

**Physical activity and mental health:
A randomised controlled trial examining martial arts training as a
psychosocial intervention in schools**

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Declaration

I, Brian W. Moore, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Arts, Macquarie University, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification at any other academic institution. Ethics approval for this study was provided by Macquarie University's Human Research Ethics Committee (Protocol number: 5201700901).

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Date: 29th January 2021

Dedication

This work is dedicated to my family. To my sons, Will and Sam; and my long-suffering wife Pip, this endeavour would not have been completed without your support and sacrifice. I cannot thank you or apologise enough.

Acknowledgments

This work would not have been possible without the contributions of many people. Any work is the sum of many parts and reflects the explicit and implicit influences a person experiences during their life. I cannot adequately acknowledge these. For all those who have influenced and contributed to the development and culmination of this work, I humbly thank you.

However, I would like to specifically acknowledge my higher degree supervisors, Dr Stuart Woodcock and Dr Dean Dudley. Thank you for your generosity and guidance. I hope to live up to the model you've provided.

Abstract

The mental health of adolescents in Australia is frequently described as being in crisis. Adolescents report numerous barriers impeding their access to mental health care including poor mental health literacy, fear of being stigmatised, a preference for self-management and the accessibility of treatment (Lawrence et al., 2015). The large treatment gap regarding adolescent mental health is very concerning, especially in view of significant Australian Government funding (Australian Government National Mental Health Commission, 2016). Given the importance of early intervention to minimise the effects of mental illness across the lifespan (Australian Government Department of Health, 2011), it is critical to establish accessible and empirically based treatments that engage adolescent populations.

The idea that physical activity and martial arts training promotes mental health is not new. However, research examining both topics requires greater rigour (Faulkner & Taylor, 2005; Vertonghen & Theeboom, 2010). Consequently, the efficacy of these approaches to address mental health is often questioned. This study aimed to investigate how using physical activity to deliver a psychosocial intervention can improve adolescent mental health, specifically using martial arts training as a unique physical activity that may develop psychological strengths.

As school systems provide natural and accessible ways to deliver mental health interventions to adolescents (Werner-Seidler et al., 2017) with the potential to reduce existing barriers to treatment (Sanchez et al., 2018), this study was delivered to Year 7 and 8 students in secondary schools in New South Wales, Australia. The study entailed a 10-week martial arts-based intervention that also incorporated a psychoeducational component. The intervention was assessed using standardised psychometric instruments under randomised-controlled trial conditions. The primary intervention outcomes were resilience and self-efficacy.

Univariate and repeated measures analysis of variance showed that the intervention improved participants' resilience and self-efficacy. Both outcomes improved following the intervention, however univariate analysis indicated the strongest outcome was measured for resilience, while repeated measures analysis found the strongest outcome was observed for self-efficacy. Regression analysis showed that most demographic factors did not affect the study's outcome variables, the exception being socio-educational status which accounted for 10% to 14% of the observed variance for resilience outcomes and 7% to 10% of the observed variance for self-efficacy outcomes. Participants reported strong post-program intentions to continue martial arts training which suggested the intervention successfully engaged participants and had sufficient fidelity.

The study provided additional evidence that physical activity, in this case through martial arts training, improves the mental health outcomes associated with psychological strengths. The intervention has the potential to fill a mental health treatment gap through delivery as a school-based strategy and engaging youth with a psychosocial intervention using physical activity. Given the importance of early intervention and the high frequency of youth not accessing mental health support, this research demonstrates a novel method for engaging adolescents and an efficacious approach for improving mental health outcomes.

Publications and presentations

The following publications and presentations have been produced as a result of the research conducted for this thesis.

Publications in refereed journals

Moore, B., Woodcock, S., & Dudley, D. (2021). Wellbeing warriors: A randomised controlled trial examining the effects of martial arts training on secondary students' resilience. *British Journal of Educational Psychology*. <https://doi.org/10.1111/bjep.12422>

Moore, B., Dudley, D., & Woodcock, S. (2020). The effect of martial arts training on mental health outcomes: A systematic review and meta-analysis. *Journal of Bodywork and Movement Therapy*, 24, 4, 420-412. <https://doi.org/10.1016/j.jbmt.2020.06.017>

Moore, B., Dudley, D., & Woodcock, S. (2019). The effects of martial arts participation on mental and psychosocial health outcomes: A randomised controlled trial of a secondary school-based mental health promotion program. *BMC Psychology*, 7, 60. <https://doi.org/10.1186/s40359-019-0329-5>

Moore, B., Woodcock, S., & Dudley, D. (2019). Developing wellbeing through a randomised controlled trial of a martial arts based intervention: An alternative to the anti-bullying approach. *International Journal of Environmental Research and Public Health*. 16, 81. <http://doi.org/10.3390/ijerph16010081>

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Moore, B., Dudley, D., & Woodcock, S. (2020). *Physical activity and mental health: The psychological effect of martial arts training*. The King's Institute. Sydney, Australia.

