors to guarantee that the findings or specific emergent themes were correct.

3.10 Data storage and access

The details regarding the storage and access control of participant data in this study are as follows: A file linking participants' names to pseudonyms is stored on a password-protected computer and is separate from the interview transcripts; only the researcher has access to this material. All participants in all reporting and intermediate analyses were assigned a pseudonym. Only the researcher supervisors and the researcher heard audio recordings, and all transcripts and summaries utilised pseudonyms. Audio data were stored in password-protected digital audio files on a secure D Drive system at Victoria University, Footscray Campus, and the interview response file contains non-identifiable personal data kept in a locked filing cabinet.

Participants were informed that they could withdraw unprocessed, re-identified, and personally identifiable data throughout the research. In addition, all files and documents relevant to participant data and information have been kept on file under Victoria University policy. They are accessible to appropriate authorities for five years after the thesis is submitted to the university. These steps contribute to the research's ethical conduct and maintain the study's trust and integrity.

3.11 Limitations

The chosen research methodology is subject to certain constraints that have influenced the interpretation of the findings. For instance, the study may have a limited sample size, with only 3 schools participating. This small sample may not represent the diverse range of educational settings and demographics, such as socioeconomic status, geographical location, or student abilities. As a result, the findings may be biased and not generalisable to a wider population of schools. Additionally, reliance on interviews and teacher feedback can introduce bias, as participants might provide socially desirable responses or may not accurately recall past events.

Furthermore, different schools might have varying standards for internal assessments and feedback mechanisms, leading to inconsistent data quality. For example, School C might use different metrics or testing rigour compared to Schools A and B. Furthermore, differences in how the GRIN/GRIN-alike program is implemented across schools can also affect the outcomes, as some teachers might adhere strictly to the program guidelines, while others might deviate, leading to variable results. Lastly, factors such as school environment, administrative support, and available resources can significantly influence the outcomes but may not be adequately controlled or accounted for in the study.

3.12 Summary

This chapter presents an overview of the methodology employed in the research study, including a qualitative phenomenological approach to analysing a mathematics intervention program while also considering human rights. The chapter covered various aspects of the methodology, including the use of purposeful and snowball sampling measures, inclusion and exclusion criteria, and the multi-step recruitment process applied in the study. Additionally, the chapter highlighted the use of in-depth, semi-structured interviews for data collection conducted with a diverse group of participants. The interviews were then transcribed and analysed using a multi-step inductive analytical process, which involved identifying themes and patterns in the data. This process allowed for a deeper understanding of the experiences and perceptions of the participants and the effectiveness of the mathematics intervention program. Finally, the chapter concluded by addressing the measures taken to ensure the credibility and trustworthiness of the findings. These measures included member checking, peer debriefing, and the use of multiple data sources. Overall, the methodology used in this study provides a rigorous and comprehensive approach to analysing a complex intervention program while also considering human rights.

Chapter 4: Findings Regarding the GRIN Program Implementation

The purpose of this chapter and chapter 5 are to present the findings from the interviews, including commentary on the interpretation and contrasting meanings of the data. Although there is a separate discussion chapter, this findings section combines both results and some interpretative discussion. The researcher provides preliminary interpretations of the data here, highlighting important points and arguments that will be elaborated upon in the discussion chapter. This approach allows for a more integrated understanding of the data and sets the stage for a deeper exploration in the subsequent discussion.

4.1 Introduction

This phenomenological study aims to learn about the experiences of leaders and teachers in the numeracy assistance program. Participants comprised one principal, two numeracy leaders, and six GRIN tutors, four of whom were junior secondary mathematics teachers, one a retired math teacher, and one a numeracy coach. Two GRIN tutors at School A were appointed to the support program, and two GRIN tutors at School B are numeracy teachers assigned to the program. Two GRIN tutors at School C were explicitly engaged in the intervention program.

This chapter focuses on presenting and analysing the results of the qualitative approach used to capture the experiences and perceptions of mathematics teachers and school leaders directly involved in implementing the mathematics intervention program. The primary goal is to provide readers with valuable insights into the potential barriers and opportunities to implementing the program, as perceived by the teachers who played a central role in its implementation. The qualitative data obtained through interviews are the focal point of this implementation of the discussion.

4.2 Overall background of the research findings

The qualitative research study relied on teacher interviews to address the main research question – How is the GRIN mathematics intervention program perceived by teachers at three secondary schools in Victoria? – and the two sub-questions: How does the GRIN/GRIN-alike program impact teachers' perceptions of teaching mathematics? And What changes in student achievement have been reported by teachers since the implementation of the GRIN/GRIN-alike intervention program? Structurally, descriptions were constructed based on interviews conducted with mathematics teachers to address these questions. Analysing these descriptions made it possible to generate composite descriptions that encapsulate the core aspects of the phenomena under investigation. The table below shows the results, classified into five themes and 13 subthemes.

Table 4.1 Summary of themes and subthemes that emerged from qualitative study interviews

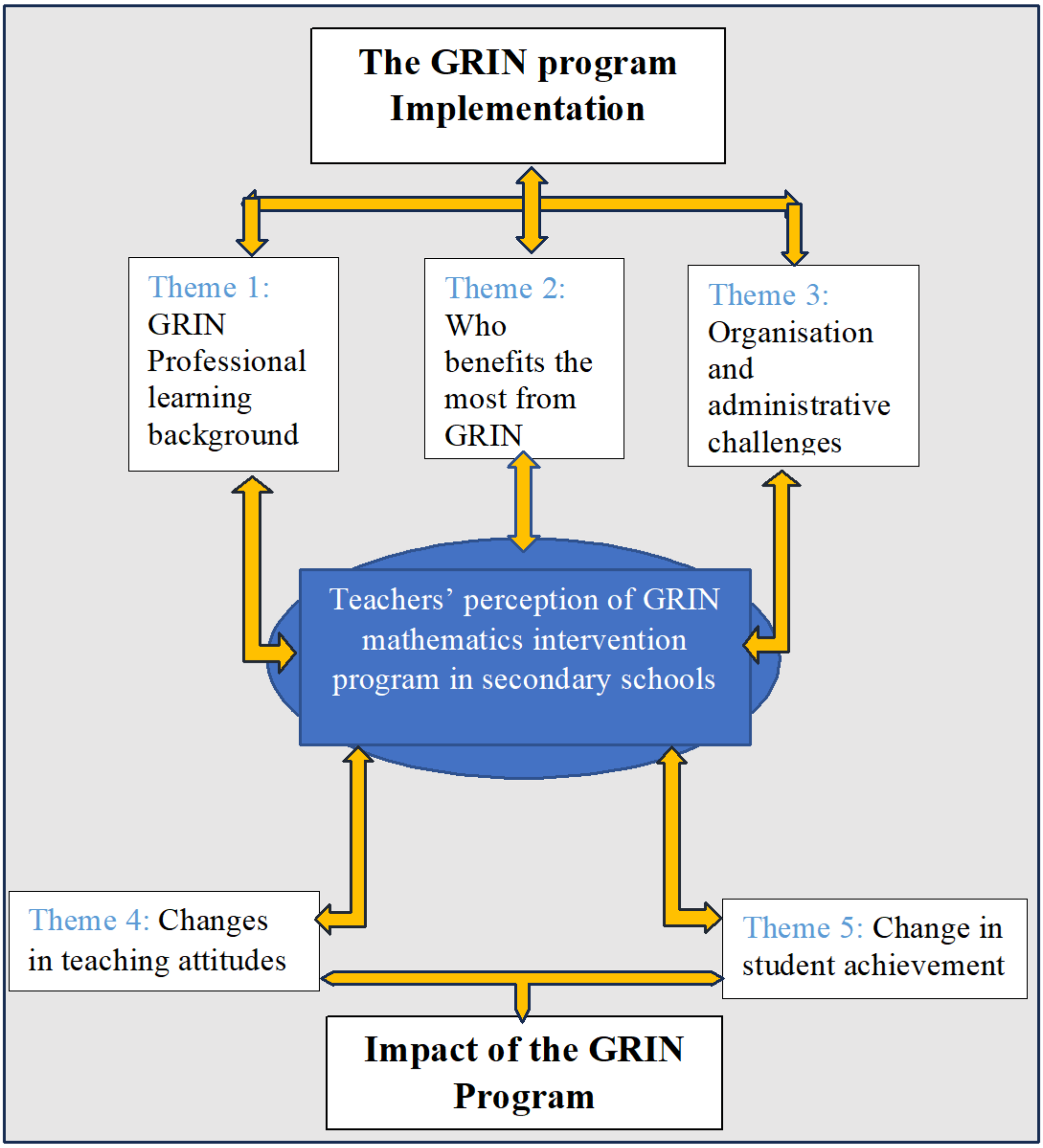
Themes	Subthemes
GRIN Professional Learning Background	1. Who are the GRIN Tutors? 2. GRIN Experience
Who benefits the most from GRIN?	1. Who is in charge of choosing GRIN students? 2. Target Students
Organisation and administrative challenges	1. Timetabling 2. Duration of GRIN program for student participants 3. Planning and the priority of GRIN
Changes in teaching attitudes	1. Positive and negative opinions of GRIN program 2. Teacher awareness
Change in student achievement	1. Pre-teaching 2. Change in attitude 3. Confidence boosted and growing mentality to learn 4. Change in grading

It is essential to understand that the program has different official names across the schools. In School C, for example, the program is referred to as the 'Front-Loading' program, owing to the absence of GRIN training or licences, while acknowledging its resemblance to the GRIN program. These details are important in comprehending the context of the study and the differences in the implementation of similar interventions across three schools. Notably, a numeracy leader, T6C, emphasised that 'the support program is the Front-Loading program; you probably want to call it GRIN, but you know, but we call it the Front-Loading'.

Despite variances, all three schools in the study adopted similar frameworks for implementing and selecting students in the mathematics intervention program. Whether officially referred to as GRIN or Front-Loading, all teachers consistently employed the term GRIN. This indicates a high degree of consistency in program administration across the schools. The GRIN/Front-Loading program is an intervention initiative to assist students falling behind in mathematics. GRIN tutors work with students in small groups to prepare them for upcoming mathematics classes and to reduce cognitive load (Parrish & Bryd, 2022). A robust partnership between the students' regular mathematics teachers and the GRIN teachers is essential to devise the focus and language for all prior mathematics classes to cater to the student's particular learning needs. The GRIN intervention methodology aligns with small-group methods to support students with knowledge gaps. According to Fuchs and Fuchs (2007), this learning environment benefits students who require additional support in their learning. The GRIN program emphasises providing focused, group support for students in RTI, tier 2 (refer to section 2.6.1), aligning with this approach and aiming to address individual learning needs and reduce cognitive load.

The study recognises that participants' perceptions in the intervention program are crucial for us to gain an accurate representation of the truth. Our experiences shape who we are as individuals, and it is no surprise that they also shape our attitudes, beliefs, aspirations, and perceptions as human beings (Smith et al., 2014). By allowing participants to share their perceptions of the program, we can better comprehend their behaviours and ultimately gain a more accurate representation of the truth (Lather, 1992; Robottom & Hart, 1993). Adopting an open-minded approach to data collection and analysis is essential for providing valuable insights into pedagogical paradigms and human behaviours in the context of the GRIN intervention program. Therefore, the study facilitated this by requesting junior secondary mathematics teachers to recollect their previous experiences with the program. The results yielded by the study have been organised into five coherent themes, within the program factors of implementation and impact as presented in Figure 4.1, that aim to provide a comprehensive understanding of teachers' perceptions and experiences with the GRIN intervention approach. The current research gap regarding the efficacy of the GRIN program in improving mathematics education can be addressed by involving the teachers in the decision-making process, which can prove to be instrumental in shaping successful interventions.

Figure 4.1 Emergent themes



The study's findings have been categorised into five themes with subthemes, as shown in Table 4.1. These themes and subthemes emerged from the collected data in the study and assisted in shaping and capturing the experiences of teachers participating in the mathematics intervention program. Identifying and categorising themes in the study's findings have yielded valuable insights into the teachers' perceptions, facilitating a comprehensive understanding of their experiences. The process of organising these findings into themes and subthemes, structured around strategies or settings, contributes to a clear and organised presentation of the data. This thematic approach enhances the study's ability to convey meaningful patterns and trends within the teachers' perceptions, ultimately contributing to a more nuanced and insightful interpretation of the research findings.

The first three themes, revealed in the diagram findings, will be analysed and discussed in this chapter on ‘The GRIN program implementation’. These themes focus on the program’s collaborative nature, effective communication and teamwork among stakeholders, and the dynamics within the collaborative network. These insights provide valuable information about the program’s implementation and impact on the learning environment. The study’s findings also revealed challenges within the theme of ‘Organisation and Administrative Challenges’. This theme highlights perceived difficulties in applying the GRIN intervention program, such as logistical issues, resource constraints, or adjustments required in pedagogical practices. Understanding these challenges is crucial for identifying areas that need further support or improvement to optimise the program’s effectiveness.

Additionally, the theme of ‘Impact of the Intervention Program’ revolves around changes in teaching attitudes and teachers’ perceptions of changes in student achievement since the implementation of the GRIN intervention. The theme examines how the GRIN intervention program has influenced teachers’ attitudes and approaches to teaching. The program may have prompted shifts in how teachers perceive their role in the classroom and their methods of instruction. This indicates that teachers’ engagement with the intervention program has led to a deeper understanding of their student’s requirements and the implementation of targeted instructional strategies to address those needs. The study’s findings have provided a comprehensive overview of the teachers’ experiences in the mathematics intervention program by identifying and categorising these themes. These insights can contribute to the broader understanding of effective instructional strategies, inform future program development and implementation, and guide improving relationships and collaboration among educators and students.

The next chapter will address the other two remaining themes from the diagram findings under ‘Impact of the GRIN program’. These themes explore teachers’ perceptions of changes in student achievement resulting from the intervention program. Subthemes within this category include increased student self-efficacy in mathematics and improved confidence in performing mathematical tasks. These findings reinforce that the GRIN program has positively impacted students’ academic growth and belief in their abilities to succeed in mathematics.

4.3 Specific findings associated with the GRIN implementation

A comprehensive understanding of how mathematics teachers perceive the mathematics intervention program in junior secondary schools in Victoria, the findings from the first three themes – GRIN Professional Learning Background, Who Benefits Most From GRIN? and Organisation and Administrative Challenges – can provide helpful insights into the perceptions of teachers towards the program implementation. By examining these themes individually, we can better understand the factors influencing the program's implementation and its impact on teachers and students. Through this in-depth analysis, we can develop a more nuanced understanding of the strengths and weaknesses of the program and identify areas for improvement that can enhance its overall outcome successfully in helping students struggling to learn mathematics, all through the lens of mathematics teachers' perceptions.

4.3.1 GRIN professional learning background

A. Who are the GRIN tutors?

During the interviews, the participants were asked to share their thoughts on the background of GRIN tutors, focusing on three fundamental aspects of numeracy support: mathematical knowledge, contextual knowledge and strategic knowledge. This exploration aligns with the framework proposed by Willis (1998), recognising that these dimensions should be considered distinctively based on the age and educational stage of the students receiving support.

The data collected revealed that three schools in the study use secondary mathematics teachers with a mathematics degree as GRIN tutors. This decision is based on the belief that a mathematics degree provides GRIN tutors with a profound understanding of the core curriculum's context and familiarity with effective teaching strategies. Selecting mathematics teachers with a solid mathematical background aligns with the research study's emphasis on the crucial role of mathematical knowledge in teaching this subject matter (Hill et al., 2008). This approach ensures that GRIN tutors possess the expertise needed to facilitate practical learning sessions for students in the GRIN program. For instance, a principal stated, '[the mathematics intervention tutor is] a qualified mathematics teacher in the school, often a teacher who teaches Year 7'. This choice reflects the intention to bring in qualified professionals who not only have a deep understanding of mathematics but are also familiar with the specific challenges and curriculum requirements faced by students at the secondary level.

Furthermore, responses explicitly highlighting the importance of a strong knowledge of the specific year level the GRIN tutors are tutoring were offered by T1A and T4B, reinforcing the significance of contextual knowledge. The GRIN tutors must have a comprehensive understanding of the content and concepts that are taught at a particular grade level. This facilitates tailoring their instructional approaches to meet the individual student's needs and enables them to align their interventions with the ongoing program instruction. A clear example of aligning tutors to year level was presented by participant T1A:

> We just used the people who have done GRIN, who would have been all the maths teachers. You need a very strong knowledge of the year level you are tutoring, so if the GRIN program was for year seven, you were tutoring the sevens in GRIN.

Moreover, L1A, a numeracy leader, explains that the school intentionally uses mathematics teachers to deliver the GRIN program because they are already familiar with what will be taught, which reflects the strategic knowledge component. This strategic knowledge enables GRIN tutors to employ appropriate pre-teaching strategies, preparing students for upcoming mathematical concepts and reducing cognitive load during regular classroom instruction (Parrish & Bryd, 2022). Participant L1A further stated:

> We use maths teachers; that is how we have used the model rather than the learning systems involved in the GRIN program. That was the deliberate intention because we felt there was a benefit from the teachers delivering the GRIN program. After all, that meant that they knew what would be taught, and it benefited the whole idea and interpretation of the GRIN program because it is pre-teaching. And so, I felt that was more beneficial.

Based on the responses, the school's approach involves assigning current mathematics teachers who teach the same student year level as GRIN tutors, which differs from the recommendations provided by the GRIN developer in Chapter 2. The developer suggests involving at least one mathematics teacher in the GRIN team. Additionally, the school selects up to four staff members to participate in the GRIN intervention, and they can take on the role of GRIN tutor. The role of GRIN tutor can be assigned to a teacher, numeracy coach, leading teacher, or an educational support staff member. While the schools in the study have adapted the GRIN program to their specific contexts and preferences to see if this selection may be more beneficial than aligning with the GRIN developer's recommendations, the subsequent exploration of the following themes will likely shed light on the rationale behind the schools' decisions and the implications for the effectiveness of the GRIN program in their unique contexts.

The role of school leaders in overseeing the mathematics intervention program is essential in creating conditions conducive to effective teaching and learning. As highlighted by Dinham (2017), the leadership's responsibility is to provide an environment where teachers can teach, and students can learn optimally. However, implementing this approach appears challenging in schools A and B, as these schools are not assigning GRIN tutors who are genuinely interested in the program. T1A's statement that the program is perceived as a 'filler of loads for teachers' suggests that some teachers may feel that the GRIN intervention is an additional burden rather than an opportunity for professional growth and student support. As this teacher also pointed out:

> Unfortunately, the attitude is not necessarily the best person for the job at this school. It is taking the GRIN program, which is used as a filler of loads for teachers. I haven't had room in my teaching. Why take the GRIN program for the last two years, two to three years?

Commenting further on the teaching loads, L1A, a numeracy leader, explained:

> The biggest issue is in terms of loads, teaching loads. At the junior school [Years P–6], when I was told that I was the deputy head, there also said the pathways coordinator, we gave our junior, our teachers who are involved in GRIN, and a time allocation to do that. That is different from the current situation here [Years 7–12], which is a big blocker.

In contrast, as mentioned by L2B, School B faced limitations in the selection process, being constrained to working with already designated numeracy support staff. There was evidence that the restricted selection process impacted the alignment between tutors and the specific needs of the intervention program, affecting its overall outcome. Furthermore, teachers' attitudes towards their profession have been recognised as crucial factors influencing their performance and student outcomes (Ahmad et al., 2013). Schools A and B's approach to running GRIN with teachers under allotment, rather than employing teachers for specific roles, was perceived by teachers as a lack of prioritisation or favourable conditions. This approach had an impact on their enthusiasm and commitment to the program.

On the other hand, School C has more flexibility. According to T6C, the school have staff members employed by the school to run the literacy program, and part of that role involves working with the numeracy program. This integrated literacy and numeracy intervention approach provided teachers and students with a more cohesive and supportive environment. As explained by T6C, '[w]e have the staff members that the school employs and runs the literacy program. Part of the program had to do with numeracy.' The insights gathered from the data about the role of school leaders in running the mathematics intervention program emphasise the critical importance of supportive leadership. The actions and decisions of school leaders play a significant role in the program's outcome, and they can also affect the teachers' perceptions. Maponya's (2020) research reinforces these insights, emphasising the role of supportive leadership in the mathematics intervention program's success and its impact on teachers' perceptions.

As the interview investigated the discussion of GRIN tutors more profoundly, the question of whether GRIN tutors should be the regular mathematics teachers for GRIN students brought forth differing perceptions among participants. L1A recounted a situation in which the regular mathematics teacher was frequently the GRIN teacher, but occasionally, GRIN students had different mathematics teachers. L1A outlined that having a teacher who does not teach the student regularly is more effective for the GRIN program. L1A claimed that 'it is more effective when a teacher who does not teach that child is taking a GRIN program'. In contrast, T1A presented a different viewpoint, acknowledging that having the same teacher for GRIN and regular classes can be effective. T1A highlighted the benefits of familiarity, where the teacher is already acquainted with the student's needs and learning style. Additionally, T1A noted that having the same teacher for both classes can help build trust and rapport between students and teachers. T1A provided a specific example, stating:

> Suppose I had a student in the GRIN program who was also in my class. That did not happen that often, but when the two matched up, it was really good because the students knew they could trust me and approach me; it was better for the students like this.

T6C, a numeracy coach and GRIN tutor, favoured having diverse teachers teach GRIN. According to T6C, variety in teaching strategies can benefit students as different teachers bring unique strengths and perceptions to their instruction. This diversity in instructional approaches can enhance students' learning experiences and provide them with multiple ways of understanding mathematical concepts.

Moreover, T6C highlighted the importance of being open to learning from different teachers and being receptive to various instructional methods. Scott (2023) emphasises that students learn in diverse ways, so the challenge for teachers is to discover which approaches help them learn most effectively. Fenstermacher et al.'s (2015) work supports this notion by suggesting that students should be encouraged to embrace multiple perceptions and approaches to mathematical concepts rather than being confined to a single teaching style. This supported by Fitzmaurice and Mac an Bhaird's (2023) study in higher education, which found that tutors should be able to explain concepts differently from how it is taught in regular lessons. This approach allows students to develop a broader understanding of mathematical concepts and apply them in different contexts (Kalogeropoulos et al., 2019a). By advocating for diversity in teaching strategies within the GRIN program, T6C's perspective emphasises the importance of embracing diversity in selecting teachers for the GRIN program to enrich students' learning experiences. Including various teaching perceptions can create a rich and dynamic learning environment, catering to students' different learning styles and preferences. T6C shared:

> To me, I like variety. I think different people bring different things to their teaching. So, the classroom teacher will have a certain strength in delivering something. I would find that, in my case and most cases, it's good to have somebody with a different viewpoint and a different way of instructing. Some teachers don't like that because they want to be taught their way. But that's not the way. You have to be able to take your maths concept in three different ways. So, therefore, it doesn't matter, yes.

The responses from the mathematics teachers regarding the students being exposed to varying perceptions and teaching strategies versus the benefit of the classroom teacher gaining a deeper insight into the students' capacity and development present a complex issue in the context of the GRIN program. The discussion raises important considerations for schools and educators in optimising the program's success and meeting students' learning needs. Research studies such as those of Robutti et al. (2016) and Beswick et al. (2006) have highlighted the importance of teachers' engagement with mathematics and their content knowledge. The study by Beswick et al. (2006), conducted in Tasmania, specifically reveals that many secondary teachers lack confidence in the mathematics curriculum and teaching. Addressing teachers' content knowledge and pedagogical skills is crucial to improving the quality of mathematics education. In cases where classroom teachers face challenges in delivering mathematics effectively, having a different teacher as the GRIN tutor may be more beneficial for students.

The argument in favour of having the classroom teacher also serving as the GRIN tutor is grounded in the belief that continuity in instruction and a deeper insight into the student's capacity can lead to more personalised and tailored support (Keefe & Jenkins, 2005). When the classroom teacher also serves as the GRIN tutor, they bring a familiarity with the student's strengths, weaknesses and prior learning experiences, allowing for targeted interventions that align with the student's individual needs. This approach builds on the existing teacher–student relationship, as the classroom teacher has already established rapport and understanding with the student. This familiarity can provide consistency in instruction and a more nuanced understanding of the student's learning journey (Arthars et al., 2019). The teacher can leverage this knowledge to provide customised support that addresses the student's specific areas of difficulty and builds on their existing knowledge and skills. However, it is important to recognise that not all classroom teachers may have a strong background in mathematics or teaching outside their field (Goos et al., 2020; Weldon, 2016). In such cases, their ability to provide practical support to students in numeracy could be limited. In such cases, having a different teacher specialising in numeracy support can complement regular classroom instruction and offer special help to students.

B. GRIN Experience

Participants from School A shared their experiences, highlighting the importance of having formal training on the GRIN approach and its implementation. Some GRIN tutors, including T2A, a classroom teacher, felt they had not received sufficient training on the program and had to rely on their 'instinct' while tutoring students. This indicates a significant gap in providing guidance and resources to GRIN tutors, which can limit their ability to implement the program to its fullest potential. Teachers are not well-informed about GRIN interventions and may not be very enthusiastic about the program, as highlighted by T2A:

> Well, I haven't been trained yet. So, the GRIN program was just an instinct for what students were there to do. I was watched by the other teachers that have been trained teaching, not that I was on the right path.

Similarly, T1A's experience with GRIN at School A highlights the need for formal training and support for teachers involved in the program. T1A learned about the program through an online search, as it was not a professional requirement.

> We haven't received training here… I got a lot of stuff from the GRIN program of the Guy from Monash, a professor or something he started, and resources from Google, out of personal curiosity and a desire to learn more, and just such that a lot of information that might just myself because I was curious, and I just wanted to know, but nothing in a professional sense.

In contrast, L1A, another participant at School A, had received comprehensive training. At the time of the interview, L1A was responsible for the junior [Years P–6] campus GRIN program and was not involved at senior college (Years 7–12). As L1A, a numeracy leader, reflected on these process aspects of her training, she explained that:

> I initially attended the ISP [Inclusion Support Program] when the ISP ran the first grant GRIN session. So, I was involved in all of those that were, I think, about a series of five days a period, and we had to be spaced out monthly.

However, L1A expressed a concern regarding the lack of consistent training across all participants at her school, which may lead to discrepancies in the implementation and understanding of the GRIN approach:

> When the GRIN opportunity was first put out, our pathways teacher suggested or asked for volunteers from the junior school [primary levels] in a secondary school. I don't believe that our head of maths was involved in that training, which is, perhaps, an issue.

The situation in School A, where none of the individuals involved in GRIN received training, raises concerns about the efficacy of the implementation compared to other schools that fully participated in professional learning for the GRIN program. As the developers outline, the GRIN program emphasises the importance of GRIN tutors and school administration participating in professional learning to ensure successful implementation. The comparison is discussed in detail in subsequent chapters.

In contrast, at School B the principal and the numeracy leader proactively investigated the GRIN program before deciding to engage. They attended the professional development sessions provided by the university, and the teachers who participated in the program were trained. The numeracy leader's involvement in investigating the program reflects a strategic approach to introducing the intervention. As the Key Learning Area (KLA) Leader of mathematics, the numeracy leader explored the program's potential benefits and determined its suitability for the school's needs. After attending the PD sessions, the numeracy leader facilitated the implementation of the GRIN program at the school by guiding and supporting the teachers, helping them understand the program's principles, and providing resources and assistance. As L2B, a numeracy leader, explained:

> I was the KLA leader of maths. It was my job, first of all, to investigate the program. So, they [the school leadership] had heard about the GRIN program, we went off and did a few days of PD, the company to start with, to see what it was like. Then, my job was to facilitate the implementation and support the teachers in starting the program.

School C's mathematics intervention program is called the 'Front-Loading program', which the school knows is similar to the GRIN program. The implementation of this program is overseen by the numeracy coach (T6C), who manages and coordinates its implementation, including teachers' selection and training. PC, the principal of School C, has stated that the official GRIN program is not being implemented. However, he did acknowledge that the person in charge of the intervention program has extensive experience leading interventions for the program. According to PC, TC6 has years of experience and skills in working with students. As PC explained:

> We are not running the official GRIN program. He [TC6] has years and years of experience. Perhaps you have to ask him about the ins and outs of the different trainings he has had, but he was a numeracy coach for the department for many years, so he has lots of experience, lots of skills, lots of knowledge about how to work with students so you'd have to ask him about that… we don't have a purchase program or anything like that. It's teaching. That's what teachers do; they teach.

Interestingly, T6C, had not undergone official GRIN training. However, he believed he was well-versed in the GRIN program due to his teaching experience and previous involvement in numeracy coaching at various schools, some of which had implemented the GRIN program. T6C's familiarity with the GRIN program stemmed from his experience at a previous school, where the assistant principal, who was from a school that used the GRIN program, suggested implementing a similar approach for preparing students. T6C then adopted the concept of Front-Loading and tailored it to suit the specific needs and constraints of the current School C. He stated:

> My first school as a coach was at [school name] in 2018, the assistant principal at the time. He was from [school name], and they used to do the GRIN program. They thought that was a good way for me to use my time, so apart from coaching teachers, they could see this as an opportunity to prepare students. So, we talked about the GRIN program. He said it was Front-Loading, and they do it three times a week; you make it happen. So, we did.

T6C went on to elaborate that he utilised the same approach at a previous school to School C, T6C continued:

> [I] took the same process there [T6C's old school]. They had three 20-minute sessions or two 20-minute sessions due to their schedule, which only had five periods a day, with one period only 30 minutes. So, I just located Front-Loading. What do I need to do? This is what I need to do that work. So I didn't need to be trained on how to do it.

In addition, T6C, who served as the numeracy coach and a GRIN tutor, mentioned that mathematics teachers did not receive specific training for the program. This indicates that the mathematics teachers are expected to implement the program without formal training. However, for ESS (educator support staff), T6C recognised the importance of guiding and supporting them through content by providing information about what they will teach in the upcoming week. T6C briefly summarised this proceed when he stated:

> For the math teachers, there will be no training, but for the teacher who was an ESS [he needed to guide them through content], 'Here is what they [students] are doing in the next week, and I will be doing some work with the teachers [ESS] regarding that.

Another participant shared their experience with the GRIN program. T5C, a retired mathematics teacher who worked as a GRIN tutor at School C, mentioned that she did not receive formal training for the program. However, she was already familiar with the GRIN program and believed it to be a promising intervention program. Her positive perception of the program motivated her to take on the GRIN tutor role, even though she did not have formal training. As T5C explained:

> I am a retired maths teacher. So, I have just come back for two days a week to do this COVID tutoring… I was aware of the program before I got involved, and I mean, I knew how GRIN works, which is why I was happy to get GRIN here because I think GRIN is a really good program.

The responses from T6C and T5C at School C shed light on the varying levels of training and experience among the individuals involved in the GRIN-alike intervention. Moreover, exploring T6C's experiences and perceptions and those of other participants at School C can provide beneficial insights into the significance of the Front-Loading program and its alignment with the GRIN program's objectives by examining the outcomes and experiences of students who participated in the program to identify any obstacles or achievements that were encountered during implementation and to provide recommendations for improving and enhancing the delivery of the mathematics intervention program at School C.

The responses from the three schools above indicate that only a few teachers have been formally trained as GRIN tutors and being a GRIN tutor is merely a title at Schools A and C. However, the perceptions of teachers suggest that they value professional development experiences, particularly opportunities to reflect on and exchange ideas and resources, understand the impact of the GRIN program, and participate in a broader professional network. This thematic idea is exemplified in the statements from T1A and L1A below, highlighting the importance of ongoing professional development and training for successfully implementing the GRIN program. As T1A commented:

> I think it would be useful, even if it were just a day or half a day, to check in with other tutors and, you know, share ideas of what works and what doesn't. The philosophy behind the program, I think, would be very useful.

L1A was concerned the GRIN program was not running properly at her school, stating:

> I think within the school, it's really important to do a GRIN PD update every year so that everyone has a common objective and knows what the intention of the program is because my concern is the way that it has been run here. Yeah, was that not how it should be? It is not the attention of the program.

The quote from T1A highlights the importance of collaboration and networking among GRIN tutors. Creating opportunities for teachers to come together and exchange experiences, strategies, and best practices can lead to more cohesive and effective program implementation (Australian Institute for Teaching and School Leadership [AITSL], 2021). Learning from one another's successes and challenges can enhance the overall quality of the intervention and support continuous improvement (Schleifer et al., 2017). While professional learning is recognised as a key source for enhancing teachers' pedagogical content knowledge and promoting student achievement (Dinham, 2017), the GRIN program is an out-of-school professional development initiative. The GRIN program incurs high costs, both financially and in terms of teachers' time, which may have influenced its implementation and the level of formalised training provided within schools.

4.3.2 Who benefits the most from GRIN?

1. Who is in charge of choosing GRIN students?

This section provides an overview of the selection of students process for the GRIN program. The three schools in the GRIN program have a similar approach to selecting students, with the final decision made in collaboration with administrators and relevant staff members. Schools A and B have a 'head of the pathways' position, like a mathematics leader responsible for selecting students, with classroom teachers able to nominate students but the administration having the final say. The selection process involves various assessments, including Progressive Achievement Tests Mathematics (PAT-M) scores (Caldwell & Hawe, 2016; Cowie et al., 2021), National Assessment Program – Literacy and Numeracy (NAPLAN) scores (2023, 2023), and other assessments conducted at the outset of Year 7. As T1A stated: 'We have the head of the pathways, who specially coordinates [the selection process]. They [review] the PAT mathematics scores and NAPLAN scores to select the students.' Similarly, for student selection as School B, L2B explained that '[w]e would run PAT mathematics and PAT reading – a number of assessments at the start of the year for the students. Then, we would identify those who were quite behind in their learning.'

The process selection at School C is different. It offers an alternative to the GRIN model with a Front-Loading program that caters to all levels of junior secondary students for each mathematical topic at their own pace. The selection process at School C involves pre-testing students at the beginning of each topic in Years 7, 8 and 9. The pre-test data, NAPLAN data and prior achievements at the school are used to identify students needing support (Freshworks, 2018; Vogel et al., 2022). PC explained:

> Our students are pre-tested at the start of every topic in Years 7, 8 and 9. Before the topic starts, and they start teaching it in class, pre-test data, then we also have all the NAPLAN data as well as prior achievements at the school year eight and nine. We can identify the students who need support.

The participant responses indicated that the three schools depended heavily on the data to select GRIN students, using standardised test scores complemented by other assessments and prior achievements, in the belief that the data can provide a comprehensive picture of students' abilities and needs in mathematics (Getenet & Getnet, 2023). As L1A, a numeracy leader, shared:

> We are ensuring that the selection of the students is based on the data. So that we are targeting the right students and making the most of the program.

Another numeracy leader, L2B, stated:

> We were looking at kids that were around standard two. So, it is quite considerably behind the expected level. So, kids are retesting at about that one–two level. And they were the ones that were initially targeted.

The different approaches to student selection across the three schools indeed highlight the importance of tailoring intervention strategies to meet the specific needs and goals of each school's student population. The Front-Loading program at School C exemplifies a proactive approach to addressing students' diverse learning needs and ensuring that all students receive appropriate support. Conducting pre-tests for all mathematics topics before each topic starts allows them to gather reliable data on each student's specific strengths and weaknesses within mathematics as suggested by Vogel et al. (2022). This approach enables School C to adequately target each student's weaknesses and provide more targeted and personalised support through the mathematics intervention program (Robinson et al., 2021).

In contrast, the other two schools, A and B, assess students at specific times, likely referring to the assessments conducted at the beginning of Year 7. While this approach still provides some valuable data, assessing students only at specific times might not offer the same level of specificity and timeliness as School C's ongoing pre-tests for each topic. By continually assessing students' progress and needs before each topic, School C can make more informed and data-driven decisions about which students require assistance and tailor the mathematics intervention program accordingly. This real-time and fine-grained assessment approach may contribute to the program's effectiveness in addressing students' individual learning needs. Understanding the decision-making process and the criteria used to select students can offer significant insights into the program's impact and effectiveness in improving student achievement in mathematics, which will be discussed later in Chapter Five.

Another important finding from the data analysis was that both the parent and the student must willingly agree to participate in the GRIN program after the students are identified. This requirement indicates that the students participating in GRIN actively seek assistance in improving their mathematical skills. This willingness to participate is a positive sign, as it highlights that the students recognise the importance of seeking support to enhance their mathematics abilities (Howard et al., 2021). It is encouraging to see motivation among the GRIN students, as these challenges can be particularly difficult to address in mathematics intervention programs. The literature supports the challenges in improving mathematics among students with behavioural concerns, lack of desire, disruptive behaviour and poor attendance (Quin, 2017). In such cases, effectively engaging and motivating these students to participate in intervention programs can be a significant hurdle. The fact that the GRIN program experienced minimal difficulties in this regard indicates the program's success in capturing students' interest and commitment. Therefore, the involvement of the person in charge of selecting GRIN students appears to play a significant part in ensuring that the identified students are willing to attend the program (Herman et al., 2017). The selection process for GRIN students, which involves assessments and consent from both students and parents, is a thoughtful and collaborative approach to intervention, which we will learn more about in the upcoming themes.

2. Target Students

Based on the interview data collected, it was found that the GRIN program typically targets students 6–18 months behind expected levels in their mathematics skills based on testing methods. The program aims to support students who are 'sort of at standard, just a little bit below', as explained by T4B. This targeted approach allows the program to provide focused assistance to students who need additional support to reach grade-level proficiency. L2B stated that finding students who met the GRIN criteria and fit into the GRIN tutors' allotment in her school took a lot of effort. As a result, she had to choose some students who were even further behind their peers to participate in the program. L2B explained that the school purposely includes students who struggle significantly in mathematics, exceeding the program's initial target of those who are only slightly behind. This adaptation was made because there are too many students in need of assistance with mathematics. L2B shared the process:

> We tended to take kids that were lower than their [the program developers] ideal, and they ideally wanted to take kids that would just be a little behind and lift them up. But of course, at a school, we have got kids just so far behind that we would need to try and catch them up as well. So, it was sort of like, well, I am sure it's going to benefit them as well.

L2B's explanation highlights the practical challenges schools face when selecting students for the GRIN program. In real-world educational settings, schools often have students with diverse proficiency levels and varying academic needs (Wilson, 2021). This diversity can pose a challenge when determining which students should be included in the GRIN program. The decision to include students substantially below the ideal target proficiency level in the GRIN program is often driven by the belief that the program can still benefit them and help them catch up with their peers. Schools recognise the importance of providing tailored support to each student's needs, which is why they see the GRIN program as a great opportunity to bridge the gap for those struggling with their mathematics skills, as stated by Gorski (2017).

School C adopts a different approach to selecting target students for its mathematics intervention program. According to T6C, the school chose students 6–18 months behind in their mathematics skills. The rationale behind this selection is that students within this range have the potential to experience rapid improvement with the targeted intervention provided (Kalogeropoulos et al., 2019a). The analogy drawn by T6C, comparing the selection process to saving a drowning person first (see below), suggests that School C prioritises students who can benefit quickly from the intervention. School C aims to provide timely support and help them catch up more rapidly by focusing on students who may be slightly behind in their mathematics skills. This unique approach prompts a comparative analysis with Schools A and B, revealing variations in selection criteria and philosophies. T6C found this unique approach to be practical for targeting intervention students:

> Like saving a drowning person, do you save the person who is drowning or the person who is sinking down the bottom, who sank down the bottom? You have to save a drowning person

> because you know that they can deal with them quickly, and then you get the other person. It sounds terrible, but I did lifesaving.