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List of acronyms and abbreviations

ACARA: Australian Curriculum, Assessment and Reporting Authority

ACTRN: Australian Clinical Trial Registration Number

ADHD: Attention Deficit Hyperactivity Disorder

AGAIHW: Australian Government Australian Institute of Health and Welfare

AGDoE: Australian Government Department of Education

AGDoH: Australian Government Department of Health

AGNMHC: Australian Government National Mental Health Commission

AGPC: Australian Government Productivity Commission

AMA: Australian Medical Association

ANOVA: Analysis of Variance

APA: American Psychiatric Association

AUD: Australian Dollars

CONSORT: Consolidation Standards of Reporting Trials

CYRM: Child and Youth Resilience Measure

HREC: Human Research Ethics Committee

ICSEA: Index of Community Socio-educational Advantage

MHCNSW: Mental Health Council New South Wales

NSW: New South Wales

NSW DoE: New South Wales Department of Education

PTSD: Post-traumatic Stress Disorder

SDG: Sustainable Development Goal

SDQ: Strengths and Difficulties Questionnaire

SEQC: Self-Efficacy Questionnaire for Children

SES: Socio-educational Status

SPSS: Statistical Package for the Social Sciences

USD: United States Dollars

WHO: World Health Organisation

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CHAPTER 1

INTRODUCTION

1.1 Background

The mental health of adolescents in Australia is frequently described as being in crisis (Australian Broadcasting Corporation, 2019; Special Broadcasting Service, 2018). Mental health is a significant health, social and economic issue. However, despite an estimated annual global cost of \$2.5 trillion (USD) (World Health Organisation [WHO], 2016), the Australian Medical Association (AMA) reports that mental health and psychiatric care are “grossly” underfunded in Australia (2018, para 2).

While mental health is often characterised in terms of pathology and mental illness (American Psychiatric Association [APA], 2013), mental health is more than the absence of mental illness (WHO, 2018). Mental health can be considered as a continuum ranging from pathology to wellbeing (Mittelmark & Bull, 2013) and mental health promotion should address both mental illness and actions that improve psychological well-being (WHO, 2018). Throughout this work, the term *mental health* refers to both aspects of the mental health continuum, although it should be noted this study primarily focuses on wellbeing and psychological strengths. This is discussed in greater detail in theoretical orientation underpinning the study.

The mental health of Australian adolescents is of particular concern in the literature. An estimated one in seven (or 560,000) Australian youths experience mental health disorders (AMA, 2018). This presents a significant public health burden (Werner-Seidler et al., 2017). According to the *Second Australian Child and Adolescent Survey of Mental Health and Wellbeing*, the total prevalence of mental illness among Australian adolescents aged 12 to 17 years was 13% for females and 16% for males (Lawrence et al., 2015). The prevalence of

mental illness rises sharply in later adolescence, peaking at approximately 27% of young people aged 18 to 19 years meeting the diagnostic criteria for a serious mental illness (Mission Australia, 2017). The most commonly diagnosed psychological disorders among Australian adolescents are Anxiety Disorders, Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder, and Depressive Disorders (Australian Government Australian Institute of Health and Welfare [AGAIHW], 2020). Australian adolescents reported that psychological distress, school problems, and body image were their most significant mental health concerns (Mission Australia, 2017).

However, only 30% of Australian adolescents aged 13-17 years report using formal services for mental health problems (Islam et al., 2020). Various barriers limit the impact of these services, including stigma (Corrigan, 2004), expense (Packness et al., 2019), poor mental health literacy (Islam et al., 2020), and service accessibility (Moore et al., 2019a). This may be exacerbated by adolescents preferring to use informal supports for mental health (Mission Australia, 2017). The large treatment gap regarding adolescent mental health is very concerning, especially in view of significant Australian Government funding (Australian Government National Mental Health Commission [AGNMHC], 2016). Given the importance of early intervention to minimise the effects of mental illness across the lifespan (Australian Government Department of Health [AGDoH], 2011), and the increasing prevalence of mental illness during later adolescence (Mission Australia, 2017), it is critical to establish accessible and empirically based treatments that engage adolescents.