The perceptions of the participants, as well as the research findings, indicate that the GRIN program's success rate may be highly due to its targeted approach in selecting students who have the potential to benefit the most from the intervention. The program's emphasis on prioritising students within the 'second bottom quintile' (Kalogeropoulos et al., 2019a, p. 2) for mathematics aligns with the research's recommendation to focus on students who have the potential to catch up and make significant progress in their mathematical skills. The research emphasises the importance of selecting students with the most significant potential to benefit from intervention programs like GRIN. This strategic approach ensures the support and a realistic chance of catching up to grade-level expectations (Goos et al., 2020).

T2A's concern about the reliance solely on testing methods for the GRIN selection process highlights an important aspect of student assessment and program efficacy. Swiecki et al. (2022) point out that test scores may only provide a limited and discrete snapshot of a student's performance rather than a nuanced view of their learning. T2A's perception underlines the potential limitations of test scores in capturing the full spectrum of a student's abilities, their growth potential, and the multitude of factors influencing their learning experience:

> I don't think the testing alone should identify whether students are in the GRIN program. You know, sometimes students do not perform well in assessment, and it does not necessarily reflect their ability; it could be that something has happened on that particular day, so it should be a willingness to want to do it. It should be valued and part of the timetable for the students and the staff, which would be set up for more success.

Whether or not students meet the requirements for GRIN at the three schools will significantly impact their progress and achievements during the implementation period. In the subsequent themes and data analysis in Chapter Five, teachers' perceptions will shed more light on the effects of the GRIN program on students' progress and achievements, providing a better understanding of how the program affects student growth. By reviewing students' engagement with the program and their responses to the intervention, it will also be possible to assess how the selection process affects the overall success of the GRIN program.

4.3.3 Organisation and administrative challenges

One of the predominant and recurrent themes emerging from the interviews was the presence of organisational and administrative challenges in implementing GRIN. When questioned about the typical operation of the GRIN program, six out of the nine participants characterised it as challenging, with all expressing concerns. The data below provide an overall picture of the GRIN program at the three schools.

1. Timetabling

As a recommendation from the GRIN developers mentioned in Chapter Two, the GRIN sessions can be conducted before or after school or during recess and lunch breaks. In other situations, students may be withdrawn from other non-mathematics lessons to participate in GRIN sessions (Monash University, 2023). Participants from Schools A and B highlighted how timetabling GRIN sessions was a challenging aspect of implementing the program. According to their statements, scheduling GRIN sessions outside of regular class time in secondary schools proved complex. Scheduling these sessions outside regular classes – such as before or after school or during recess and lunch breaks – is a viable option to provide additional support. However, only School A used this approach, and participants at this school reported several issues in practice that warrant consideration.

Firstly, the limited availability of teachers and students during non-class hours poses a challenge for timetabling GRIN sessions. Teachers already have full teaching loads and other responsibilities, making it challenging to find suitable time slots for conducting additional GRIN sessions. This finding aligns with other research on the GRIN program, which finds similar scheduling challenges due to the busy schedules of teachers and students (AU, 2014). For the program to be effective, teachers need to have adequate time and capacity to dedicate to planning and delivering GRIN sessions, and this may not always be possible during regular class hours, as pointed out by teachers at School A. This highlights the importance of careful planning during the implementation of the program. Similar concerns were raised by Rodgers et al. (2019), who report that some teachers found creating individual plans too time-consuming, further stressing the need for adequate planning and consideration. T1A succinctly summarised this issue when she stated:

> Unfortunately, at this school the attitude is not necessarily the best person for the job. It is taking the GRIN program, which is used as a filler of loads for teachers. So, I not had room in my teaching, so I have taken the GRIN program for the last two to three years.

T1A commented further, explained the difficulty when the GRIN students scheduled for before and after school:

> They have to come in early, so they would get here by that we would start at 20 [minutes before] class for the day and go to 20 to nine, and then they… request off to mentor group, which is like a form group. Then, get it started for the day. I don't think we can probably find it; we could make it longer. I guess it just wouldn't fit... And then when we have a session at the end of the day. You know, the kids have to go off to sport and all their different commitments at the end of the day. So, yeah, I don't think we could get more than 20 minutes out of them before and after school.

Secondly, as mentioned by L1A, timetabling GRIN sessions at lunchtime was the only option for School A due to students' commuting distances. If students travel long distances to school, it may not be practical or feasible for them to attend GRIN sessions after school. However, it was stressful for teachers and students as lunch breaks are usually short and crucial for relaxation:

> In terms of staffing and teacher loads, we do it during lunchtime in senior [years 7 to 12] school campuses. We have a lot of students who travel a great distance to come to school, and they can't really do the GRIN after school. It is timetabling who, how, and where GRIN happens.

Additionally, the challenges with running GRIN sessions during lunchtime at secondary schools, as mentioned by L1A, highlight the complexities of balancing academic support with students' extra-curricular activities and social interactions. Lunchtime is practical for students to engage in various activities, spend time with friends and have a break from academic work. Research by Whiting et al. (2022) supports the significance of social interactions during lunchtime. They find that being active with peers during lunch strongly correlated with a sense of belonging among students. Furthermore, Mason (2021) highlights that lunchtime allows students to engage in multiple activities simultaneously, including social participation, eating and playing. These activities contribute to social development and overall health in schools. L1A explained further that some students may resist or be reluctant to give up their lunchtimes for GRIN sessions:

> It is just this trickier overlay of management in managing the staffing and managed or processing for students so that they still get a balance of being able to do extra-curricular activities that run lunchtime, but also to have some time with their friends… activities running during lunchtime, students are reluctant to give up their lunchtimes, so that is a big issue.

Thirdly, as highlighted by T2A and other participants, there are complications of implementing academic support programs for students during adolescence. In Australia, junior secondary education occurs when students are 11 to 13 years old and are experiencing physiological, psychological and social changes associated with puberty (Moroney & Stocks, 2005). According to Brown et al. (2008), students in this age group may be susceptible to peer influences and social pressures, making it challenging to commit to academic support programs during lunchtime. The fear of being perceived as uncool or missing out on social interactions with friends emerged as a significant factor influencing students' participation in the GRIN program. This peer pressure, overriding their initial willingness to engage, made some students discontinue attending sessions prematurely. As T2A stated:

> It did not feel cool to be doing extra stuff at lunchtime and missing out on being with friends, so that was incredibly difficult. The disappointing thing was that it was lunchtime. For them to say, I am really sorry. I am not going to continue because it is really hard during lunchtime because of the social group that they are in. Some girls weren't very pleasant. And so, they stopped. They decided to stop attending it, but it wasn't for long. It was only three weeks to go, and they had stopped. The parents were disappointed that they had stopped as well. But it had to do with peer pressure.

At Schools B and C, the suggestion to withdraw students from other non-mathematics lessons for GRIN sessions was implemented. Initially attempting to run GRIN sessions outside of class time, School B encountered difficulties with student attendance. L2B shared her experience:

> We found it very difficult, and we looked at trying to run it, say before or after school, as the kids would not come. So, we just found that it did not work and needed to be during class time because when we tried to do those other options, we just found that kids were not prepared, you know, they would tell you that they wanted that help and that they wanted the assistance. But when it actually came to turning up at those times, it was not so popular.

L2B pointed out that, after encountering the difficulty, School B shifted to conducting GRIN during class time. However, even with this adjustment, challenges persisted. L2B, the numeracy leader, expressed concerns about the potential impact of removing students from other non-mathematics classes for GRIN. One of the biggest challenges faced by School B during the GRIN program was the lack of support from other subject teachers. Many teachers are hesitant to allow their students to miss class time for extra mathematics support, making it difficult for GRIN tutors to provide the necessary assistance. As a result, the GRIN tutors had been forced to withdraw students from their mathematics classes. As one teacher stated:

> When we actually would run it [GRIN session] in a secondary school, that was the issue. It was whether we took them [students] out. We didn't want to take them out of maths class

> because that defeated the purpose, but then other subject teachers got upset if we took them out of other areas.

L2B mentioned that the school already had designated teachers for mathematics support, and these teachers had limited availability, with only four periods to take on GRIN. Scheduling GRIN sessions around these teachers' timetables proved challenging, making it difficult to accommodate all students who could benefit from the program. According to all participants at School B, withdrawing students from their mathematics classes for additional support was inefficient for those already struggling in mathematics. The challenge of timetabling GRIN sessions, student reluctance to participate during their free time, and the inability to withdraw students from other classes were cited as contributing factors to the decision to discontinue the program after two years of experimentation. This was explained by L2B:

> Part of the reason we never stayed with the GRIN program was because we found it too difficult, you know, in a high school setting. It's much easier in a primary school setting where the kids are with the teacher all day. So, finding time to take them out of the class was not easy.

The limited availability of tutors, who had their own classes to teach, including mathematics and science, added to the complexity. With tutors having specific time slots allocated for tutoring sessions, finding times that aligned with students' regular class schedules became challenging. One attempted solution was to timetable the students around their classes. However, withdrawing students from other classes proved difficult, as the staff preferred to keep the students in their regular classes, particularly at the beginning of class periods when important instructional explanations were provided. As L2B explained:

> We didn't have full-time tutors, so we had to timetable the kids around their classes. It was hard to withdraw the students from other classes, and the staff preferred to keep them in class, especially at the beginning of periods when they needed to explain everything.

L2B recalled one teacher who allowed students to leave their regular classes: 'If the kids come into my class, I want them to come out in the second half.'

T4B, at the same school, outlined the same reason the school stopped running the program:

> The program itself works really well, but it is more designed for a primary school setting [where students can do it during class time] rather than their own time, and we were not allowed to withdraw them from other classes. So, it just got too tired. Then, a secondary school setting is needed in terms of the restrictions around implementing it. It was just the restraints around trying to implement it. The kids stopped wanting to participate in.

Another participant at School B compared the GRIN program to the MYLNS (Middle Years Literacy and Numeracy Support) program used at school. T3B stated that:

> Both programs help the student with Numeracy. The structure of the MYLNS program is more well-structured and suitable for a secondary setting than GRIN. MYLNS is built with a normal timetable for teachers and students. The GRIN intervention program is structured outside the timetable, like before school, lunchtime, and after school. This causes problems in the long run.

Overall, L2B believes that despite the challenges faced during the trial, GRIN could benefit students if the school provided the proper support and addressed the implementation issues. This suggests that there is potential for the program to be successful with the right resources and strategies. L2B and T4B agreed that a primary school setting better suited GRIN. Primary schools have more scheduling flexibility and can integrate the program more effectively into their existing routines. Additionally, research by Blatchford et al. (2015) details that primary school students are more receptive to interventions like GRIN and may face fewer peer pressure issues than older secondary school students. However, when asked if there was a solution to this challenge, T4B, L1A, and L2B concluded that there was no easy fix at their school.

The principal's perception of high enthusiasm and support for the GRIN program at School C signifies the positive culture surrounding the initiative. This positive culture is crucial for the success and effectiveness of the mathematics intervention program (Seeley, 2016). The principal plays a pivotal role in actively fostering this supportive environment by emphasising the importance of mathematics and encouraging the whole-school community to show strong support for mathematics intervention programs (Dinham, 2017). The school has a well-organised system with a dedicated numeracy coach and a flexible timetable accommodating tutors and students. According to the principal, the numeracy coach spends a lot of time organising the timetable to ensure that teachers have set times when they are free to conduct GRIN sessions. As PC pointed out:

> It is a very floating, flexible timetable… he [T6C] also spends a lot of time on it. A lot of time at that, teachers have set times when they [students] are free to do it.

One significant aspect of School C's approach to the program is its decision not to withdraw students from regular mathematics classes. The principal firmly opposes this practice, stating that taking students out of mathematics class would be unproductive when they are already behind, as it may lead to them falling further behind (Department of Education Victoria, 2024). Instead, the school uses the Front Loading model, which involves pre-testing students at the beginning of each topic and providing targeted support from other subjects during regular class time. As PC stated:

> Never withdraw from maths to do maths work. That is, sorry, that's stupid. Why would you take kids out of maths class when they are already behind? They fall further behind.

The numeracy coach, T6C, highlighted the importance of coordinating the GRIN program to ensure adequate student support. T6C emphasised the need for timely information from teachers about upcoming lessons so the GRIN tutor can align their instruction with the GRIN students. According to a report by Sonnemann and Hunter (2023), careful planning and collaboration between teachers, tutors and other staff can minimise student studies disruptions and ensure they receive the necessary assistance without missing out on critical subjects in other classes. T6C explained that creating the timetable around removing students from classes is 'quite complex':

> I coordinate the program. I created the timetable, which is quite complex because you have to take it. You've got to recognise that you've got to be removed from a class. We take years seven and eight, which cannot be the same class. Obviously, you only want them to be removed for 20 minutes during that time.

This requires careful planning to ensure the timetable allows this targeted intervention without disrupting the students' regular class schedules. T6C continued to explain that the structure provides some insight into how he has approached the program's implementation and how the delivery of content is handled in his absence:

> I do all the timetables and then deliver part of that program. I am only here one day a week. Therefore, other teachers would be doing the Front-Loading, a coordination aspect of my work. Then, my delivery is to make sure that the teachers put the main notes they deliver in the next lesson...the students will be drawn two or three times a week out of non-maths, English classes. They'd be Front-Loading the content delivered in the outcome required during the week.

Overall, the strong support from the school community, the dedication of the numeracy coach (T6C), and the efficient timetable implementation have collectively contributed to the success of the mathematics intervention program at School C, as will be discussed in Chapter Five.

2. Duration of the GRIN program for student participants

The variation in the duration of students' participation in the GRIN program across the three schools introduces a nuanced aspect of program management. Schools A and B have specific time limits for students' involvement, raising questions about the rationale behind these constraints. T1A, from School A, expressed disappointment with the program's 12-month limit, emphasising the constraint in program continuity: '12 months, that was it… So, they did it in Year 7; they [not allowed to] do it in Year 8. The logicalness is that we gave someone else a turn.'

Similarly, at School B, according to L2B, after six months students need to be reassessed, and if they are still benefiting from the program they may continue. Otherwise, other students who need support are given a chance to participate. L2B explained this approach ensures that other students in need of support are given a chance to participate:

> They were allowed to stay in the tutoring for six months or a half of the year. And then we reassessed. If they were getting something out of it and they wanted to continue. Then, we looked at extending them for the rest of the year. Otherwise, we swapped over with other kids who needed support.

In contrast, School C's flexible approach allows students to participate for as long as required, depending on their performance in mathematics topic tests. The school's principal emphasised that mathematics intervention assistance is available to any student in need, and there is flexibility in accommodating individual learning needs:

> For every topic, the students tested. [Our] instructional mathematics model [includes] a pre-test at the start of every topic. It is formative assessments throughout, and there is the post-test as well… Every student, depending on their pre-test, their overall maths level, and what we learned from previous assessments.

The differing duration of time for students to participate in the intervention program reflected the complexity of student learning. The duration of intervention programs for students can impact their long-term effectiveness; according to Dignath and Büttner (2008), sustained participation can have significant benefits. Similarly, Brodesky et al. (2022) find that most schools allocated an entire school year for mathematics intervention classes. Additionally, Brodesky et al. (2022) suggest that longer-duration classes in mathematics intervention programs can contribute to the development of stronger teacher–student relationships and create a more supportive classroom environment. T2A also emphasised the importance of allowing sufficient time for students to develop skills, understanding, and study habits in intervention programs like GRIN. In this regard, T2A commented:

> It would be beneficial if it were more than regular to start with, but you know, if they did it for more than a year, like over a longer period. There would be more chances of success, and

> they would develop a better understanding, improve their confidence, and be more successful in maths and general understanding.

The varying approaches to the duration of student participation in the GRIN program reflect the different contexts and resources available at each school. While Schools A and B have implemented time limits due to financial constraints and organisational challenges that make it difficult to accommodate all students continuously, School C has adopted a more flexible approach to accommodate student's individual needs and progress in mathematics topics.

3. Planning and the priority of GRIN

The interviews conducted at School A revealed significant challenges in planning and implementing the GRIN program. According to the teachers at the school, support from school leadership and administration is crucial in prioritising GRIN sessions and providing adequate time for planning, preparation and training. Unfortunately, they expressed dissatisfaction with the lack of support and supervision they received from the administration. T1A, an experienced mathematics teacher at the school, also highlighted that no time is allocated for planning the GRIN program or proper training and guidance. This resulted in her feeling there was a lack of proper planning and methods, and that she needed to rely on her own working knowledge and familiarity with math materials to make it function. This issue of under- prioritising GRIN was highlighted by T1A: 'You are not given any time to run to plan for the GRIN program, or you are not allocated any time at all… I'll be honest with you: there is no long-term planning done and methods.'

T2A shared similar sentiments, stating that the administration never provided clear instructions or guidance on how to support the students in the GRIN program:

> There were never any [administrators] who took me aside and discussed how I needed to do it or what I needed to do. It was just that I needed to support the students. Moreover, it was called the GRIN program.

L1A, the numeracy leader at School A on the junior campus, strongly emphasised the role of stakeholders and leadership in driving the implementation of the GRIN program. L1A raised the issue of prioritisation and responsibility, suggesting that the school's level of success may vary depending on the perceived priority of the program and who takes responsibility for driving its adoption:

> Yeah, but in my previous role, I ran that meeting and always did professional development. So, if I were a driving force to implement into our junior [years 1 to 6] school, I would make

> sure our staff knew what GRIN was rather than just... We always had a professional development start the year, and we worked together and collaborated in teams.

L1A noted that the program may not be as effective in the current setting due to a lack of prioritisation and clarity regarding who is responsible for its implementation: 'It hasn't been run and is probably as effective here at this [senior] campus purely because it is not a priority about who is taking the responsibility.'

T1A and T2A expressed a sense of uncertainty in their program implementation due to the lack of support and training. They believed that full administration support and prioritising the needs of the GRIN program were crucial for its success.

The interviews conducted at School B reveal a systematic and optimistic approach to implementing the GRIN program, which includes proper training for team leaders and teachers. This highlights a commitment to ensuring that staff members are equipped with the necessary knowledge and skills to fulfil their roles effectively (Dinham, 2017; Wilson & Cooney, 2002). According to L2B, the tutors involved in the GRIN program received training on their specific responsibilities and tasks. This initial training was essential in preparing them for their roles and ensuring they understood their expectations. She stated that '[w]hen we first set it up [the GRIN program], the tutors were trained in what they needed to do'. A crucial aspect of the strategy was establishing structured communication between tutors and teachers. This was facilitated through communication books, allowing for the exchange of notes and information about lesson plans. As L2B described, '[t]he key thing was getting the communication between the tutors and the teachers. So, we created a communication book.'

The lesson structure was designed to be structured and easy to build, providing a framework for planning and conducting GRIN sessions. As L2B explained:

> There were a number of booklets that we [received], and we did the PD [professional development] and learning. The lessons structure about how the GRIN session should be structured and what needed to be done within each [lesson], the structure was based on language and the activity. It was a very structured and easy-to-build lesson, so there was input like we would take the lesson's structure. The first five minutes need to be this. The next 10 minutes need to be this type of activity. You were so planning that we had to plan those sessions as well. But the structure for that lesson is very structured.

Other participants at the school also acknowledged and emphasised the breadth and depth of the structure and approach at School B. According to T3B, '[t]he main resource of GRIN was the structure of each lesson given in training, and the booklets... and collaboration was the main idea of GRIN. Teachers and tutors have given time to discuss students' progress.' Meanwhile, T4B reported receiving the GRIN resources from training and using them in GRIN lessons: 'We probably did a combination [of resources from GRIN and teaching experience].'

However, it is important to acknowledge that even with the proper training, School B still needs to overcome challenges due to resource limitations, which pose significant hurdles in fully accommodating all students who could benefit from the program. This suggests that there may be more students in need than the program can currently support. L2B shared that the responsibility of overseeing the GRIN program at the school has presented some challenges and that 'Timetabling' has been affected due to the priority of GRIN, as mentioned in section 4.3.3. L2B stated that putting together lessons and sessions for GRIN is considered easy, and securing the necessary resources is a significant challenge:

> One of the big issues was the resourcing. Putting lessons and things together was easy because we could plan those. And we could get those sorts of lessons out. The types of lessons that you run in a GRIN session aren't hard to put together.

In contrast to the educational approach of School B, School C's principal (PC) was dedicated to fostering a positive mathematics culture and prioritising mathematics intervention for students. PC emphasised the importance of mathematics skills as a foundational element for students' overall success. He believed investing in numeracy and literacy support is crucial for ensuring students' success at every level; it is not just an extra cost but an investment in their future. Additionally, PC's perception of numeracy as the language of the 21st century and the importance of investing in students' mathematics abilities highlight the school's strong commitment to providing opportunities for their students to excel in mathematics. According to PC:

> There is no special funding. It is important. One of our key approaches here is to make sure that students are literate and numerate; they can be far more successful through school, and that is at every level. So, that's what is important for us.

PC emphasised the school's commitment to literacy and numeracy without special funding: 'We put extra support into literacy and numeracy, and the teachers get the extra time, and we carry that cost, but it is an investment. It is not a cost.' PC believed that the commitment to providing extra support in literacy and numeracy is framed as an investment in students' futures rather than a cost. The PC sees this investment as crucial for students' success in the 21st century:

> [W]e are investing in our students' futures by ensuring they are numerate. I actually think numeracy is the language of the 21st century; everything is built on it, including all the computational thinking around coding. The whole approach to working in a standard future is based on students' numeracy skills. So, we need to invest in supporting students to be successful.

School C's approach to mathematics intervention was centred around the expertise of the numeracy coach and the teachers' teaching abilities. While they do not rely on purchasing specific GRIN materials or providing formal GRIN training, they believe teaching and supporting the students effectively matters most. As PC succinctly noted, '[w]e do not have a purchase program or anything like that. It's teaching. That is what teachers do; they teach.' This approach underlines the importance of pedagogy and the teacher's role in delivering practical mathematics support.

The consistent challenge of insufficient dedicated time for collaboration between GRIN tutors and regular mathematics teachers was evident across all three schools, as reported by teachers. Teachers in Schools A and B highlighted informal communication during lunchtime, after school or in other brief moments. The study identified key challenges as the lack of a formalised structure for collaboration and insufficient dedicated time for collaboration. This resulted in limited communication between GRIN tutors and regular mathematics teachers, who expressed frustration regarding the lack of collaboration and connection between these two groups. T1A emphasised their informal communication: 'No, we do not get given time. We do it informally, at lunchtime, after school, etc. Yeah, we are not given time. No, time is not part of our load. Similarly, T2A shared their experience: 'That was done at lunchtime, and we kept a book we would work through. Additionally, that same book would stay in the room, and I would return to it.'

Despite facing a similar situation, with no time given to collaboration, T4B was fortunate to have a positive relationship with the classroom teacher. This allowed them to communicate effectively and work closely together. T4B shared their experience:

> One teacher and I worked together, and we would provide each other feedback. So, I had her kids and would upload and pre-load them before her class or teach the same level, which worked really well because it was easy content. It is just where we were up to in that curriculum at the time. But again, we would provide feedback to each other via, you know, recess or email.

PC, the principal, and T5C, the tutor, acknowledge that every staff member at a secondary school is preoccupied with the curriculum and numerous requirements. They believe that having a dedicated person, like T6C, responsible for leading the implementation of the GRIN program is crucial in such a busy environment. As PC stated:

> Everyone is busy in school; there are lots of things going on, and there are lots of requirements from the Department of Principals about what you have to do. You must put people in place to keep the agenda going … You have a good staff. You have, you know, the people who see the value in it. And you have got to have someone driving it as well, so it is not. You need to have a [TC6], and you need to have staff who are keen to learn and see students' improvement. I am lucky; we have got that here.

T5C acknowledges that teachers work extremely hard, and often collaboration can pose a challenge to fit into a busy schedule. As T5C aptly pointed out, the absence of designated time for collaborative activities can be challenging to make it happen:

> There is no collaboration because the teachers need more time to collaborate. They teach 20 hours, so I could ask to collaborate with them. However, they do not have the time that you know, and teachers work far too hard; you can only do casual collaboration, which always happens between teachers. However, there is no formal way of collaborating.

It is evident that all schools experienced difficulties facilitating collaboration between GRIN tutors and regular mathematics teachers due to time constraints and workload. This issue of teacher workload has been the subject of interesting research (see e.g., Rajendran et al., 2020; Timperley & Robinson, 2000; Zydziunaite et al., 2020). Hargreaves' (2003) paper 'Education in the Age of Insecurity' adds depth to the understanding of teachers' complexities in the knowledge society, emphasising the need for collaboration and the impact of external pressures on teaching. Likewise, Hargreaves' (2021) exploration of collaboration, including formal and informal aspects, and the considerations for designing effective teacher collaboration is a valuable perspective in addressing educators' challenges.

The interviews indicated that School A assigns a low priority to the GRIN program, which presents a significant obstacle to the program's effective implementation. Teachers and leaders believed that the lack of priority to the program results in inefficiencies and challenges. There was a sense that the program is treated as an afterthought rather than being taken seriously and given the necessary resources and training. T2A suggested, '[i]f we take on programs, we need to do them properly, not in name only.' T1A commented further:

> That is what I mean, given very low priority. It was never, and it was never a high priority... If our executive took it seriously and appreciated that it was a great program beneficial to students. Furthermore, [if] they were prepared to start properly and prepared to give people training. I think all those things would be fantastic.

Furthermore, at School A there was a perception that GRIN is used as a filler for teachers' loads, and there is a lack of proper training and support for those involved. Teachers and leaders expressed the need for higher program prioritisation and proper training. L1A suggested giving GRIN tutors more free time and reducing other responsibilities, such as yard duty, which could help improve the program's implementation:

> It is in terms of management at the senior [Years 7–12] school. It is how we manage it, and, you know, there are possible solutions. For example, teachers involved in the program have reduced yard duty roles. So, I am finding ways to manage it. So that the GRIN program is given a high profile but also serves as a consistent approach to the implementation and running of the program.

Similarly, at School B there was dissatisfaction with the funding allocated to numeracy as compared to literacy. Teachers, such as L2B, expressed frustration over the perceived lack of resources and attention dedicated to numeracy, impacting the implementation of the GRIN program. L2B articulated this frustration, stating:

> Schools invested in massive amounts of literacy, like they get 100 times more funding from the school than numeracy, which is very frustrating… Knowing how much they put into literacy, they do not put enough into numeracy.

4.4 Summary

The teachers' recommendations for improving the GRIN mathematics program in secondary schools emphasise the need for prioritisation, proper training, and support from the entire school community. These recommendations are based on the challenges and issues identified in the existing models at Schools A and B, particularly in the area of timetabling. Additionally, some teachers (T2A and T6C) have suggested that the person responsible for selecting students for the GRIN program should consider other criteria beyond academic performance. This suggestion indicates that the teachers recognise the importance of holistic student development. By considering other aspects of students, such as their interests, motivation and learning styles, a diverse and inclusive learning environment that meets the needs of all students can be created.

Teachers believed that the success of the GRIN program depends on it being seen as valuable and important within the school's educational framework. They suggested that having a designated person trained in the GRIN program, who can advocate for its significance and report on its effectiveness, would make a significant difference. This highlights the need for a dedicated coordinator or leader to ensure proper implementation and impact of the program, as noted by Dinham (2017).

Consistency and time allocation are vital aspects of the GRIN program's success, as highlighted by teachers and the principal at School C. They argued that creating a timetable that aligns with other essential subjects is vital to avoid conflicts and ensure students can fully participate in GRIN sessions without missing important content from other classes. Additionally, allocating enough time for pre- and post-tests is essential to identifying students' needs and providing targeted support, as highlighted by Al-Ramamna and Jreisat (2023). The Principal class participant highlighted the need for a clear approach and expectation, dedicated staff who are committed to student improvement, and support from the school community. Someone who drives the program is also a significant aspect that contributes to its success.

T5C's emphasised that providing GRIN tutors with time to collaborate with regular mathematics teachers and other GRIN tutors is crucial for the program's success. Collaborating allows teachers to share insights, strategies and best practices, enhancing their overall approach to delivering the GRIN sessions. By working together, they can plan and prepare more effectively, ensuring that the sessions are tailored to meet each student's specific needs.

The successful implementation and continuation of the GRIN program is dependent on the availability of sufficient funds and resources. According to T1A and L2B, adequate funding allows the program to operate for an extended period, providing students with the opportunity to stay in the program for as long as necessary to achieve significant improvements in their mathematics skills. It has been suggested that the program should run for a duration exceeding one year to ensure that students receive continuous and sustained support, as highlighted by some teachers.

Financial constraints, however, remain a significant limitation for the GRIN program, expressed by the participants and highlighted in the literature (Goss & Sonnemann, 2020). 'Piecemeal' funding refers to fragmented or insufficient funding, which can lead to uncertainty and restrict the program's ability to reach a broader scope of students requiring support. The need for adequate funding and resources to implement the program effectively is supported by researchers such as Sonnemann and Hunter (2023) and Windle and Miller (2012), who emphasise the significant impact the GRIN program can have on student numeracy skills.

Insufficient funding can limit the program's reach and potential to make a meaningful difference in students' mathematics development. T5C shared her perceptions on the matter, emphasising the need for additional funding to support the program:

> Absolutely, but the trouble is that the funding is always done piecemeal. You are going to do a bit one year and a bit the next year. Whereas, you know, it should not be added funding. It should be called funding. There should be more teachers in schools. It is still a Band-Aid approach. While it does have good outcomes, it is still just Band-Aid [solution] and still only targeting a very small number of students,…there are probably many more who [could benefit] but are not [able to access to the program] getting it.

Overall, the success of the GRIN program is significantly influenced by the school's ability to secure adequate funding and resources, prioritise professional development and support for teachers, and address any time constraints that may arise during implementation. The current findings reinforce that with adequate resources and support, the GRIN program can have a positive and lasting impact on students' mathematics skills and academic success.

Chapter 5: Findings of Impact of the GRIN Program

5.1 Outline of research findings

This chapter presents an overview of GRIN program practice, drawing insights from teachers' perceptions on the themes of 'Impact of the Intervention Program'. The chapter is divided into several sections, each focusing on specific aspects of the teachers' perceptions of the program. The first section explores the theme of Change in Teaching Attitude, shedding light on how the intervention has influenced the teachers' approach and attitudes towards teaching. The following section focusing on Change in Student Achievement is equally intriguing, as it discusses how the pre-teaching approach helps reduce the cognitive load on students, leading to better understanding and retention of mathematical concepts. Furthermore, the perception of intervention effectiveness section provides insights into how teachers perceive the overall effectiveness of the GRIN program in supporting students. Lastly, the chapter highlights the positive effects of the GRIN program on students' achievement and attitudes towards mainstream mathematics lessons.

5.2 Impact of the intervention program

5.2.1 Changes in teaching attitudes

This theme focuses on the impact of the GRIN program on teachers' perceptions, approaches, and attitudes towards teaching mathematics. It includes the following subthemes.

1. Positive and negative opinions of GRIN program

The positive feedback from teachers emphasised the value of working with smaller groups of students in the GRIN program. According to T1A and T5C, the experience was enjoyable and beneficial for students and teachers. This feedback is consistent with a study conducted by Fuchs and Fuchs (2007), which also supports the notion that smaller group instruction can lead to positive student engagement and learning outcomes. T1A's statement that the sessions flew by and were always enjoyable highlighted the positive environment created by the GRIN program. She stated: 'Time you get to work with a small cohort of students. And that is really valuable; it was always enjoyable, and the 20 minutes flew by.' Additionally, T5C's endorsement of the program and belief in its effectiveness further reinforces the teachers' positive perceptions held by teachers regarding GRIN, commenting that 'I would say I enjoy working with small groups. It is very rewarding', and 'I know how GRIN works, which is why I was happy to get GRIN here because I think GRIN is a really good program.' The benefits of small-group instruction in filling knowledge gaps, as explored by Keith (2018), align with the teachers' perceptions, as it allows them to provide targeted support and focus on filling gaps in their students' understanding.

Another positive of GRIN, according to L1A, is that undertaking GRIN professional learning positively impacted her confidence as a mathematics teacher and leader. This teacher found the GRIN professional learning program beneficial, expressing satisfaction with its training, implementation and outcomes. Dinham (2017) and the OECD (2019) have also found that professional learning programs can enhance teachers' confidence and broaden their teaching strategies. L1A's feedback highlights the positive influence of the GRIN program on teaching practices and leadership skills.

However, there are negatives to GRIN. The perceptions of a mathematics teacher and a numeracy leader at School B highlight potential drawbacks to implementing the GRIN program in secondary schools. According to T4B, 'the programs itself works really well, but I think it is more designed for a primary school rather than a secondary school setting in terms of the restrictions around implementing it'. The teacher detailed the restrictions and challenges of implementing GRIN in a secondary school context. L2B supported this view, stating that 'the parameters of high schools and the situation are just really difficult; it is much easier to run in a primary school'.

The teachers' overall perception was that the GRIN program is effective, but they have faced practical difficulties implementing it in secondary schools. Goos et al. (2020) conclude that primary schools might be better suited for the program due to their structures, resources and teaching practices, which are more aligned with the requirements of the GRIN program. Primary schools often have fewer complex curriculums and more flexible schedules, making implementing the program easier.

2.Teacher awareness

Regarding GRIN pedagogy, teachers who participated in the GRIN program reported that it did not directly change their teaching practices in the classroom. However, they did highlight that the program increased their awareness of their students' existing knowledge and areas of challenge. Additionally, the GRIN program fostered a positive and trusting environment for teachers and students. This aligns with the findings of Russell et al.'s (2016) study on the impact of small-group implementation. T1A's perception captured this sentiment:

> No, it [the GRIN program] did not affect how I taught in the classroom. Although, what it did give me was greater recall and trust with students if I had a student in the GRIN program who was also in my class. That did not happen often, but when the two matched up, it was really good because the students knew they could trust me and approach me, so it was better for the students like this. It did not change my pedagogy and how I went about things.

T2A also recognised the impact of the GRIN program's pedagogy on her teaching. While she noted that her teaching approach remained relatively consistent, she acknowledged that the GRIN sessions heightened her awareness of her students' areas of weakness. This awareness enabled her to provide targeted support and reinforcement during regular classroom instruction:

> I don't think I changed how I taught them; it made me more aware of their deficiencies or things we picked up on within that tutorial time so that I could reinforce and support them better within the class. In that way, I don't know that it changed how I taught them, but it probably made me more aware of what they did and did not know.

These responses highlight the GRIN program's auxiliary benefits, including enhancing teacher–student relationships, increasing awareness of students' learning needs, and providing targeted support in the mainstream classroom; as reflected in Quin's (2017) study, this can enhance teacher–student relationships and help teachers better understand the learning needs of their students. When teachers are more aware of their students' learning needs, they can provide targeted support and tailor their instruction to meet those needs. This personalised approach fosters a sense of individualised care and support, which can significantly impact students' motivation and engagement in the classroom. Moreover, research by Scales et al. (2020) emphasises the importance of teacher–student relationships in influencing students' motivation, engagement and sense of belonging. When students feel a positive connection with their teacher, they are more likely to be motivated to learn, actively engage in the learning process, and develop a sense of belonging within the classroom community.

The GRIN mathematics intervention program is designed to offer several benefits, starting with its unique setup that allows teachers to focus exclusively on a small group of students within a dedicated workspace. This small-group dynamic promotes the development of interpersonal and communication skills among students. The GRIN program's structure enables teachers to deliver more personalised attention and support to students, which can be further enhanced when the GRIN teacher is also the student's regular mathematics teacher. This alignment enables the teacher to better identify students' needs during tutor sessions and continue extended assistance in the classroom.

Another key advantage of the GRIN program is its positive impact on students' progress in mathematics classes. When students participating in GRIN feel mentally happier and more comfortable, teachers also experience satisfaction. As T1A stated:

> I feel happy for the student. If they are happy, they feel more comfortable in their own skin and happy with their progress. That is a good thing. That is a great outcome from them, you know; it is both individual health. Yeah, it is a good outcome. Yeah, they feel better about themselves, which is fantastic.

Education research supports the connection between happiness and academic performance. Happier individuals tend to be more engaged in their academic endeavours, and a positive relationship exists between happiness and student achievement (Kasikci & Bugra Ozhan, 2021). The GRIN program appears to aid students in overcoming mathematical challenges and contribute to emotional well-being and positive thinking, resulting in improved overall well-being.

The principal, PC, highlighted teachers' perceptions of the program's benefits for students, recognising its role in helping students navigate the mathematics curriculum and succeed in class. He stated that '[a]cknowledging it supports students to access the curriculum and be successful in class'. However, PC also acknowledged that the mathematics teacher at the school implementing the Front-Loading program does not significantly impact their personal happiness or job satisfaction regarding to the program or work-related matters. He stated:

> When you asked the math teacher at this school, who is doing a Front-Loading program, [if the program] makes you happy when it comes to work-type of stuff like that, [the program] would not be [impacted to] that level.

The results provided by teachers and numeracy leaders highlight the significance of teacher awareness and beliefs in the context of students experiencing difficulties in learning mathematics. The teachers' self-perception of being proficient in mathematics pedagogical approaches and their engagement in the GRIN program to apply what they already consider excellent is noteworthy. This alignment with the findings reported by Beswick (2012; 2018) and Beswick et al. (2012) further emphasises the teachers' perception of their proficiency in mathematics pedagogical approaches and active involvement in teaching, indicating confidence and expertise. Their participation in the program allows them to bridge the gap between theory and practice, enabling them to translate their theoretical understanding into practical implementation.

5.2.2. Change in student achievement

One of the most important and prevalent themes from each interview was the Change in Student Achievement. When asked to describe a student learning outcome in the GRIN program, all participants unanimously described the positive outcomes students experienced due to their participation in the GRIN intervention. This overarching theme can be further explored through four distinct subthemes: 1. Pre-teaching, 2. A change in attitude, 3. A boost in confidence and the cultivation of a growth mindset, and 4. A change in grading.

1. Pre-teaching

During the interview, the participants were asked about their thoughts on the purpose of the GRIN intervention program. According to all participants, the program aims to reduce the cognitive load for at-risk mathematics students by providing them with the foundational knowledge of language, skills and concepts necessary for comprehending upcoming topics in their regular mathematics classes. Schools aimed to schedule the pre-teaching sessions as close to the regular classroom lesson as possible. Ideally, these sessions were held immediately prior to the lesson. However, in practice, sessions could occur within a week of the regular class, typically 1 to 3 lessons before the students attended their normal mathematics class. This timing allowed students to receive targeted support just before they engaged with the new content in their regular classroom setting, helping to reinforce their understanding and confidence. L1A, a mathematics teacher and numeracy leader, highlighted the focus of the GRIN program on consolidating learning and addressing misconceptions about mathematics. One of the key strategies employed in the program is pre-teaching upcoming topics, which allows students to be a step ahead and better prepared to understand new concepts. This approach aligns with the findings reported in a study by Parrish and Bryd (2022), which outline that pre-teaching can reduce cognitive load. Additionally, a significant benefit lies in pre-teaching vocabulary, which enhances students' comprehension. L1A perceptions were captured as follows:

> It [GRIN] is to help students consolidate their learning to debug any misconceptions about math learning... pre-teaching what is coming up. So, as I said, it is giving students consolidation, and it is a step ahead rather than being a step behind... the benefit [student participation in the GRIN] is to pre-teach the vocabulary, which is the biggest benefit.

T2A indicated that the GRIN sessions complement classroom learning by reinforcing covered topics. This includes discussing terminology, concepts, and visuals and setting out problems. The sessions are tailored to address specific areas where students may need additional support, and they work collaboratively on what will be taught in the next lesson. As T2A put it:

> We would talk about what we had done in class, so I would know from that class if there were particular things that they were unsure of. If it was terminology, or if it was a concept of what we were doing, or setting out or visuals or whatever, I would talk about that, and then I would work with them and give them examples, and we would work together on what was coming to the next lesson.