This study examined a different route to improving adolescent mental health. While there is some evidence in support of physical activity (more generally) and martial arts training (more specifically) promoting mental health and having important psychological benefits, research examining both topics requires greater rigour (Faulkner & Taylor, 2005; Vertonghen & Theeboom, 2010). Consequently, the efficacy of these approaches to address mental health

is often questioned. This study aimed to rigorously investigate using physical activity as the basis of a psychosocial intervention to improve adolescent mental health. The study specifically examined martial arts training as a unique physical activity that may develop psychological strengths.

1.1.1 *Services addressing the mental health of Australian adolescents*

A range of formal services are available to support the mental health of Australian adolescents (Mission Australia, 2017). These include health services, telephone counselling services, online services, and school-based services. However, the efficacy of these services is unclear (Mental Health Commission of New South Wales [MHCNSW], 2014; Rosenberg & Hickie, 2019). In addition to the barriers limiting the impact of mental health services, it is pertinent to consider whether Australian adolescents' perceptions of treatment efficacy might contribute to their preference for seeking help for personal or emotional problems from a friend (74%) or parent (69%) compared to a mental health professional (9%) (Gray & Daraganova, 2018). This is particularly worrying due to the potential for misinformation or inadequate care.

Schools arguably have a critical role in supporting adolescents (New South Wales Department of Education [NSW DoE], 2019), as the school system provides a “natural and accessible” way to address the mental health issues of students (Werner-Seidler et al., 2017, p. 32). However, schools often provide the only source of mental health care for 70% to 80% of children and adolescents (Paternite, 2005; Rones & Hoagwood, 2000), with the consequence that teachers and school staff frequently assume frontline mental health provider roles (Sanchez et al., 2018). Given that many teachers and school support staff report low confidence to carry out roles in mental health care (Moon et al., 2017), this is a concern.

The *Youth Mental Health Report Youth Survey 2012-16* proposed that, “schools should provide evidence-based universal mental health prevention and intervention programs for

young people” (Mission Australia, 2017, p. 6). School-based mental health services are provided by a variety of people with a range of qualifications including school counsellors and psychologists, teachers and other school staff, and Department of Health and non-government organisation staff. However, there is little consistency in the types of mental health services provided by schools. School-based mental health services range from formal to informal, may be individual or group based, and may or may not use specific mental health programs. An additional concern is that while some evidence reports that school based mental health services are as effective as traditional outpatient clinic services in improving mental health outcomes (Kang-Yi et al., 2018), there are many services being used or paid for by schools for which there is little or no empirical evidence (Rones & Hoagwood, 2000).

1.1.2 *Physical activity and mental health*

Physical activities are generally accepted as promoting important psychological benefits (Biddle & Mutrie, 2008). While there is a growing body of empirical evidence supporting this (e.g., Dale et al., 2019), existing research exhibits significant methodological problems (Mammen & Faulkner, 2013) and the mechanisms underpinning the relationship between physical activity and mental health are not well understood (Lam, 2016).

Nonetheless, there is significant support for using physical activities as a mental health strategy despite the limitations of this evidence. Research has found that physical activity decreases the symptoms of anxiety (Lam et al., 2016) and depression (Mammen & Faulkner, 2013; Rethorst et al., 2016); and positively affects behaviours related to mental health by improving sleep (Youngstedt & Frelove-Charton, 2005) and strengthening social inclusion (Coalter, 2005). Physical activity has been found to alter brain-derived neurotrophic factors such as dopamine, noradrenaline, and serotonin which are significant neuro-physiological factors underpinning mental health (Lam, 2016). This suggests physical activity may have

inherent mental health promoting qualities and it is therefore proposed that physical activity may be a suitable medium from which to structure a psychosocial intervention. Given the barriers impeding adolescents accessing mental health services, universal and targeted school-based delivery of psychosocial interventions using physical activity may have significant potential to fill a mental health treatment gap.

Traditional martial arts training is a unique form of physical activity that has been found to promote psychological benefits and may incorporate mechanisms that parallel mental health interventions. Thus, while many types of physical activities might be used as a platform for improving mental health outcomes, martial arts training warrants greater investigation as a physical activity medium in this context.

1.1.3 *Martial arts training as a psychosocial intervention*

The martial arts are a culturally complex form of physical activity that have contested definitions. While the martial arts are a ubiquitous human phenomenon with an extensive history (Lorge, 2012), the term is complicated by popular usage and cultural interpretations of the martial arts. Martial arts could include reference to any “fighting art” (Donohue & Taylor, 1994, p. 13); however, paradoxically the martial arts are often presented in extremely violent terms (Fuller, 1988) while concurrently being considered as having a pacifistic philosophy that promotes mental health benefits (Zivin et al., 2001).

Research examining the mental health outcomes from martial arts training is limited (Moore et al., 2019a), focusing on aggression and personality correlates (Vertonghen & Theeboom, 2010). Studies examining the outcomes of martial arts training on mental health frequently report positive effects regarding mental illness including anxiety (Li et al., 2004; Wang et al., 2014), depression (Chou et al., 2004; Toskovic, 2001; Wang et al., 2014), and post-traumatic stress disorder (PTSD) (Weiss et al., 2017); and characteristics associated with

wellbeing and mental health strengths such as self-efficacy (Reishehrei et al., 2014; Ryan et al., 2015), self-regulation (Massey et al., 2013; Milligan et al., 2015), and wellbeing (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005). However, some research has reported negative effects (Bjorkqvist & Varhama, 2001; Endresen & Olweus, 2005; Reynes & Lorant, 2004). In addition to this, numerous methodological issues limit the generalisability of research examining the mental health outcomes from martial arts training. These include conceptual and definitional issues, reliance on cross-sectional research designs, small sample sizes, self-selection effects, reliance on self-report measures without third party corroboration, limited use of follow-up measures, and not accounting for gender differences (Moore et al., 2020; Vertonghen & Theeboom, 2010).

Several authors have suggested that martial arts training exhibits similarities to psychological therapy (Burke et al., 2007; Burt & Butler, 2011; Wargo et al., 2007) and may be a useful therapeutic approach (Woodward, 2009). However, little research has been conducted into the application of martial arts training as a psychological intervention (Macarie & Roberts, 2010; Moore et al., 2019b). Given that martial arts training is not a standard or established treatment for mental health issues, the potential psychological benefits of martial arts training may ground this activity within the context of complementary therapies. As complementary therapies are used frequently in Australia (Reid et al., 2016; Solomon & Adams, 2015) and are used more than conventional therapies by people diagnosed with anxiety and depression (van der Watt et al., 2008), it is important to consider the potential of using physical activities such as martial arts training as a school-based intervention to engage adolescents.

In this study, martial arts are operationally defined by the author as: (1) a socially constructed human behaviour based on physical activity; (2) referring to the various skills and

practices that have originated as a method of combat or self-defence; and (3) incorporating a psychological health and personal development dimension.

1.2 Purpose and aims of this study

The aim of this study was to investigate (using a randomised controlled methodology) to what extent martial arts-based psychosocial interventions are an efficacious strategy to improve adolescent mental health in a secondary school-based setting. The study examined the wellbeing and pathological aspects of the mental health continuum in adolescents from the context of well-being and psychological strengths.

1.3 Research questions

The specific research questions are:

- (a) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' resilience at post-intervention and follow-up?
- (b) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' self-efficacy at post-intervention and follow-up?
- (c) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' mental health difficulties at post-intervention and follow-up?
- (d) To what extent do demographic co-variates have any effect on the intervention outcomes?
- (e) To what extent did the intervention program engage adolescent participants?

1.4 Research hypotheses

It was hypothesised that:

- (1) Participation in a 10-week martial arts-based intervention would increase resilience at post-intervention.
- (2) Participation in a 10-week martial arts-based intervention would increase resilience at follow-up.
- (3) Participation in a 10-week martial arts-based intervention would increase self-efficacy at post-intervention.
- (4) Participation in a 10-week martial arts-based intervention would increase self-efficacy at follow-up.
- (5) Participation in a 10-week martial arts-based intervention would decrease psychological difficulties at post-intervention.
- (6) Participation in a 10-week martial arts-based intervention would decrease psychological difficulties at follow-up.
- (7) Participation in a 10-week martial arts-based intervention would engage the participants in a mental health intervention.

1.5 Significance of the thesis

The WHO (2016) has reported that the impacts of poor mental health are growing. From an economic perspective, the costs associated with mental health are projected to increase 240% between 2016 and 2030 (WHO, 2016). However, this may not adequately convey the total costs of supporting mental health, given the problem affects “the entire social fabric” (Trautmann et al., 2016, p. 1245). While early intervention using accessible and empirically based treatments is critical to minimise the effects of mental illness across a person’s lifespan (AGDoH, 2011), only 30% of Australian adolescents aged 13-17 years report using formal services for supporting mental health (Islam et al., 2020). This indicates there is a significant treatment gap addressing Australian adolescents’ mental health.

This thesis makes a unique contribution to the literature by providing evidence regarding the efficacy of physical activity, specifically using a martial arts-based intervention, to improve adolescents' psychological strengths in a school-based setting. The study has the potential to fill a mental health treatment gap by using physical activity as “a hook” (Hartmann, 2003, p. 124) to engage and deliver adolescents an efficacious psychosocial intervention.