L2B, another numeracy leader, underlined the initial emphasis is on building students' understanding of key mathematical terms and vocabulary relevant to the topic. This enhances their ability to interpret questions and grasp concepts. Ideally, GRIN sessions precede regular class lessons, ensuring students comprehend the terminology used by their teacher. As L2B clearly explained:

> The first thing was language keywords vocabulary to build a kid's understanding of the words we use within the topic they are learning. If you do not use basic operations, you can say plus different key terms so that they can get a better understanding when they are reading a question. There was a focus on language and vocabulary. And that started like the first part of this session.

As explained by L2B, the ideal sequence involves conducting the GRIN session before the regular learning session: 'The ideal situation is that you have the GRIN session first, and then you have the learning so that the kid understands the terminology that the teacher will use as they go into class.' This approach allows students to familiarise themselves with the terminology and concepts used by the teacher during the subsequent class. By having the GRIN session first, students can better understand the material and be better prepared for the upcoming learning session. This idea aligns with the concept of pre-teaching instructional sequences, as mentioned in Watt and Therrien's 2016 study. The study indicates that pre-teaching can effectively improve the overall mathematics skills of students with learning difficulties.

Similarly, T4B clarified that GRIN sessions involve going through new vocabulary and terms before the upcoming lesson. This preparation aids students in understanding and engaging with the content more effectively during their regular mathematics classes. According to T4B, these sessions ‘would be just going through the vocab and, like, going through new vocab and what it meant prior to the lesson’.

Collectively, these responses highlight the central role of the GRIN program in preparing students for their mathematics lessons by familiarising them with essential vocabulary, concepts, and skills. The program’s focus on reducing cognitive load and addressing potential challenges in understanding aligns with its goal of helping students succeed in their mathematics learning journey. Riccomini et al. (2015) point out that mathematics is vital for developing mathematical proficiency, and learning vocabulary is crucial for understanding concepts, communicating ideas, and building confidence. The insights provided by the participants emphasise the importance of proactive preparation and tailored support to enhance students’ readiness and confidence in the classroom.

The primary objective of the GRIN intervention program is to help students feel more comfortable and prepared in their regular classes. By introducing new concepts beforehand, students can become more familiar with the material and build their confidence, leading to increased participation and engagement in class. This approach seems to be working well according to participants’ feedback; the perceptions of T5C further illuminate this key objective:

> Teach the students, and by teaching what they are about to learn on front loading them so that it is not all new to them when they go into class. They have seen it before. And so, they become more confident.

T6C echoed a similar sentiment, stating, ‘I just teach them a mini-lesson on what they will learn in the next period’. T6C’s strategy of providing a mini-lesson previewing upcoming content aligns with the concept of pre-teaching discussed by Setyawati (2020). This pre-teaching approach equips students with a foundational understanding of the upcoming material, allowing them to approach the lesson with greater confidence and a head start. T6C’s belief in the benefits of this approach reinforce the importance of supporting students to enter the classroom with a level of familiarity, enabling them to better engage with the complexities of the material:

> Consequently, instead of trying to learn something from the very start. They have already understood what they are going to be doing, which gives them confidence to say, okay, I can focus on the intricacy of that content.

The teachers' perceptions collectively emphasise the proactive and empowering nature of the GRIN program. The program provides students with a preview of upcoming lessons and the tools to approach learning confidently and quickly. This approach enhances students' understanding and empowers them to actively engage in their learning process, setting the stage for more effective and successful classroom experiences. According to Long (2014), the GRIN program is acknowledged for boosting students' self-efficacy. Self-efficacy refers to an individual's belief in their ability to succeed in specific tasks or situations. By engaging with the GRIN program, students gain a sense of preparedness and are less likely to feel apprehensive during regular lessons. This is particularly relevant when considering the finite capacity of human working memory, as students are better prepared to process and retain information when they have already been exposed to it through the GRIN program. The teachers' perceptions further support that the GRIN program enhances students' preparation and reduces apprehension in regular lessons. By providing students with a preview of upcoming content, the program helps alleviate any anxiety or uncertainty. This proactive approach enables students to approach their regular lessons more confidently and effectively.

However, it is worth noting that participants' perceptions of the pre-teaching practice differed across schools. Schools B and C faced challenges in the implementation of pre-teaching due to the involvement of GRIN tutors who were not the regular mathematic teachers of the GRIN students. Limited time and financial constraints played a role in this strategy. Effective communication between mathematics teachers and tutors was crucial for the success of pre-teaching in GRIN sessions. In contrast, School A adopted a unique approach whereby students' mathematics teachers also taught them in GRIN sessions. This unique factor raises intriguing questions about whether GRIN tutors should ideally be the regular mathematics teachers of GRIN students and how this arrangement could benefit the students' learning outcomes.

2. Change in attitude

Based on the perceptions shared by the five teachers and three numeracy leaders who were interviewed, it is evident that participation in the GRIN program had an impact on student behaviour in mathematics classes. The observed differences in students' attitudes before and after participating in the program were notably positive. This transformation was particularly noticeable among students who struggled with mathematics concepts. As described by one teacher, T1A, students who lacked a clear understanding of mathematics often exhibited behaviours of avoidance and withdrawal in regular mathematics classes. These students hesitated to participate, ask questions, or draw attention to themselves due to their uncertainty. This aligns with Romano et al.'s (2021) finding that students who perceive themselves as struggling may shy away from engaging in class discussions for fear of being exposed as struggling learners. As T1A noted:

> Kids who do not quite understand what is happening tend to try and hide, but they do not want to draw attention to themselves. So, they want to avoid asking questions, in general. Anyone a little bit weaker is usually quite reluctant to get help.

The numeracy leader L2B reported that some students expressed apprehension and fear towards mathematics learning before participating in the GRIN program. These anxieties commonly led to feeling overwhelmed and anxious within traditional mathematics classes (Rubinsten & Tannock, 2010). However, the implementation of the GRIN program resulted in a positive impact on the students' attitudes and confidence levels. L2B explained: 'I know a couple of kids that really stood out and have been really scared about maths and learning as we set them off in the GRIN program.'

L1A, another numeracy leader, emphasised that students who participated in the GRIN program demonstrated a more positive attitude after its completion. This indicates that the program addressed the cognitive aspects of learning and fostered a supportive and encouraging learning environment (Westwood, 2003). Students who had initially struggled and felt overwhelmed in regular classes benefited from the targeted support and nurturing environment provided by the GRIN program. She stated that '[s]tudents, rather than just sitting, perhaps being overwhelmed in a class, selected to do the GRIN program, and as a result, students have come away with a more positive attitude'. Furthermore, T5C noted that some students initially had a negative attitude towards GRIN because they were chosen to participate in the program. She claims that students are worried that participating in GRIN will set them apart from their peers by classifying them as 'not very smart'. She explained:

> At the start, a couple of them [students] were not very happy because they were labelled as not very smart. And you know, I sort of explained to them, well, it is, you know, it is not. We are not saying that she is hopeless at maths; we are saying you are a little bit behind, and if I give you a little bit of help, you will be able to catch up

The perception that students might shy away from engaging in class discussions due to the fear of being exposed as struggling learners underlines the importance of creating a safe and non-stigmatising learning environment. This aligns with studies by Roeser et al. (1996) and Shernoff (2017), which emphasise that teachers' efforts and the overall classroom climate significantly impact students' perceptions of safety and support. Creating a nurturing learning environment enhances students' confidence, motivation and well-being. Teachers, such as T5C, play a pivotal role in dispelling these concerns and ensuring that students understand the supportive nature of the program.

These findings emphasise the multifaceted role of mathematics teachers beyond the teaching of mathematical concepts. Teachers emerged as sources of emotional support, comfort, and trust for struggling students. This aligns with the broader literature that emphasises the significance of addressing early adolescents' social and emotional needs, particularly in subjects that may be challenging for them (Graham et al., 2007). Ultimately, these insights reiterate the essential nature of creating a supportive and inclusive learning environment where students can academically and emotionally thrive.

The teachers and numeracy leaders reported consistently observing a positive shift in students' attitudes towards the GRIN program. After participating in the program, students expressed a newfound understanding of mathematical concepts that had previously eluded them. This newfound understanding, in turn, translated into increased confidence and engaged participation in their regular mathematics classes. As T4A noted: 'The kids, it was more antidote that we noticed, that the kids would actually, you know, start participating in classroom discussions.'

The teachers reported a significant shift from the students' earlier tendencies to avoid participation due to their uncertainty about mathematical concepts. The positive impact on students' participation further highlights the program's ability to foster a more inclusive and engaging learning environment. In addition, L2B and T3B emphasised the feedback they received from the regular mathematics teachers of GRIN students. This feedback indicated that the students who had attended the GRIN program exhibited a more positive attitude towards mathematics and learning in general. This enhanced their engagement in mathematics class and contributed to their overall motivation to learn. T2A stated:

> [when the mathematics teacher] asks them [GRIN students] a question and calls on them in class to explain something, they would not be as nervous at the beginning of the class, and with those things, they will take some risks more so than they would have previously.

The GRIN program's positive impact on student attitudes towards learning aligns with the views of Darling-Hammond (2020) and Hattie (2012). Both researchers emphasise that effective programs and positive learning environments contribute to student success in any curriculum. This suggests that the GRIN program impacts students' mathematics performance and influences their overall attitude towards learning.

Another significant observation made by T4B was the transformation of withdrawn students into more engaged and enthusiastic learners. Previously, these students might have been hesitant to participate in classroom discussions. However, the GRIN program empowered them, making mathematics class more enjoyable and engaging learning environment. The unique aspect of the GRIN program, whereby students are exposed to front-loaded mathematical concepts, plays a crucial role in enhancing students' confidence. L1A shared a student's description of the program as the 'book of spells.' This notion of having insight into upcoming lessons imbued the students with a sense of empowerment and anticipation. Consequently, these students were more eager to participate in discussions and were often the first to offer their contributions. This gave them a head start in mathematics class, and, as a result, she noticed that '[t]hose kids are always the first to put up their hand because they knew what was coming'. With that, 'students have come away with a more positive attitude' and 'transferred across to their literacy and other subjects'.

The positive impact of the GRIN program was not limited to the mathematics subject. According to L1A, students' enhanced attitudes towards mathematics class translated to a more positive outlook across various subjects. This indicates that the GRIN program's impact on students' confidence and engagement in learning had a positive and lasting influence on students' academic experience. T5C echoed similar sentiments regarding the transformative impact of the GRIN program on students' attitudes. As T5C pointed out, students' attitudes towards mathematics significantly shift as they recognise the positive outcomes of participating in the GRIN program. This shift is marked by increased happiness, confidence, and a newfound appreciation for the time spent in tutor sessions. She stated that '[GRIN students] are doing better at mathematics, clearly feeling more confident, and so they are glad to come out of class and come to me'. This sentiment was also reflected by T4B, who noted that students' enjoyment of coming to mathematics class had improved due to the preparatory and confidence-building nature of the GRIN lessons.

The program's impact on students' attitudes and engagement is evident in their increased enthusiasm for learning. 'They started to enjoy coming into math class,' remarked T4B. Feedback highlights the positive impact of GRIN lessons on building students' self-efficacy and confidence. According to Urdan and Pajares (2006) and Schunk and DiBenedetto (2016), prominent researchers have emphasised the importance of confidence building, self-efficacy, and motivation in learning achievement. These researchers highlight that individuals' beliefs in their abilities and fostering a positive learning environment can significantly influence their outcomes. They mentioned that factors such as mastery experiences, social modelling and feedback play crucial roles in building and sustaining student confidence.

Likewise, T1A shared her perception of the transformation in students' attitudes, describing it as a maturing process. She noticed that students engaging with the GRIN program approached their learning more maturely and exhibit greater responsibility. She explained that '[GRIN students] are a bit more mature about how they go about it and because they're achieving at a better level'. As a result of their improved performance and understanding, they also display tremendous enthusiasm and effort. In her view, this positive change in attitude and behaviour directly resulted from their participation in the GRIN program. She stated that '[t]hey try harder... and their attitude changes'.

This study found that numerous GRIN students' initial reluctance to engage in the program emphasises the need for a supportive and nurturing environment. As students' progress through the program and experience the benefits first-hand, their perceptions evolve, and they begin to value the opportunity for additional support. The link between confidence, effort and positive attitudes towards mathematics is crucial to the GRIN program's impact. When students believe in their ability to understand and excel in mathematics, they are more motivated to invest greater effort. This alignment between attitude and effort highlights the role of positive attitudes as drivers of academic success (OECD, 2021a).

As the study unveils the power of attitude in shaping students' learning experiences, the upcoming subtheme will delve further into the significance of developing a learning mentality within the context of the GRIN program. It reveals a more comprehensive understanding of how it fosters a positive learning mentality and the potential implications for students' educational journeys.

3. Confidence boosted and growing mentality to learn

As articulated by L1A, the GRIN program offers students a sense of consolidation. The program aligns with the principles of a growth mindset by providing students with a step-by-step process for tackling mathematical challenges. With each successful encounter with mathematics challenges, students experience a gradual accumulation of confidence, fostering the growth mindset. As Dweck (2016) highlights (see Chapter Two, Section 2.3.4), a growth mindset is the belief that abilities and intelligence can be developed through effort, practical strategies and perseverance. It contrasts with a fixed mindset, which views abilities as fixed traits that cannot be changed. This process aligns with the core tenets of the growth mindset philosophy, where students learn how to approach obstacles and embrace them as opportunities for growth (Yeager & Dweck, 2020; Yilmaz, 2022). As L1A aptly described, '[the GRIN program] provides students with consolidation… this built the confidence in the students step by step as the outcome they can solving mathematics challenges.'

The story below, shared by the numeracy leader (L1A), provides a powerful illustration of the transformative impact of the GRIN program on a student's confidence and overall academic journey. The student, initially struggling with literacy and numeracy, went on to become the school's junior school captain. This positive transformation highlights the role of confidence in shaping students' success and achievements. L1A reflected on this student who was struggling with literacy and numeracy:

> She struggled at school but ended up being the school's junior school captain. That purely came about because the confidence flipped. The GRIN was part of that; there are a number of other factors as well, but GRIN was a big part of that.

L1A's observation reflects how GRIN fosters self-belief and a sense of accomplishment, key elements of a growth mindset. The growth mindset instilled through programs like GRIN contributes to students' belief in improving and overcoming challenges. This mindset influences their approach to mathematics and has a broader impact on their educational journey. The example of the junior school captain underlines how programs that foster a growth mindset can be instrumental in empowering students to reach their full potential.

Additionally, a growth mentality encourages students to take risks and embrace mistakes as integral to the learning process. Teachers from three schools noted that GRIN students were more willing to participate in class discussions, leading to increased engagement and confidence. This aligns with the insights shared by Dweck (2010), who explains the positive impact of a change in mindset on students' learning journeys. This newfound confidence translated into students being more open to attempting mathematical problems, even in their regular mathematics classes. Teacher T2A explained:

> The [GRIN students] were more engaged and felt more confident. Moreover, with those two things, they are more inclined to ask questions or not be nervous. If you called on them in class to explain something, they would not be as nervous at the beginning of the class, and they would take some risks more than they would have previously.

T2A's account highlights that increased confidence empowers students to ask questions and take risks in their learning.

According to the School C principal, PC, participating in the GRIN program gives students self-assurance and boosts students' learning ability:

> It is also self-belief. When you improve at something, you start getting good results. You start feeling proud of yourself, and that promotes that self-belief. I think learning is all about confidence. Moreover, this program helps that confidence and allows kids to feel good about what they are doing. We do not have kids here who say, 'I hate maths'.

The impact of the GRIN program on students' confidence and the cultivation of a growth mindset emerged as a central theme from the participants' responses. This shift in students' attitudes can have profound implications for their academic engagement, willingness to take risks and overall approach to learning. The concept of a growth mindset, as discussed by Dweck (2016) and Brozo and Flynt (2008), emphasises the belief that intelligence and abilities can be developed through effort and hard work. When students adopt a growth mindset, they understand that their abilities are not fixed and that they can improve and excel in mathematics with dedication and perseverance. Moreover, the GRIN program addresses immediate academic challenges and nurtures students' holistic development as resilient, motivated, and self-assured learners by fostering a growth mindset and boosting confidence. The study emphasises the pivotal role of attitude and mindset in student achievement and that exploring the next subtheme, 'Change in Grading', provides beneficial insights into the program's impact.

4. Change in grading

The interviews extensively explored the GRIN program's perceived benefits, focusing on its impact on student grading and achievement. Numeracy leaders at Schools A and C reported improvements in grading due to GRIN participation. Teachers' perceptions varied, with some noting that students' grades had significantly improved while others observed more moderate growth or none. T1A provided a nuanced perception, sharing that some students' grades had slight improvement while others had shown substantial growth in confidence and ability. T1A explained: 'I have one kid who did go better but did not go along with it, and then I have had better kids, and then have just gone through the roof and kept growing in confidence and ability.' T1A further illustrated that the GRIN program's positive effects could be seen in students' continuing mathematics studies into VCE. This observation underlines the program's contribution to short-term improvement, long-term academic engagement, and the pursuit of mathematics education. Orthner et al. (2013) suggest that promising interventions can have both short- and long-term impacts on student engagement and valuing of education.

At School A, another teacher, T2A, shared an observation about the impact of the GRIN program on student grades. T2A mentioned that GRIN students experienced an improvement of about one grade in their academic performance. This aligns with the findings of a study conducted by the Commonwealth of Australia (2014). However, T2A noted that the extent of improvement in the GRIN program varied depending on the specific topic being studied. The statement suggests that the program's impact on student performance may differ depending on the subject area or specific topics within mathematics. She recalled, '[students result] would have probably been increased by a grade, depending on which topic [they were studying]'. This observation highlights the context-specific nature of the program's effects on student achievement. Different mathematical topics may present varying levels of challenge and difficulty for individual students. As such, the GRIN program's targeted support and pre-teaching strategies may have a more pronounced impact on certain topics, leading to a potential grade increase.

In contrast, School B's numeracy leader indicated that while the GRIN program did help enhance students' confidence in mathematics, the formal data from standardised tests did not reveal any significant differences. This suggests that the program's impact on student performance measured by standardised tests may not have been as pronounced as initially expected. This complexity in assessing program efficacy solely through standardised testing is emphasised, highlighting the need to consider qualitative feedback and experiential insights from teachers and students. The numeracy leader further explained:

> We have data because we run the PAT test at the start of year seven and then at the end. So, we can look at the improvement. We didn't see a lot of bang for our buck.

Similarly, T4B acknowledged that while some GRIN students could catch up with their peers after participating in the program, the overall impact might not have met initial expectations.

However, T5C from School C expressed confidence and holds a positive view of the GRIN program's potential impact on students' learning outcomes. She believed that GRIN students have the capability to narrow the learning gap with their peers after participating in the program. While she expresses confidence in the program's success within the current academic year, she acknowledges that the extent of progress – whether it results in a complete catch-up within 12 or 18 months – might vary for different students. As T5C concluded:

> I think it will be successful this year, I don't know whether they will catch up the whole 12 or 18 months, but I think they will catch out. So, but you know, they may need it for more than one year.

It is important to note that the GRIN program did not mandate specific testing or participant data collection. Instead, the evaluation drew upon existing data from regular mathematics class assessments, school testing programs, and feedback from teachers and students from the teachers' interviews. The focus on Change in Student Achievement within this study is significant, as it aligns with the core objective of the mathematics support program (Meiers et al., 2013). This focus on measuring changes in student achievement was explicitly reflected in the three subthemes identified in the study, which provided significant insights into the primary theme of positive shifts in students' attitudes towards learning mathematics.