1.6 Overview of methodology

The study was conducted in two distinct phases. Phase one involved a systematic review of the: (1) mental health problems confronting Australian adolescents; (2) mental health services addressing this issue; (3) relationship between physical activity and mental health; and (4) evidence examining the effects of martial arts training on various mental health outcomes. A systematic review of the published literature on the effectiveness of the services addressing Australian adolescents' mental health and other strategies such as physical activity and martial arts training may serve as a policy foundation for evidence-based practice guidelines, economic evaluations, and future research agendas. It also provided a synthesis of evidence and identified gaps in the literature to indicate where future research is needed.

Phase two of the study implemented a randomised controlled trial to examine the effect of a 10-week martial arts-based psychosocial intervention on adolescents' mental health outcomes. The participants were grade 7 and grade 8 students across five public and Catholic secondary schools situated in western Sydney. Participants completed a standardised and validated survey instrument at three time-points (baseline, post-intervention, and follow-up) during the study. Data obtained from the survey instruments were analysed using quantitative methods.

1.7 Overview of thesis

The chapters within the thesis are as follows.

1.7.1 *Chapter One: Introduction*

This chapter introduces the thesis by briefly considering the background of the mental health issues confronting Australian adolescents and mental health services addressing this. The purpose and aims of the study are presented through a statement of the study's research questions and hypotheses.

1.7.2 *Chapter Two: Literature Review*

The literature review provides detailed information regarding the background of the mental health issues confronting Australian adolescents. The mental health services addressing this issue are considered, including the role of schools in addressing the mental health of Australian adolescents. This study has taken a different route to improving adolescent mental health and reviewed the case for physical activities as a mental health strategy in school-based settings. Specifically, the study examined martial arts training, which is a unique physical activity that potentially improves mental health outcomes. Previous research examining the psychological outcomes from martial arts training is reviewed. The chapter also reviews the theoretical orientation underpinning the study.

1.7.3 *Chapter Three: Methods*

This chapter reviews the methods used by the study, which is synthesised with the methodological approach underpinning the research. The quantitative and experimental study design used in the research is considered. Descriptions of sampling and recruitment procedures,

the intervention program evaluated by the study, instruments and outcome measures, and data analysis are provided.

1.7.4 Chapter Four: Results

The results are structured in sections providing information about the study's sample characteristics, scale validity and reliability data, and results evaluating the study's intervention program. The data regarding the intervention program relate to the outcome measures resilience, self-efficacy, and mental health difficulties, which were examined using univariate and repeated measures analysis of variance, and regression analysis. Chi-square analysis provided information regarding participant engagement.

1.7.5 Chapter Five: Discussion

This chapter discusses the study's results, specifically considering the intervention's effects with regard to how the current results support or do not support previous research. The practical significance of the study's findings are discussed and a perspective regarding whether martial arts-based psychosocial interventions are an efficacious strategy to improve adolescent mental health in school-based settings is offered. The implications and limitations of the study across several domains are reviewed.

1.8 Summary

The mental health of adolescents in Australia is frequently described as being in crisis, and an estimated one in seven (or 560,000) Australian youth experience mental health disorders (AMA, 2018). However, only 30% of Australian adolescents aged 13-17 years report using formal services for supporting mental health (Islam et al., 2020), suggesting a significant

mental health treatment gap. This study examined the efficacy of physical activity to promote mental health, specifically using a martial arts-based psychosocial intervention aiming to improve adolescents' psychological strengths in a school-based setting. The intervention was evaluated using a randomised controlled design. Data were obtained using survey instruments at three time-points (baseline, post-intervention, and follow-up) during the study and analysed using quantitative methods.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

The mental health problems confronting Australian adolescents are significant. However, despite being well intentioned, the mental health services addressing this problem are arguably inadequate. This literature review provides detailed information regarding the background of the mental health issues confronting Australian adolescents. The services addressing adolescent mental health are considered, including the role and efficacy of schools in addressing adolescent mental health. This study examined using physical activities as a mental health strategy for improving adolescent mental health (primarily focused on wellbeing and psychological strengths) in school-based settings. Specifically, the study examined martial arts training, which is a unique physical activity that potentially improves mental health outcomes. The chapter reviews definitions and perspectives of the martial arts and provides a detailed review of previous research examining the psychological outcomes from martial arts training. The theoretical orientation underpinning the study is reviewed. Through examining these issues, the chapter provides an overall context for the study.