5.4 Summary

The unexpected outcome of increased confidence in students' mathematical abilities emerged as a central theme from the interviews. While the primary intention of the mathematics program was to provide positive experiences and improve performance, there was an additional consequence of boosting students' confidence in their mathematical skills. Contrary to the researcher's projections, this unforeseen effect of increased effort and an overall shift in attitude aligns with Bandura's (2000) concept of self-efficacy, highlighting that motivation, performance accomplishments, and emotional well-being are rooted in individuals' belief in their own abilities. The unforeseen effect of heightened effort and a more positive attitude towards mathematics represents a valuable and potentially transformative aspect of the GRIN program's impact.

The interview evidence indicated some positive outcomes from the GRIN/Front-Loading program, demonstrating the potential for narrowing achievement gaps. For instance, T5C observed, 'I don't know whether they will catch up the whole 12 or 18 months, but I think they will catch up.' Additionally, L1A shared a story of a struggling student becoming the school's junior captain, attributing this transformation partly to the confidence boost provided by the GRIN program. Moreover, T1A noted instances of students pursuing advanced mathematics studies, such as VCE-level subjects, further solidified the program's efficacy. Participants' anticipated enhancement of self-efficacy and mathematical mindset confirmed and enriched the program's goal of positive experiences and improved performance. This aligns with the broader principles of effective educational interventions, where the holistic development of students' attitudes, beliefs and skills contributes to lasting academic success (Yeager & Dweck, 2020; Yilmaz, 2022).

Chapter 6: General Discussion

The purpose of this chapter is to highlight the important aspects discussed in Chapters 4 and 5 that address the main research question of the thesis: How is the GRIN mathematics intervention program perceived by teachers at three secondary schools in Victoria? Additionally, this chapter further develops the findings of this study in relation to other studies. The key areas for discussion as outcomes of the research have been derived from the comprehensive analysis of teacher perceptions, insights from the literature review, and the overarching goals of the GRIN intervention program:

1. Learning environment and academic success
2. Importance of teacher–student relationships
3. Developed confidence, academic achievement, and readiness to learn, and
4. Implementation challenges and strategies.

These areas serve as signposts for organising the discussion and analysis of the research findings, providing a structured framework to explore the multifaceted impacts of the GRIN intervention program on students and teachers alike.

6.1 Learning environment and academic success

Poor levels of mathematics education achievement among secondary school students are a growing national and global concern (Chand et al., 2021; Muir, 2019). The situation is even more pressing, and seemingly worsening, for students with learning difficulties who are struggling with mathematics at the Australian junior secondary level worsening (ACARA, 2023). It is crucial to address the needs of these students through tailored teaching approaches, especially in junior secondary-level mathematics, where students may lack a foundational understanding of numbers and require interventions beyond relying solely on symbolic representations. This involves employing instructional methods that go beyond using mathematical symbols and notations, ensuring a comprehensive and experiential approach to enhance students' conceptual understanding of numerical concepts. The Victorian Department of Education's (2024) emphasis on differentiated instruction aligns with contemporary educational principles that tailor teaching approaches to small group or individual needs. The approach endorsed by Fuchs et al. (2008), emphasising differentiated instruction, is particularly beneficial for students with knowledge gaps. Significant components of the learning environment come into play in heterogeneous group settings, such as those employed in the GRIN program. The GRIN teacher, operating within a small-group setting, gains the advantage of managing and mitigating significant value disparities among students, ultimately enhancing the program's efficacy (Kalogeropoulos & Bishop, 2017). This controlled environment fosters a belief among students that they can succeed when provided with the opportunity.

Furthermore, the recommendation to group students based on similar mathematics abilities, as highlighted by Gamoran (2021) and Gamoran and Weinstein (1998), aligns with effective teaching strategies. This grouping strategy is recognised as a means of optimising teaching efficiency, allowing educators to tailor challenges to the specific skill level of each group. Simultaneously, it facilitates targeted support, creating a dynamic learning environment responsive to students' diverse needs.

The data from this study contributes to the existing literature by providing insights and perceptions from teachers who have implemented the GRIN intervention program. It allows for direct exploration of the alignment between the program's design and the effective components of intervention programs identified in the literature (e.g., Kalogeropoulos et al., 2019a, 2019b). Furthermore, the interviews provide a practical perspective on the effectiveness of specific teaching strategies within the GRIN program, complementing the findings from Sullivan and Gunningham (2011)'s study. The interview data enriches the understanding of how the GRIN program relates to and contributes to the outcomes of existing research on effective numeracy programs and teaching strategies for students with learning difficulties in mathematics. The congruence between the design of the GRIN intervention program and the effective components of intervention programs identified in the existing literature emphasises the program's potential for positive impact, as supported by Svane et al. (2023), Buffum et al. (2010) and Fuchs et al. (2008). The literature review also delves into effective teaching strategies and their implications for students with learning difficulties in mathematics, offering a rich source of insights. The comprehensive studies by Dowker (2017), Gervasoni and Sullivan (2007) and Scherer et al. (2017) stand out as valuable contributions to this field. Their work meticulously examines effective teaching strategies, synthesising research findings to provide educators with evidence-based instructional approaches and interventions specifically tailored to enhance the mathematical learning outcomes of students facing challenges.

Hattie (2009) conducted a seminal meta-analysis exploring the factors influencing academic achievement, specifically focusing on the learning environment. Through a comprehensive synthesis of research, Hattie's study analyses the effect sizes of various interventions and strategies related to the learning environment and their impact on student outcomes. Importantly, it provides compelling evidence that a positive and supportive learning environment is crucial in fostering academic success. This insight is particularly relevant to the current research, reinforcing the significance of creating a positive atmosphere for students with learning difficulties in mathematics. Contributing further to this understanding, Wang and Eccles' (2013) longitudinal study examined the influence of the school context, including the learning environment, on students' achievement motivation and academic engagement. Their study underlines the importance of a positive and supportive learning environment in promoting students' motivation, engagement, and, ultimately, their academic success. Aligning with the focus of the present research, these studies collectively reinforce the notion that a positive learning environment is instrumental in cultivating a growth mindset among students. This positive mindset encourages them to confront challenges, instils belief in their abilities and actively engages them in the study of mathematics (OECD, 2021b). The alignment of these studies with the current research further solidifies the importance of fostering a conducive learning environment, especially for students facing learning difficulties in mathematics.

The findings from the interviews with mathematics teachers at secondary schools support the understanding that the learning environment significantly impacts students' attitudes to and beliefs regarding mathematics (McMinn et al., 2021). As reported by the teachers, the GRIN program has a positive impact on creating a positive learning environment. The program's unique teaching and learning setting, which involves small groups of students, contributes to its effectiveness in fostering a positive and supportive atmosphere. In alignment with a broader educational understanding (Buffum et al., 2010; Han et al., 2015; Keith, 2018; Yu et al., 2022), these teachers acknowledge the pivotal role of the learning environment in shaping students' attitudes and beliefs.

Four key points emerged from the analysis of the findings related to the learning environment and its impact on students' success in mathematics. This first is the significance of a positive learning environment, which shapes students' attitudes and beliefs towards mathematics. A supportive and encouraging environment within the classroom and the broader educational context can foster a growth mindset and encourage students to adopt a learning mentality. The GRIN program's interactive and welcoming atmosphere, facilitated by small groups of students, sets it apart from traditional mathematics classrooms and contributes to its effectiveness. The second relates to fostering a supportive learning environment, with the

GRIN program creating a supportive and inclusive learning environment in which students feel safe to take risks, ask questions and seek help. Positive teacher–student relationships, peer collaboration and constructive feedback are key elements in establishing such an environment. This can help students develop a sense of confidence, take ownership of their learning and build resilience in facing challenges. Thirdly, the GRIN program provides engaging and relevant learning experiences by utilising learning experiences that are engaging, relevant and meaningful to students. By connecting the mathematics curriculum to real-world contexts, personal interests and students' prior knowledge, the program enhances students' motivation and enthusiasm for learning. When students find the content meaningful and applicable, they are more likely to develop a positive learning mentality and actively engage in their mathematical studies.

The interview findings align with the insights derived from the literature review and theoretical framework, reinforcing the advantages of a small-group learning approach for students with knowledge gaps. As illuminated by research from Buffum et al. (2010) and Keith (2018), small-group learning emerges as a potent vehicle for establishing a more individualised and supportive learning environment, ideally suited to cater to the unique needs of students grappling with specific learning challenges. In essence, the synthesis of these findings underscores the critical significance of fostering a positive and supportive learning environment, as exemplified by programs like GRIN, in shaping students' attitudes and beliefs and their active engagement in mathematics. The cultivation of such an environment emerges as a catalyst, making it more probable for students to embrace a growth mindset, assume responsibility for their learning journey, and ultimately excel in their pursuit of mathematical knowledge.

6.2 Importance of teacher–student relationships

The GRIN program's implementation has a positive impact on teacher–student relationships, which, in turn, influence students' mathematical learning outcomes. According to the present study, the design and methodology of the GRIN program contribute to fostering stronger teacher–student relationships, promoting student engagement and supporting academic success in mathematics. These findings align with prior research, including the study by Maxwell et al. (2017) highlighting the importance of positive teacher student relationships in academic achievement. The present study indicates that the GRIN program goes beyond the traditional focus solely on content knowledge and understanding, recognising the importance of the teacher's role in creating a caring and supportive environment that encourages students to believe in themselves and approach challenges with a positive mindset. The learning environment and teacher–student relationships shaped through the GRIN program significantly impact students' beliefs and attitudes towards mathematics, ultimately influencing their academic outcomes. For example, participant PC highlighted:

> When you improve at something, you start getting good results. You start feeling proud of yourself, and that promotes that self-belief... Moreover, this program helps that confidence and allows kids to feel good about what they are doing. We do not have kids here who say, I hate maths.

T1A further emphasised:

> They [GRIN students] feel more comfortable in their own skin and happy with their progress... This is a great outcome for them, and it's important for their health and well-being.

The findings of the present study highlight that the GRIN program integrates environmental components that extend beyond content knowledge and data-driven instruction. It incorporates thoughtful and considerate behaviours, demonstrating a true and genuine desire for students to improve. This supports the recommendations of Carter and Dean (2006) and Fuchs et al. (2008) regarding the importance of understanding students' abilities and providing supportive learning environments. Furthermore, the GRIN program aligns with Klem and Connell's (2004) research, emphasising the significance of a positive and supportive learning environment. The GRIN program enhances students' engagement and motivation by fostering positive teacher–student relationships and creating an environment that values students' growth and improvement, ultimately leading to improved mathematical learning outcomes.

The findings from the current study further support the importance of solid teacher–student relationships in fostering a positive learning environment. The data reveals that when students perceive themselves as valued, respected and supported by their teachers within the context of the GRIN program, they exhibit higher levels of engagement in their learning and demonstrate a greater willingness to actively seek help when needed. These findings underscore the significance of trust and support within the teacher–student relationship. When students feel a sense of trust and support from their teachers, it creates a conducive atmosphere for learning, encourages active participation and promotes a comfortable environment in which students feel empowered to seek assistance when necessary. Studies by Howes and Ritchie (2002) and Quin (2017) have shown that trust in the teacher–student relationship can contribute to increased student engagement, improved classroom behaviour and enhanced learning outcomes. The positive impact of the GRIN program on teachers' attitudes and trust-building with students highlights that the program can create a supportive learning environment (Wang & Eccles, 2013).

This study further supports the notion that building strong teacher–student relationships is instrumental in understanding students' strengths, weaknesses and learning styles. Through the GRIN program, which employs small-group settings, as discussed earlier, teachers have the opportunity to form deeper connections with their students, facilitating a better understanding of their individual needs. The data reveals that this personalised approach allows teachers to tailor their instruction specifically to address the challenges faced by students with learning difficulties in mathematics. Teachers can build upon their existing knowledge and skills by leveraging their understanding of each student's unique requirements and providing targeted support and guidance. This individualised approach within the GRIN program fosters a more inclusive and effective learning environment, promoting the academic growth and success of students with learning difficulties in mathematics. Previous research conducted by Darling-Hammond et al. (2002), Howes and Ritchie (2002) and Quin (2017) supports the effectiveness of personalised instruction and support in improving student outcomes. When teachers tailor their instruction to match students' specific needs, it increases engagement, improves academic performance and fosters a deeper understanding of mathematical concepts.

Positive teacher–student relationships directly impact students' motivation and engagement in mathematics. When students feel connected and a sense of belonging in the classroom, they are more likely to be intrinsically motivated to learn and actively participate in mathematical activities. Teachers who foster positive relationships with their students in the GRIN program can create an environment where students feel motivated to excel, take ownership of their learning. As a result, students can develop a sense of confidence and a mindset focused on growth and learning. This finding, aligned with research by Scales et al. (2020), emphasises the importance of teacher–student relationships in influencing students' motivation, engagement and sense of belonging.

Teacher–student relationships also contribute to students' emotional and social well-being. Students who feel emotionally supported by their teachers are better equipped to navigate challenges, overcome obstacles and persist in their mathematical studies (Kasikci & Bugra Ozhan, 2021). In the GRIN program, where students may have learning difficulties, positive teacher–student relationships can provide additional emotional support, boost self-confidence and foster a sense of belonging.

Overall, this study on the GRIN mathematics intervention program in secondary schools in Victoria highlights the importance of a positive teacher–student relationship in achieving academic success. The findings highlighted that when teachers establish a positive rapport with their students, it builds trust and enhances student engagement and motivation in learning mathematics. The GRIN program offered a personalised approach, which helped teachers and students to form individualised relationships that addressed students' unique needs. This personalised approach was essential for effectively engaging students in the learning process. These findings are reflective of prior research that consistently emphasises the significance of a positive teacher–student relationship in academic achievement (Maxwell et al., 2017). Additionally, the influence of teacher involvement and enthusiasm on student education has been well-documented in the literature (Bardach & Klassen, 2021; Kelley et al., 2002). The study adds to this body of knowledge by illustrating how the GRIN program's focus on personalised relationships further amplifies the positive impact of the teacher–student connection on student learning outcomes.

The study's findings suggest that the outcomes of the GRIN program are not significantly affected by the student-class-teacher relationship, provided that there is a positive student-tutor relationship in place. However, the research acknowledges that there is insufficient evidence to fully analyse the impact in cases where a positive relationship exists between the student and tutor but not with the class teacher. This represents a gap in the current research that could be addressed in future studies. The interview data emphasises that the intervention program environment, such as the GRIN or similar programs, fosters more favourable relationships between teachers and students compared to the regular classroom setting.

6.3 Developed confidence, academic achievement and readiness to learn

The impact of the GRIN intervention program on students' academic performance and confidence is evident through various observations and studies (Kalogeropoulos et al., 2019a, 2019b; Sullivan & Gunningham, 2011). This positive transformation is credited to the program's emphasis on boosting confidence and instilling a readiness to learn. By nurturing resilience in students when confronted with challenges, the program motivates them to invest increased effort in their learning pursuits. The outcome is a demonstrable enhancement in learning outcomes and a commendable reduction in student achievement gaps. According to the current study, the program's deliberate focus on fostering both confidence and a proactive approach to learning positions it as a holistic intervention that addresses academic performance and contributes to the broader development of students' mindsets and capabilities.

A significant finding of the present study was the GRIN intervention program's strong emphasis on nurturing confidence, recognising its pivotal role in cultivating a positive attitude towards learning. As delineated by Yeager and Dweck (2020) and Yilmaz (2022), this boost in confidence and the development of a readiness to learn revolves around the fundamental belief that intelligence and abilities are not fixed but can be developed through effort and effective strategies. By instilling this belief, the program encourages students to confront challenges and perceive mistakes as invaluable learning opportunities. This is exemplified by the testimony of T2A, who noted, '[i]f you called on them [GRIN students] in class to explain something, they would not be as nervous... and they would take some risks more than they would have previously'. As advocated by Dweck (2016) and Brozo and Flynt (2008), this shift in confidence creates spaces for students to persist in the face of setbacks and approach their learning with positivity and proactivity. This newfound confidence and readiness to learn are particularly crucial in mathematics, where students often encounter difficulties and challenging problem-solving tasks. Through its commitment to fostering a growth mindset, the teachers interviewed in this study emphasised how the GRIN program equips students with the necessary tools to overcome challenges and actively engage in their learning. Through the program, students are provided with specific strategies, resources and support that empower them to tackle difficulties they encounter in their mathematical studies. The teachers observed that as a result of participating in the GRIN program, students demonstrated increased confidence and a willingness to take on mathematical challenges.

The GRIN intervention program's positive impact on student's academic performance and mindset was further supported by the findings from the present study. The data collected corroborate the observations and studies of researchers such as to Kalogeropoulos et al. (2019a, 2019b) and Sullivan and Gunningham (2011). Specifically, the findings highlighted that the intentional emphasis on cultivating a growth mindset and nurturing self-efficacy among students in the GRIN program contributes to their improved academic performance. The data also revealed that this heightened engagement and proactive attitude translated into improved learning outcomes, effectively narrowing student achievement gaps. Students who participated in the GRIN program demonstrated greater empowerment and a willingness to persist in facing difficulties, leading to increased success in mathematics. The program's holistic approach, which integrated psychological factors with academic support, positioned it as comprehensive and effective for GRIN students. By addressing academic needs and psychological factors, the students involved in GRIN successfully prevented discouragement and significantly bolstered overall success in mathematics.

Another notable finding of the present study was the program's promotion of a readiness to learn, which is crucial for developing a positive attitude towards learning. With the structured approach to mathematics concepts, repeated practice, and opportunities for success, the GRIN program effectively helps students cultivate a positive attitude towards the subject and believe in their ability to overcome challenges. The data reveals that this development of skills and confidence has long-lasting effects on students' educational journeys. Students are more likely to approach new challenges with a growth mindset and a willingness to invest the necessary effort for success. Furthermore, a significant impact of the GRIN program, as evidenced by the data from teachers' interviews in this study, is the narrowing of student achievement gaps. The program supports students in overcoming self-doubt and negative beliefs about their abilities. This leads to increased confidence and belief in their capacity to succeed academically, regardless of their initial skill level or background. Consequently, students who may have previously faced challenges or experienced achievement gaps witness improvements in their academic performance, contributing to narrowing the gap between them and their peers. T5C's comments further support the notion that students who have faced challenges or experienced achievement gaps can witness improvements in their academic performance through the GRIN intervention program. T5C observed, 'I don't know whether they will catch up the whole 12 or 18 months, but I think they will catch up'.

According to the teachers in this study, the GRIN program positively impacted students' self-efficacy and growth mindset. The students who participated in the program realised that their hard work and effort directly impacted their understanding of mathematics. By fostering a growth mindset and instilling confidence in their abilities, GRIN helped students excel in their learning. Recent studies have highlighted the importance of mindset in students' success in mathematics (Dong et al., 2023). However, the effectiveness of the GRIN program in improving student achievement varied among individual students, as reported in a present study. While some teachers observed increased grade growth among participating students, this improvement was inconsistent across all students. The impact of the GRIN program can differ from student to student, as T1A mentioned, one student did better but did not fully participate, while others have shown in 'growth in confidence and ability'. Nonetheless, the study found that students' grades had the potential to improve slightly or significantly over time due to the GRIN program, indicating that GRIN students could catch up with their peers. T5C acknowledged the potential extended duration of support needed for some students, stating, 'they may need it for more than one year'. One noteworthy finding was that GRIN students experienced increased confidence in mathematics as perceived by teachers, even in cases where there were no significant changes in their performance. This demonstrates that the program positively impacted students' attitudes and beliefs about their mathematical abilities, which can contribute to their long-term success in the subject.

The GRIN program did not mandate specific testing or participant data collection. Instead, the evaluation utilised existing data from regular mathematics class assessments, school testing programs, and feedback from teachers and students gathered through interviews. Based on their responses, all three schools reported improvements in student self-efficacy and increased confidence in mathematics. At School C, participants' NAPLAN and annual testing results showed significant student improvement at both national and school levels. Conversely, School B did not observe a significant difference in their yearly demand testing. As one teacher, L2B, noted, "We have data because we run the PAT test at the start of year seven and then at the end. So, we can look at the improvement. We didn't see a lot of bang for our buck." Similarly, T4B acknowledged that while some GRIN students managed to catch up with their peers after participating in the program, the overall impact might not have met initial expectations. At School A, participants observed that student improvement in the GRIN program varied depending on the specific topic being studied.

The program has also been effective in boosting students' psychological well-being. Through guided reflection and the development of positive attitudes towards intelligence and abilities, students gain a sense of competence and confidence. This, in turn, enhances their overall self-esteem and emotional well-being, creating a positive foundation for their academic success (Durlak et al., 2011; Heng & Chu, 2023). Moreover, the GRIN program influences students' long-term educational aspirations. Participant T1A provided additional insight into the lasting impact of the GRIN program, noting that its positive effects were evident as students continued their mathematics studies into VCE. This observation suggests that the program contributes to immediate improvements and lays a foundation for sustained success in higher levels of education. The continuity of positive outcomes in VCE underscores the potential of the GRIN program to influence students' long-term academic trajectories in mathematics.

6.4 Implementation challenges and strategies

The implementation of the GRIN program in secondary schools is not without its challenges, as reported by the teachers in this study. While the program holds promise for improving the academic performance of underperforming students, challenges such as inconsistent funding and lack of administrative support emerged as notable obstacles. Collaboration among stakeholders and strong leadership were emphasised as crucial for the successful implementation of the program.

Teachers participating in the study echoed concerns similar to those expressed in a study by Downton et al. (2022), in which school leaders raised apprehensions about the conditions necessary to support mathematics improvement. These conditions encompassed prioritising mathematics improvement, allocating time for mathematics leadership and structuring schools to facilitate collaborative learning among teachers. In alignment with these perceptions, participants in this study underscored the need for prioritisation and a shared sense of responsibility for implementing the GRIN program. However, a divergence in perceived priority was noted at the school level. In Schools A and B, teachers emphasised the significance of support from school leadership and administration in prioritising GRIN sessions and allocating ample time for planning, preparation, and training. The lack of support and supervision from the administration was a recurring concern expressed by teachers, indicating a potential barrier that must be addressed to enhance the successful implementation of the GRIN program.

The current study's findings bring forth an intriguing observation, indicating no notable distinctions in student achievements between teachers who received training for the GRIN program and those who did not. This implies that the program's effectiveness is not solely reliant on teacher training. Instead, the research emphasises the importance of several other pivotal factors identified by teachers, including support from school leadership and administration, the availability of adequate resources and the cultivation of a collaborative school culture. These elements emerged as crucial contributors to the successful implementation of the GRIN program and its consequential impact on student achievement.

The dissatisfaction expressed by teachers in the study regarding the lack of support and supervision from the administration highlights a critical issue within the funding system, extending from the government level to individual schools. Some teachers voiced disappointment with the inconsistent and unequal distribution of funds within their schools, focusing on administrative matters rather than supporting teaching and learning. This creates disparities in resources and support for teachers, potentially hindering the effective implementation of intervention programs like GRIN. This finding aligns with existing literature, including the work of Goss and Sonnemann (2020), Greenwald et al. (1996) and Lamb et al. (2020), who have emphasised the detrimental effects of funding disparities on educational outcomes. Unequal distribution and inappropriate prioritisation of funds can lead to disparities in resources, teacher training and support systems, ultimately affecting the quality of education provided to students.

Addressing these funding issues and ensuring a more equitable distribution of resources is crucial for successfully implementing intervention programs like GRIN and, ultimately, for improving educational outcomes. Adequate funding and support should be directed towards initiatives that directly impact teaching and learning, including professional development for teachers, instructional materials, and interventions that enhance student learning. Furthermore, school administrators need to prioritise and allocate resources effectively, considering the needs of both teachers and students. This includes providing ongoing support, supervision, and professional development opportunities specifically tailored to implementing programs like GRIN (Leithwood, 2021; Patfield et al., 2023). By addressing the funding disparities and focusing on supporting teachers in their instructional practices, schools can create a more conducive environment for the successful implementation of intervention programs and enhance educational outcomes.

Implementing the GRIN program in a secondary school setting can present challenges, as the teachers in this study acknowledged. While teachers recognised the program's potential to improve the academic performance of underperforming students, they also underscored the critical importance of collaboration among stakeholders and the presence of strong leadership for successful implementation. This perspective reinforces the research of Downton et al. (2022), who report that school leaders expressed concerns about the conditions necessary to support improvement in mathematics education. These conditions encompass prioritising mathematics improvement, allocating time for mathematics leadership and structuring schools to facilitate teacher collaborative learning. The emphasis on collaboration and leadership highlights the multifaceted nature of effective program implementation within the educational context.

In this thesis, participants also stressed the need to prioritise and take responsibility for implementing the GRIN program. However, the perceived priority may vary at the school level. In Schools A and B, teachers emphasised the necessity of support from school leadership and administration in prioritising GRIN sessions and allocating sufficient time for planning, preparation and training. Teachers expressed dissatisfaction with the lack of support and supervision they received from the administration, indicating a potential barrier that needs to be addressed to enhance the successful implementation of the GRIN program. The study found no significant difference in impact between the class teacher and a tutor. This is attributed to the fact that the school deliberately used tutors with a background in mathematics to deliver the intervention program.. This implies that the program's effectiveness is not solely reliant on teacher training. Instead, the research emphasises the importance of several other pivotal factors identified by teachers, including support from school leadership and administration, the availability of adequate resources, and the cultivation of a collaborative school culture. These elements emerged as crucial contributors to the successful implementation of the GRIN program and its consequential impact on student achievement. This nuanced understanding emphasises the multifaceted nature of effective educational interventions, with teacher training being just one component of a broader ecosystem that influences program outcomes.

6.5 Summary

The general discussion of the GRIN program's findings highlights its positive impact across various dimensions of the educational landscape, including the learning environment, teacher–student relationships, student self-efficacy, growth mindset and academic achievement. Despite the presence of implementation challenges, the resourcefulness and collaborative efforts of teachers play a crucial role in overcoming these obstacles and ensuring the successful execution of the program. The findings reinforce that the GRIN program has significant potential to enhance students' mathematical learning experiences and outcomes.

The program's emphasis on fostering a growth mindset and supportive resources and strategies contributes to creating a positive learning environment that nurtures students' confidence and perseverance. The collaborative and supportive nature of the GRIN program further facilitates positive interactions between teachers and students, fostering trust, effective communication, and strong rapport within the learning environment. The focus on developing a growth mindset and bolstering students' self-efficacy within the GRIN program enhances their belief in their ability to succeed in mathematics. However, the current research also acknowledges and addresses implementation challenges. Teachers' resourcefulness and collaborative strategies, such as collaborative planning, sharing best practices, and seeking support from colleagues and administrators, have proven effective in overcoming these challenges. This underscores the importance of a collective effort in addressing obstacles and maximising the benefits of the GRIN program.

Chapter Seven serves as the conclusion of the thesis, bringing together the research summary of the studies conducted, and the findings obtained to provide valuable insights related to the overarching research aim. Additionally, the chapter acknowledges and discusses the limitations of the research, providing reflective insights from the researcher. These reflections contribute to a deeper understanding of the study's context and potential areas for further investigation, contributing to a comprehensive understanding of teachers' perceptions regarding the GRIN mathematics support intervention program in Victoria's secondary schools.

Chapter 7: Conclusions, Implications and Recommendations

7.1 Research summary

The present study focused on the perceptions of teachers from schools that have implemented the Getting Ready in Numeracy (GRIN) mathematics intervention program, aimed at supporting junior secondary school students who face difficulties in mathematics. The research question is: How is the GRIN mathematics intervention program perceived by teachers at three secondary schools in Victoria? The sub-questions are: How does the GRIN/GRIN-alike program impact teachers' perceptions of teaching mathematics? and What changes in student achievement have been reported by teachers since the implementation of the GRIN/GRIN-alike intervention program?

The study employed qualitative research methods to collect data from teacher interviews, revealing how Victoria's schools have successfully implemented the GRIN program to address their targets. The study underlines the value of mathematics intervention programs, such as GRIN, in supporting teachers' roles in teaching mathematics. It emphasises the need for greater communication and collaboration between mathematics teachers, GRIN tutors and the administration to ensure the effective implementation of mathematics intervention programs. This will help support students in becoming numerate in an increasingly complex society.

The research highlights the voices and practices of teachers and provides innovative ideas for researchers, policymakers, and educators. The findings of the study highlight that the success of mathematics intervention programs primarily relies on expert teachers who are committed to helping their students overcome learning difficulties. The study also underscores the importance of effective leadership and coordination in implementing action plans to attain better student mathematics outcomes. Moreover, the study highlights the significance of financial resources as a critical enabler for the success of mathematics intervention programs. The study's implications can inform education policies and practices to support teachers in enhancing students' mathematical learning.

7.2 Conclusion

The study's findings illuminate the perceptions of teachers in schools implementing the GRIN mathematics intervention program towards their junior secondary students who struggle with mathematics. Through qualitative research and teacher interviews, the study offers practical insights into teachers' professional understanding and practice in supporting underachieving students. This study is noteworthy as there is limited research regarding how Australian teachers perceive underachieving students, the critical factors, and the practices utilised to support these students. Previous studies (Boyd & Ash, 2018; Maass et al., 2019; OECD, 2019) have highlighted the need for more attention given to this topic. The findings of this study draw attention to academic underachievement as a current and complex issue of concern, particularly at the micro level of schools and their underperforming students. This aligns with the research of Chesters and Cuervo (2022) and Rowe and Perry (2022), who have also emphasised the significance of addressing underachievement in educational settings.

According to the research findings, teachers who participated in the GRIN mathematics intervention program in secondary schools in Victoria identified several factors contributing to the program's success. One key factor was the accurate diagnosis and selection of suitable students for the GRIN intervention, given the limited time and support provided by the program. The study's findings also underscored the importance of effective leadership and coordination in implementing mathematics intervention programs and improving students' mathematics performance. Schools that achieved increased learning achievement demonstrated a prioritisation of the GRIN program and utilised numeracy coaches with exceptional organisational skills. This emphasises the crucial role of strong leadership and coordination in successfully implementing and sustaining effective mathematics intervention initiatives. However, it is important to acknowledge the potential limitations and constraints that school leadership may face in prioritising mathematics improvement. Research by Downton et al. (2022) highlight concerns regarding school conditions and the challenges that school leaders encounter. These challenges may include competing priorities, limited resources, and various obligations they must address. As a result, prioritising mathematics improvement may not always receive the necessary attention and resources to effectively support students with learning difficulties.

The study revealed that teachers' attitudes towards students changed positively due to their involvement in the GRIN program. While the program did not directly impact their teaching style, it significantly influenced their awareness of students' concept exploration and learning. Teachers became more mindful of each student's diverse knowledge and skills, recognising that students had varied core competencies and understandings. This increased awareness enabled teachers to better cater to the individual needs of their students, leading to more effective instruction. Furthermore, the GRIN program fostered trust between teachers and

GRIN students, particularly when the teachers were also their mathematics teachers. This finding aligns with previous research highlighting the importance of trust in the classroom. Studies by Howes and Ritchie (2002) and Quin (2017) have shown that trust in the teacher–student relationship can contribute to increased student engagement, improved classroom behaviour, and enhanced learning outcomes. The positive impact of the GRIN program on teachers' attitudes and trust-building with students suggests that the program can create a supportive learning environment (Wang & Eccles, 2013). Teachers' increased awareness and understanding of individual student needs can lead to more personalised instruction and targeted support, ultimately improving student engagement and outcomes (Howes & Ritchie, 2002; Darling-Hammond et al., 2002; Quin, 2017).

According to the study, teachers have observed various positive changes in students' academic performance after participating in the program. These improvements include increased self-efficacy in mathematics, greater confidence when returning to regular mathematics classes, enhanced relationships with teachers, and, in some cases, extended significant academic growth. Teachers lauded the program for providing timely and practical assistance, essential for success in a subject that had previously posed significant challenges. However, given this, it is concerning that the need for mathematics intervention remains a significant issue in the Australian schooling system. The lack of funding for these programs has led to inconsistent implementation and under-commitment, as indicated by the current study and supported by research such as that of Goss and Sonnemann (2020). As an outcome of this constrained support pattern, underachieving students may not receive the necessary support to improve their skills in mathematics, and achievement gaps continue to exist.

7.3 Limitations

The current study was limited by the time frame in which it was conducted. Interviews were completed with participants who had GRIN experience two to three years prior to the interviews, which could have altered responses as their memory of the implementation of GRIN was only partly fresh at the time of the interview.

Unfortunately, the unanticipated COVID-19 outbreak, and Victoria's resulting lockdowns led to an unavoidable delay in data collection in 2020, extending the research period by a year and making the school research phase particularly challenging. However, despite the difficulties, a significant number of participants completed the data collection within the designated period, demonstrating the compassion of the school leaders and teachers who want to share their achievements with the community to develop better mathematics interventions for underperforming students.

The current findings of the study need to be interpreted in light of the study's limitations regarding the teachers' perceptions. The most prominent constraint of the study is its small sample size, which cannot capture the full range of teachers' perceptions. Consequently, drawing definitive conclusions about the barriers and constraints teachers and school leaders face when implementing GRIN is challenging. However, as a qualitative study, individual responses are valuable in increasing understanding of supporting underperforming students in mathematics implementation. Furthermore, it is important to note that only a limited number of GRIN studies have been conducted in secondary school settings (Ludicke et al., 2019). Therefore, it is crucial not to undervalue the significance of this study.

In addition, not all the schools implemented GRIN as intended, but, rather, some form of intervention based on GRIN. As a result, some teachers' perceptions were only partly representative of GRIN, reflecting the individuals' schools' mathematics intervention program. Therefore, the study findings are only relevant to a mathematics intervention similar to the GRIN rather than GRIN in its entirety.

7.4 Recommendations

Based on the study's findings, it is recommended that the GRIN mathematics intervention program continue to be supported for junior secondary schools in Victoria. The study indicates that the intervention program has positively impacted underperforming students in various school settings, extending beyond mathematics. This highlights the program's potential effectiveness in improving students' attitudes and engagement in mathematics and other academic subjects. Although the study acknowledges that the most successful outcome was achieved in a school that prioritised the program and carefully selected the right students, the insights and recommendations from the study could be valuable for other schools facing similar challenges or operating in comparable educational contexts. By considering the successful practices and strategies implemented in the studied school, other schools can adapt and apply them to their own contexts. The study's findings emphasise the importance of prioritising intervention programs for underperforming students and implementing effective student identification processes. Creating a supportive and conducive environment for the interventions to thrive is also crucial. By applying and adapting these recommendations, schools can improve students' attitudes, engagement, and overall academic outcomes in mathematics and other subjects. While the study details positive experiences and difficulties was reported by participants, it concludes that the GRIN mathematics intervention program has generally produced positive experiences for participants, which is expected of any program. The program's effectiveness and benefits are supported by conclusive evidence from the study

The findings of this study demonstrated that the success of an intervention program to assist underperforming students in mathematics is significantly dependent on the effective implementation of mathematics program actions by school leaders. Hence, school leaders must foster an environment where mathematics is highly regarded, cultivating a positive and supportive atmosphere for teachers and students. Seeking support from these stakeholders is crucial for successfully implementing the intervention program. Involvement and understanding from teachers and students alike play pivotal roles in this process. Additionally, fostering collaboration among mathematics teachers and GRIN teachers is deemed essential, especially when students are exposed to different GRIN and regular mathematics teachers. This collaborative effort ensures consistency in instruction and support, enhancing the program's overall effectiveness.

According to the teachers involved in the program, having a coordinator was crucial in creating and running the withdrawal program. The study recommends that the school employ a person to coordinate the program who can work with the guidance department to schedule the GRIN sessions and address any organisational challenges to ensure appropriate scheduling for GRIN sessions. The schools that were studied faced difficulties with GRIN timetable allocations, so it is essential to consider specific organisational issues when scheduling tutored sessions for mathematics intervention. Overcoming these issues is crucial for the program's success.

The GRIN teachers also recommended limiting group size to four students or fewer to maximise individualisation and personalisation, which the teachers believed necessary for student success. Additionally, the schools in the study are advised to use mathematics teachers when running GRIN in secondary schools to avoid the need for additional training in mathematics topics.

Moreover, the study emphasises the importance of ongoing support to GRIN teachers for effective communication practices. As such, it is recommended that the school allocate sufficient release time for teachers and tutors to receive ongoing support with routines and communication practices. Additionally, providing students with the opportunity to continue in the mathematics intervention program for extended periods is highly recommended. The study highlights that access to funds is a critical factor in ensuring the viability of the intervention program. Therefore, if the school is genuinely committed to supporting underperforming students, it is essential to have adequate financial resources to progress the program effectively.

Although the following recommendation is not necessarily simple since some staffing decisions are based on seniority, it is recommended that teachers who teach mathematics interventions should have a genuine interest in helping struggling learners. The ability to connect with students in a caring and motivating manner aligns with best practices in education. Teachers who care about their students and want to see them succeed are likelier to invest time and energy into finding effective strategies to support them. Furthermore, teachers who are passionate about helping struggling learners are more likely to explore and implement diverse teaching methods to ensure that all students have the opportunity to succeed. This can lead to the implementation of evidence-based instructional practices tailored to meet each student's individual needs.

The final recommendation emphasises the need for teachers to maintain a positive attitude and connect with their students in a caring and motivating way, which is crucial for effective teaching. When teachers encourage their students, they are more likely to believe in themselves and feel empowered to succeed. Even though it is not a structural element, it is a valuable environmental aspect. As teachers, it is essential to act as scaffolders and catalysts for student learning by understanding where they are, setting clear goals, and actively assisting them in connecting prior knowledge to new concepts.

7.5 Future research

Empirical research has demonstrated that teaching the GRIN program by mathematics teachers is an ideal methodology for effectively improving student outcomes. However, further research is needed to determine the most effective approach for students. The study encountered several limitations, including potential biases in participant responses, difficulties in describing differences in lessons between trained and untrained tutors, a relatively small sample size, and the need for more comprehensive data for generalisation. Additionally, it remains unclear whether the GRIN tutor should be the student's regular mathematics teacher or another qualified individual. Addressing these limitations in future research endeavours would contribute to a more nuanced understanding of the program's dynamics and outcomes. Furthermore, the study did not directly observe actual GRIN lessons, making it challenging to describe the differences between trained and untrained tutors. As a step towards generating more generalised findings, five key recommendations are offered:

1. Qualitative Study on GRIN Mathematics Intervention: Conducting a qualitative study on the GRIN Mathematics Intervention from the students' perceptions would be useful to gain insights into their experiences and identify areas that require improvement. This approach could involve interviews, focus groups or surveys to gather rich, descriptive data about the students' perceptions, attitudes, and experiences. Understanding the practical aspects of the intervention from the students' viewpoints can help identify specific areas that need improvement.

2. Quantitative Study with Pre- and Post-Intervention Data: Designing a quantitative study that compares students' data before and after the GRIN mathematics intervention would provide a more objective assessment of its impact. This could involve collecting data through topic tests or standardised assessments like NAPLAN (or other relevant measures). By comparing the students' performance or learning outcomes before and after the intervention, researchers can evaluate the effectiveness of the intervention in a more quantifiable manner.

3. Larger Sample Size: Future studies should aim for a larger sample size of both teachers and students to enhance the generalisability of findings. The original study's limitations regarding sample size could be addressed by recruiting a more substantial and diverse group of participants. A larger sample would increase the statistical power and allow for more robust conclusions.

4. Observation of GRIN Lessons: Direct observation of actual GRIN lessons could be incorporated into the research design to better understand the differences between trained and untrained tutors. This could also incorporate teacher as practitioner research in gathering data on their reflection of efficacy of the program. Observational studies can provide detailed information on instructional strategies, interactions, and classroom dynamics. For example, to examine the different impacts between classroom teachers as tutors and tutors who aren't the students' classroom teachers. By comparing the lessons delivered by trained and untrained tutors, researchers could identify specific practices that contribute to improved outcomes.