2.2 Mental health problems confronting Australian adolescents

Mental health is a significant issue confronting Australian adolescents and is a significant health, social and economic issue across Australian and global contexts. The WHO (2016) estimated the annual global economic cost of issues related to mental health is \$2.5 trillion (USD) and projects these costs to increase 240% from 2016 to 2030. The Australian Government Productivity Commission (AGPC) has estimated that the annual cost of mental

health in Australia is \$220 billion (AUD) (AGPC, 2020). However, despite this the Australian Medical Association (AMA) reported that compared to physical health issues, mental health and psychiatric care are “grossly” underfunded and that Australia lacks a national approach that facilitates prevention and mental health care (2018, para 2).

The mental health of Australian adolescents has created an increased public health burden (Werner-Seidler et al., 2017). An estimated one in seven (or 560,000) Australian youth experience mental health disorders (AMA, 2018). While the estimated prevalence of adolescent mental health problems varies, the *Second Australian Child and Adolescent Survey of Mental Health and Wellbeing* reported the total prevalence of mental illness among Australian adolescents aged 12 to 17 years was 13% for females and 16% for males (Lawrence et al., 2015). According to Mission Australia (2017), the prevalence of mental illness rises sharply in later adolescence, peaking at approximately 27% of young people aged 18 to 19 years meeting the criteria for being diagnosed with a serious mental illness. This highlights the importance of earlier intervention for addressing Australian adolescents’ mental health (AGDoH, 2011).

Anxiety Disorders, ADHD, Conduct Disorder and Depressive Disorders are the most commonly diagnosed psychological disorders among Australian adolescents (AGAIHW, 2020). Australian figures indicate that internalising mental health disorders such as anxiety and depression are more commonly diagnosed in female adolescents (anxiety: female = 8%, male = 6%; depression: female = 6%, male = 4%), while externalising mental health disorders such as ADHD and conduct disorder are more commonly diagnosed in male adolescents (ADHD: female = 3%, male = 10%; conduct disorder: female = 2%, male = 3%) (Lawrence et al., 2015). While prevalence rates vary internationally, similar gender differences are consistently observed for these mental health disorders (APA, 2013). Prevalence rates are important to understand, however adolescent reports regarding their experience of mental health should also

be considered as these present a clear picture of youth mental health problems.

According to the *Youth Mental Health Report Youth Survey 2012-16*, Australian adolescents reported that coping with stress was their most significant mental health concern, so much so that one in three Australian adolescents report moderate to high levels of psychological distress (Mission Australia, 2017). School problems and body image were also rated as very significant mental health concerns, while depression was rated as a significant concern among Australian adolescents with a serious mental illness (Mission Australia, 2017). Other mental health issues concerning Australian adolescents included bullying and emotional issues, discrimination, drugs and alcohol, family conflict, gambling, personal safety, and suicide (Mission Australia, 2017).

This evidence highlights the mental health crisis confronting adolescents in Australia (Australian Broadcasting Corporation, 2019; Special Broadcasting Service, 2018). It is supported as an area of need by the United Nations (2015) Sustainable Development Goal (SDG) 3, which stresses the importance of good health and well-being. However, the measures addressing mental health in Australia to-date are underfunded and largely reactionary in nature (AMA, 2018). As early intervention is critical for minimising the effects of mental illness across the lifespan (AGDoH, 2011), it is important to establish accessible and empirically based treatments that engage adolescents.

2.3 Current services addressing the mental health of Australian adolescents

Australian adolescents can access a variety of services for supporting mental health (Mission Australia, 2017). These include health services, school services, telephone counselling services and online services. However, according to Islam et al. (2020), only 30% of Australian adolescents aged 13-17 years report using these services to support mental health. Adolescents with a serious mental illness indicated they used multiple sources of help (Mission Australia,

2017), with females reporting they were more likely to access mental health services than males (Islam et al., 2020). According to Chandra and Minkovitz (2006), this gender difference may result from adolescent males having poorer mental health literacy, higher perceived stigma, and parental disapproval. Barriers to adolescents accessing mental health care are discussed below.

Mental health services for Australian adolescents are provided by qualified health professionals across various service locations, including private practice, community-based services, and hospital inpatient, outpatient, and emergency facilities. While it is concerning that only 30% of Australian adolescents aged 13-17 years reporting mental health issues accessed these services (Islam et al., 2020), it is of particular concern that approximately 35% of Australian adolescents diagnosed with a mental illness did not access any mental health treatment (Lawrence et al., 2015). The Australian Government provides mental health services through Medicare¹-funded consultations with general practitioners, psychologists, and psychiatrists (MHCNSW, 2014); and through Headspace (a non-government organisation) which is funded by the Australian Government to provide mental health services to people aged 12-25 years (Headspace, 2018). The New South Wales (NSW) State Government provides mental health services through inpatient hospital admissions and outpatient services (MHCNSW, 2014).

Australian adolescents also accessed mental health services using telephone helplines such as Kids Helpline and online services such as Headspace, Reachout, and Youth Beyondblue. The *Youth Mental Health Report Youth Survey 2012-16* reported 13% of Australian adolescents with a probable serious mental illness and 10% of Australian adolescents with no serious mental illness used telephone services for counselling or seeking

¹ Medicare is Australia's universal health insurance scheme which provides all Australians access to a range of health and hospital services at low or no cost (AGDoH, 2020).

information in the 12 months prior to 2017 (Mission Australia, 2017). During the same period online services were used more frequently: 22% of Australian adolescents with a probable serious mental illness and 14% of Australian adolescents with no serious mental illness used online services in the 12 months prior to 2017 (Mission Australia, 2017).

However, the efficacy of mental health services provided by health professionals in Australia is unclear. The efficacy of Medicare-funded consultations is questionable due to “little or no accountability at the practitioner or national policy level” (Rosenberg & Hickie, 2019, p. 300). Headspace notes high levels of user satisfaction (Headspace, 2018), but does not report service efficacy information. Lastly, despite recent funding increases at the state level there is no evidence of improved mental health service efficacy (MHCNSW, 2014).

2.3.1 *Informal help and support*

Australian adolescents report being more likely to seek informal help and support regarding mental health from friends or parents (Mission Australia, 2017). The *Longitudinal Study of Australian Children* reported that in a 12-month period, Australian adolescents aged 14-15 years were more likely to seek help for personal or emotional problems from a friend (74%) or parent (69%) compared to a teacher (25%) or mental health professional (9%) (Gray & Daraganova, 2018). While any help seeking behaviour may be beneficial and potentially develop pathways to more specialised support, the proportion of adolescents using informal care in preference to formal is concerning due to the potential for misinformation or inadequate care.

According to Lawrence et al. (2015), 66% of all Australian adolescents aged 12 to 17 years and 75% of adolescents diagnosed with a mental illness used self-help strategies to manage mental health problems. The most commonly used self-help strategies were participating in enjoyable activities (45%), doing more exercise or participating in sport (37%),

seeking support from friends (22% to 24%), and improving diet (22% to 23%) (Lawrence et al., 2015). These figures are consistent across adolescents with and without mental illnesses.

2.3.2 *Barriers to accessing mental health care*

Various barriers have been identified as preventing access to mental health care including stigma (Corrigan, 2004), expense (Packness et al., 2019), poor availability of mental health treatment (Moore et al., 2019a), lack of knowledge about how get to help, and negative experiences of mental health care (Islam et al., 2020). Consistent with this, Australian adolescents aged 12 to 17 years reported that the main barriers to seeking or receiving mental health care were poor mental health literacy, fear of being stigmatised, a preference for self-management, and the accessibility of mental health treatment (Lawrence et al., 2015). Consequently, it is important to examine school-based mental health services, which have significant potential to alleviate the barriers for adolescents accessing mental health care (American Academy of Pediatrics, 2004).

2.4 The role of schools in addressing the mental health issues of adolescents

Historically, schools have limited involvement in addressing adolescents' mental health issues and were restricted to assessment, clinical consultation and treatment services for students enrolled in or referred to special education (Paternite, 2005). However, the provision of mental health services in schools is arguably a necessary element of a school's mandate to educate all children and adolescents (Rones & Hoagwood, 2000), as improved mental health may affect students' cognitive functioning at school and improve academic achievement (Kang-Yi et al., 2018). As the prevalence of mental health issues in children and adolescents has risen dramatically (Hoagwood et al., 2018), schools are now playing an increasingly important role

in providing mental health services to students (Weist et al., 2017). Schools provide the only source of mental health care for a majority (70% to 80%) of children and adolescents (Paternite, 2005; Rones & Hoagwood, 2000). Consequently, teachers and school staff frequently assume frontline mental health provider roles (Sanchez et al., 2018).

According to the New South Wales Department of Education (NSW DoE, 2019), schools have a critical role in supporting adolescents as the school system provides a “natural and accessible” way to address the mental health issues of students (Werner-Seidler et al., 2017, p. 32). Schools typically provide universal access to adolescents (Masia-Warner et al., 2006; Paternite, 2005) and when integrated with the education curriculum school-based approaches to mental health can reduce or alleviate many existing barriers to treatment including cost, stigma, time, and location (American Academy of Pediatrics, 2004; Barrett & Pahl, 2006; Sanchez et al., 2018). As such, it is important to identify and maximise the use of mental health resources that naturally exist in the school environment such as “underutilised” teachers and school support staff (Moon et al., 2017, p. 385).