5. Longitudinal study: Conducting a longitudinal study would enable researchers to track the progress and effects of the GRIN program over an extended period. This approach would provide insights into the long-term impact of the intervention on students' academic performance and related outcomes.

A detailed research plan is crucial for operationalising the studies and ensuring their effectiveness. It is important to outline the specific steps and methods for conducting the recommended studies. This includes:

- Clearly defining the research questions.
- Selecting appropriate data collection instruments.
- Determining the criteria for participant selection.
- Outlining the data analysis procedures.

A comprehensive research plan will ensure that the studies are well-structured and can generate meaningful results.

By addressing these limitations and implementing the suggested research approaches, future studies can provide more inclusive and generalisable findings regarding the GRIN mathematics intervention. These findings can contribute to a deeper understanding of the intervention's effectiveness and guide improvements in instructional practices for GRIN students.

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Biography

Thi Kim Oanh Bhatti is an accomplished individual with a diverse educational background and a wealth of experience in the field of education. She holds a bachelor’s degree in applied science in mathematics from RMIT and a master’s degree in computer science from Victoria University. Her master’s thesis focused on developing software for Graphically solving a Linear Programming Problem, demonstrating her proficiency in software development and problem-solving. As a secondary teacher with more than 25 years of experience and a mother of three, Kim has a keen interest in child development, particularly in the area of mathematics education. She is passionate about using interdisciplinary approaches to implement numeracy intervention programs for secondary students. Kim’s contribution to the book "Resisting Neoliberalism in Higher Education Volume II, 2019" reflects her dedication to advancing educational discourse and her commitment to making a meaningful impact in the field.

Appendix A: Principal Consent Form

We would like to invite your school to be a part of a study into Teachers' Perceptions of Mathematics in middle Schools. The purpose of this research is to investigate mathematics intervention programs that aim to improve the mathematics skills of middle years students who have been identified as falling behind in their mathematics. This study will investigate the teachers' perception of whether the use of numeracy intervention in middle year meets the needs of these students. In particular, the study aims to determine if this intervention affects the attitudes of teachers towards (a) their classroom teaching and (b) students undertaking the program. Data collection will consist of online using Zoom or face-to-face semi-structured interviews. The risk associated with this research is only considered to be minimal, as all the participants are adults. However, a potential psychological risk could result from disclosure of personal opinions and thoughts about mathematics intervention programs during the interview process. The risks, which are very minimal, are far outweighed by the importance of the research. The research will fill a gap in current knowledge of mathematics intervention programs and will provide valuable insight into how these intervention programs can better help both the students and their teachers.

CERTIFICATION BY PRINCIPAL

I,……………………………………………………………………………………………...

of ……………………………………………………………………………………………

certify that I am at least 18 years old* and that I am voluntarily giving my consent my school to participate in the study:

Teachers' Perceptions of Mathematics in Middle Schools being conducted at Victoria University by:

Dr Alasdair McAndrew, Director of Teaching and Learning, College of Engineering and Science, Victoria University.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Kim Bhatti, Doctor of Education candidate, College of Arts & Education, Victoria University

and that I freely consent to participation involving the below mentioned procedures:

1. In this project, I will be required to have my teachers participate in a one-to-one interview with the researcher for approximately 35-55 minutes, which will be audio-recording.

2. I understand that my school participation is voluntary and that I am free to withdraw from this project anytime without explanation or prejudice and to withdraw any unprocessed data that my teachers have provided.

3. I understand that the data from this research will be stored at the Victoria University premises for five years from the publication of the study results and will then be destroyed.

4. I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements; my school data will be password-protected and accessible only by the named researchers.

5. I understand that after I sign and return this consent form, it will be retained by the researcher.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise my school in any way.

I have been informed that the information I provide will be kept confidential.

Signed:………………………………………………………………………………………

Date:…………………………………………………………………………………………

Any queries about your participation in this project may be directed to the research team,

Dr Alasdair McAndrew

Ph: +61 3 9919 4344, Mob: 0432 854 858, email: alasdair.mcandrew@vu.edu.au.

Dr Jean Hopman

Ph: +61 3 9919 5814, email, jean.hopman@vu.edu.au

Kim Bhatti

Mob: 0423439406, email: kim.bhatti@live.vu.edu.au.

If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email Researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

Appendix B: Participant Information

You are invited to participate

You are invited to participate in a research project entitled Teachers' Perceptions of Mathematics in middle years Schools. This project is being conducted by a student researcher, Kim Bhatti, as part of a partial fulfilment of a Doctor of Education at Victoria University under the supervision of Professor Alasdair McAndrew from the College of Engineering and Science.

This study investigates whether the use of an externally provided mathematics intervention program has a measurable effect on the perceptions and attitude of teachers in the school. Mathematics intervention program involves teacher working with small groups of students who have been identified as falling behind in their mathematics. This study will investigate the teachers' perception of whether the use of numeracy intervention in middle years meets the needs of these students.

What will I be asked to do?

If you consent to participate in this study, you will be invited to contribute data by participating in audio-recorded interviews for up to 55 minutes in your free time. You will be invited to participate in interviews with the researcher at a mutually convenient time. The interview will be audio-recorded and transcribed. During the interviews the researcher will invite you to respond to general questions about your perception of significant teaching and learning interactions and students' outcomes related to the mathematics intervention program.

What will I gain from participating?

The study will allow you to reflect upon, examine and discuss the changes in your teaching attitudes and changes in student achievement since the implementation of mathematics intervention. Participating in this research affords you the opportunity to contribute to new knowledge regarding teachers' perceptions of the mathematics intervention program. Such understanding, while not being comprehensive at this stage, may result in recommendations for improvements in the processes of teaching middle years mathematics.

How will the information I give be used?

The study forms a part of the requirements for Doctor of Education and, as such, findings will be presented at a number of forums for educational research. You will be provided with the thesis in electronic form by the end of my study. Teachers and schools will be anonymous in all publications of results. Pseudonyms will be used when referring to quotes from interview transcripts in all publications of results of the study. All effort will made to ensure that no participant will be identifiable in the final report. Pseudonyms will be used in cases where a participant is referred to specifically.

What are the potential risks of participating in this project?

The interview questions are all based around your experience of the numeracy intervention program. The risk associated with this research is only considered to be minimal, as all the participants are adults. However, a potential psychological risk could result from disclosure of personal opinions and thoughts about mathematics intervention programs during the interview process. The risks, which are very minimal, are far outweighed by the importance of the research. The research will fill a gap in current knowledge of mathematics intervention programs and will provide valuable insight into how these intervention programs can better help both the students and their teachers.

The researcher and her supervisors will be available to discuss and answer any questions that the participants are unsure of before, during and after the study. The schools and the participants will have the opportunity to read the research report before publication.

How will this project be conducted?

The study is concerned with collecting teacher voices. This study will include in-depth interviews with tutors of the intervention program and with mathematics teachers, to investigate experiences and perceptions for analysis. These interviews will be conducted at your school at a time that is suitable to you outside of teaching and meeting hours. This data will provide detailed information about the approaches, strategies and interventions utilised by the school chosen.

Who is conducting the study?

Professor Alasdair McAndrew, Director of Teaching and Learning, College of Engineering and Science

Victoria University
Email: alasdair.mcandrew@vu.edu.au. Ph: +61 3 9919 4344, Mob: 0432 854 858

Dr Jean Hopman, Lecturer, College of Arts and Education, Victoria University

Email: jean.hopman@vu.edu.au. Ph: +61 03 9919 5814, Mob: 0435360027

Kim Bhatti: Doctor of Education candidate, College of Arts & Education Victoria University
Email: kim.bhatti@live.vu.edu.au. Mob: 0423439406

Any queries about your participation in this project may be directed to the Chief Investigator listed above. If you have any queries or complaints about the way, you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

Appendix C: Participant Consent Form

We would like to invite you to be a part of a study into Teachers' Perceptions of Mathematics in Secondary Schools. The purpose of this research is to investigate the Getting Ready in Numeracy (GRIN) mathematics intervention programs that aim to improve the mathematics skills of year 7 students who have been identified as falling behind in their mathematics. This study will investigate the teachers' perception of whether the use of GRIN in junior years in secondary meets the needs of these students. In particular, the study aims to determine if a GRIN intervention affects the attitudes of teachers towards (a) their classroom teaching and (b) students undertaking the program. Data collection will consist of face-to-face semi-structured interviews. The risk associated with this research is only considered to be minimal, as all the participants are adults. However, a potential psychological risk could result from disclosure of personal opinions and thoughts about mathematics intervention programs during the interview process. The risks, which are very minimal, are far outweighed by the importance of the research. The research will fill a gap in current knowledge of GRIN mathematics intervention programs and will provide valuable insight into how these intervention programs can better help both the students and their teachers.

CERTIFICATION BY PARTICIPANT

I,…………………………………………………………………………………………...

of …………………………………………………………………………………………

certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:

Teachers' Perceptions of Mathematics in middle years Schools being conducted at Victoria University by:

Professor Alasdair McAndrew, Director of Teaching and Learning, College of Engineering and Science, Victoria University.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Kim Bhatti, Doctor of Education candidate, College of Arts & Education, Victoria University

and that I freely consent to participation involving the below mentioned procedures:

1. In this project, I will be required to participate in a one-to-one interview with the researcher for approximately 35-55 minutes, which will be audio-recording. I also understand that my participation in this research will not impact on my teaching contact.

2. I understand that my participation is voluntary and that I am free to withdraw from this project anytime without explanation or prejudice and to withdraw any unprocessed data that I have provided.

3. I understand that the data from this research will be stored at the Victoria University premises for five years from the publication of the study results and will then be destroyed.

4. I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements; my data will be password protected and accessible only by the named researchers.

5. I understand that after I sign and return this consent form, it will be retained by the researcher.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed:………………………………………………………………………………………

Date:…………………………………………………………………………………………

Any queries about your participation in this project may be directed to the research team,

Professor Alasdair McAndrew

Ph: +61 3 9919 4344, Mob: 0432 854 858, email: alasdair.mcandrew@vu.edu.au.

Dr Jean Hopman

Ph: +61 3 9919 5814, email, jean.hopman@vu.edu.au

Kim Bhatti

Mob: 0423439406, email: kim.bhatti@live.vu.edu.au.

If you have any queries or complaints about the way, you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email Researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

Appendix D: Background Interview Structure

Interview guide for teachers, leading teachers and GRIN tutor participants. The interviews will be in the form of Semi-structured face-to-face interviews. The numbered questions are open-ended, and the sub-questions are probing. They may or may not be required depending on the answers provided.

Key:

(L) can only be asked of the Leading Mathematics Teacher,

(M) can only be asked of the mathematics teacher,

(T) can only be asked of the GRIN tutor.

Otherwise, the questions will be directed to all participants.

Topic 1: GRIN program

How is the GRIN program implemented in your school?

1. How did the GRIN Mathematics Intervention Program start?
2. What does it mean by GRIN licensed school? (L)
3. Where does the funding for GRIN intervention program comes from? (L)
4. How are GRIN tutors selected and trained to run the program? (L)
5. Which focus group of students should be involved in the GRIN program?
6. What time of the year does the school run the GRIN program?
7. How is the time allocated for a student participating in GRIN lessons?
8. How long has the GRIN program been running at the school? How long is a student allowed to use the GRIN program?
9. What difficulties were encountered when implementing the GRIN program?

Topic 2: Current work situation

What is your current role in the GRIN program?

1. How long have you been involved?
2. What is your role?
3. What are your feelings about your work?
4. What do you see as your most important responsibilities and tasks?

5. Tell me your experiences of being a GRIN tutor? (T)
6. What are the essential aspects of delivering the GRIN program?
7. What level of mathematics content knowledge is required for a GRIN tutor?
8. What are the key concepts of GRIN intervention program lessons?
9. What kind of support do you receive?
10. Do you feel you need additional training to do this work?

Topic 3: GRIN Collaborative

11. What do GRIN program facilitators require to collaborate with the people involved in the program?
12. Are there any issues you face in these collaborations?
13. What strategies do you use to make collaborative work more useful and valuable to students?
14. How involved are you in planning the GRIN program?
15. What are the benefits?

Topic 4: Classroom teaching situation

16. How many years 7 students who have fallen behind in mathematics do you have in your school/mathematics classes? (L, M)
17. What was your initial thought of these students in terms of their mathematical skills and ability?
18. What was your perspective of teaching these students before they participated in the GRIN program? (M)

Topic 5: The participants' perception of the GRIN program outcome

19. What did students get out of the GRIN program?
20. Has the GRIN program raised standards of mathematics in school?
21. What would make a critical contribution to raising achievement?
22. How has the GRIN program changed the way students learn?
23. What observations have you made about the success or otherwise of

your approach/es?

24. What changes in student attitudes, behaviour or learning after participating in the GRIN program have you noticed?
25. What do you think needs to be addressed or modified in the GRIN program for better use in the future?
26. Has your attitude changed now? (M)
27. How would other students benefit from this program?

Topic 6: Professional development

What impact has the GRIN professional development had?

28. Has it impacted your ability to think/act/reason?
29. Has it impacted your working relationships?
30. How would you describe your practice?

What has GRIN professional development done for you?

31. What topics, if any, were successfully addressed in professional development?
32. How often are you required to undertake professional development?

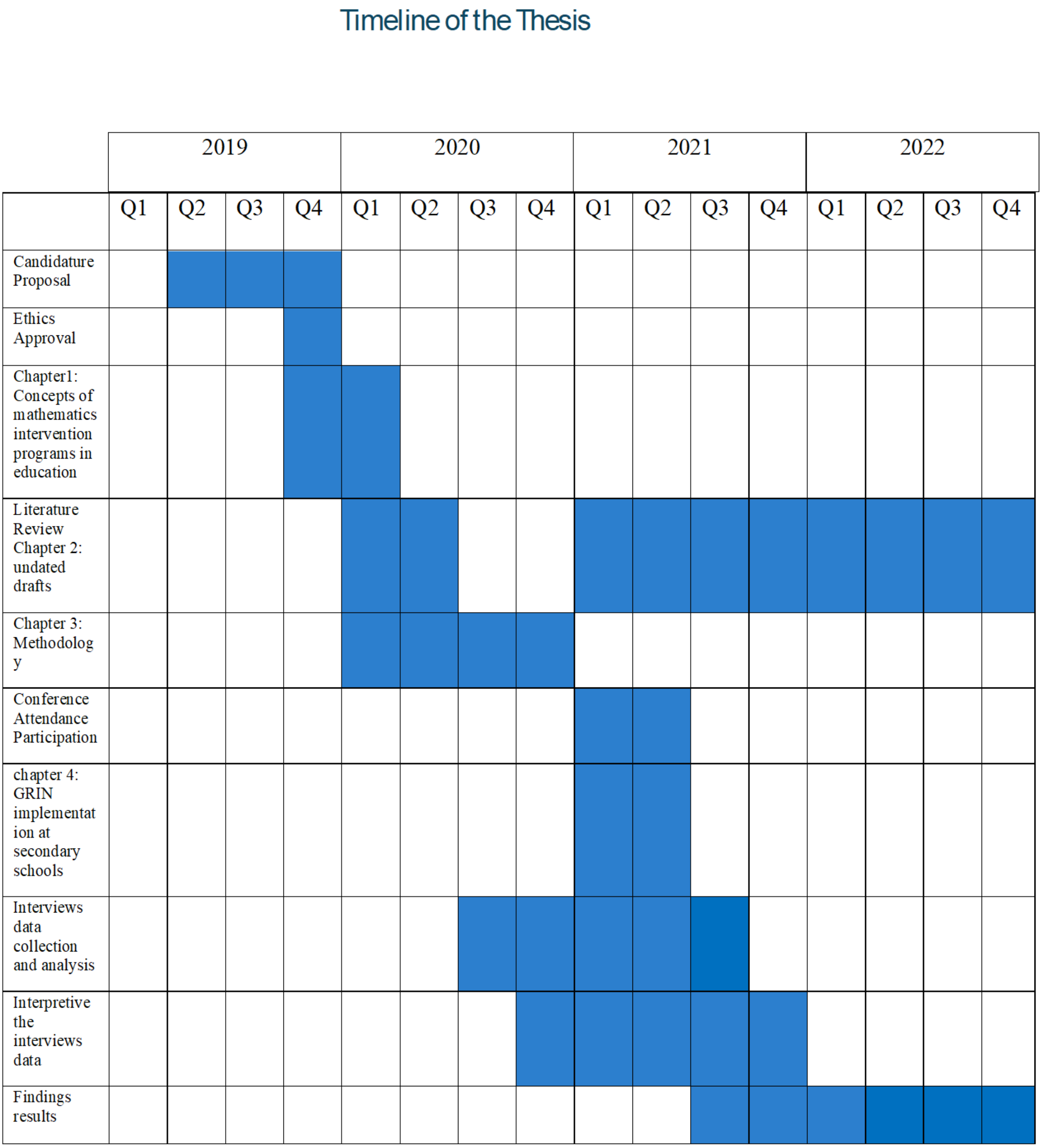
Describe GRIN professional development session that you think would be worthwhile

33. What outcomes would you look for?
34. What structure would it take?

Could this GRIN professional development structure be useful in the future?

35. Who would it be useful for?
36. Why would it be useful?
37. Where would it be useful?
38. Should there be changes

Appendix E: Timeline of the Thesis



Gant chart summarising a schedule of planned work required on each chapter between the time of the Towards Submission Milestor and the time of submission of the thesis for examination

	2023				2024
Time	Qtr1	Qtr2	Qtr3	Qtr4	Qtr1
Towards Submission Milestone Preparation	■				
Chapter1: INTRODUCTION Concepts of mathematics intervention programs in Australian education (in progress of drafting to complete)		■	■		
Chapter 2: LITERATURE REVIEW (Undated drafts toward final draft, including checking and matching all the aspects of thesis)		■	■	■	
Chapter 3: METHODOLOGY (Final draft toward completion)		■	■		
Chapter 4: FINDINGS REGARDING THE GRIN PROGRAM IMPLEMENTATION (Final draft to Complete)			■		
Chapter 5: FINDINGS OF IMPACT OF THE GRIN PROGRAM (Final draft)			■	■	
Chapter 6: GENERAL DISCUSSION (in progress of completing)			■	■	
CHAPTER 7: CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS Revision of drafts			■	■	
Thesis Revision of drafts and finalisation					■
Submission					■

Appendix F: Ethics Approval Letter

Dear DR ALASDAIR MCANDREW,

Your ethics application has been formally reviewed and finalised.

» Application ID: HRE19-143

» Chief Investigator: DR ALASDAIR MCANDREW

» Other Investigators: MS Thi (Kim) Bhatti, DR JEAN HOPMAN

» Application Title: Teachers' Perceptions of Mathematics Intervention in Secondary Schools
» Form Version: 13-07

The application has been accepted and deemed to meet the requirements of the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007)' by the Victoria University Human Research Ethics Committee. Approval has been granted for two (2) years from the approval date; 08/10/2019.

Continued approval of this research project by the Victoria University Human Research Ethics Committee (VUHREC) is conditional upon the provision of a report within 12 months of the above approval date or upon the completion of the project (if earlier). A report proforma may be downloaded from the Office for Research website at: http://research.vu.edu.au/hrec.php.

Please note that the Human Research Ethics Committee must be informed of the following: any changes to the approved research protocol, project timelines, any serious events or adverse and/or unforeseen events that may affect continued ethical acceptability of the project. In these unlikely events, researchers must immediately cease all data collection until the Committee has approved the changes. Researchers are also reminded of the need to notify the approving HREC of changes to personnel in research projects via a request for a minor amendment. It should also be noted that it is the Chief Investigators' responsibility to ensure the research project is conducted in line with the recommendations outlined in the

National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007).'

On behalf of the Committee, I wish you all the best for the conduct of the project.

Secretary, Human Research Ethics Committee

Phone: 9919 4781 or 9919 4461

Email: researchethics@vu.edu.au