A large percentage of educators report viewing mental health education as very important (89%) (Graham et al., 2011). However, teachers and school support staff frequently report low confidence to carry out roles in mental health care (Moon et al., 2017), and often view school-based mental health programs as an “add on” that is not central to the role of education (Paternite, 2005, p. 659). This might help explain why only 25% of Australian adolescents aged 14-15 years sought help for mental health problems from teachers (Gray & Daraganova, 2018). However, despite significant potential to address mental health issues, it is important to emphasise that schools are not a panacea for adolescent mental health and cannot be held entirely responsible for all students’ mental health needs (Paternite, 2005).

School-based mental health programs may improve access to diagnosis and treatment of mental health problems for adolescents, while being less expensive than private or

community-based services (American Academy of Pediatrics, 2004). To this end, a key policy recommendation of the *Youth Mental Health Report Youth Survey 2012-16* was that “schools should provide evidence-based universal mental health prevention and intervention programs for young people” (Mission Australia, 2017, p. 6). This is supported by the United Nation’s Sustainable Development Goals (2015), with particular regard to promoting health and wellbeing (SDG-3) and quality education (SDG-4). However, while research examining the efficacy of school-based mental health programs is increasing, there are many services being used, or paid for by schools for which there is little or no empirical evidence (Clinton et al. 2018; Rones & Hoagwood, 2000).

2.4.1 *What mental health interventions have been used in schools, and what degree of efficacy do they show?*

According to Mission Australia (2017), school-based services are the most commonly accessed mental health service used by Australian adolescents. However, while school-based mental health services have been found to be as effective as traditional outpatient clinic services in improving clinical outcomes (Kang-Yi et al., 2018), there is little consistency in the types of mental health services provided by schools. School-based mental health services may be formal or informal, individual or group-based, and may or may not use specific mental health programs. These services are provided by a variety of individuals with a range of qualifications including school counsellors and psychologists, teaching and other school staff, and Department of Health and non-government organisation staff.

School-based approaches to mental health are often based on a three-tiered model of treatment where mental health needs are addressed at the: (a) primary level, which provides universal mental health services to all students; (b) secondary level, which provides targeted mental health services to at-risk students; and (c) tertiary level, which provides targeted mental

health services to students identified with serious mental health needs (American Academy of Pediatrics, 2004; Moon et al., 2017). Across these levels, research has suggested that successful school-based mental health services have several key components. These include consistent program implementation, inclusion of parents, teachers or peers, integration of programs into the general classroom curriculum, using developmentally appropriate program components, and use of multiple treatment modalities (Reschly et al., 2017; Rones & Hoagwood, 2000).

According to a meta-analysis conducted by Sanchez et al. (2018) school-based mental health services generally demonstrated a small to medium effect while school-based universal services demonstrated a small effect on mental health. This is consistent with other meta-analytic data reporting that school-based mental health services exhibited a small effect on depressive symptoms and anxiety symptoms (Werner-Siedler et al., 2017). Although school-based universal prevention services generally showed small effects, it is important to note that small effects can yield large impacts (Prentice & Miller, 1992) and produce meaningful improvements at the population level (Werner-Siedler et al., 2017).

2.4.2 *School counsellors and student mental health treatment efficacy*

School counselling is available across Australian education jurisdictions and national policy is supportive of school-based counselling (Harris, 2013). However, there is little consistency regarding the nature and prevalence of school counselling across Australia, which is due to individual states being responsible for policy and implementation of school-based services. For example, the qualifications required to be employed as a school counsellor vary among Australian states ranging from counselling diplomas to psychology degrees, and the number of school counsellors employed per school aged student ranges from 1:850 in the Australian

Capital Territory to 1:1800 in Tasmania² (Harris, 2013). The services offered by school counsellors include psychological assessment, counselling, and intervention services; and are intended to contribute to student learning and wellbeing outcomes (NSW DoE, 2020b).

While adolescents access school counsellors more than any other mental health professionals (Mission Australia, 2017), it is difficult to determine the efficacy of this mental health service. School counsellor treatment outcomes are commonly examined by measuring school counsellor self-efficacy, which is arguably a problematic measure of treatment efficacy (Reese et al., 2009). A qualitative study examining nine school counsellors reported that perceived self-efficacy regarding treatment outcomes was high (Atici, 2014). Although this does not preclude school counsellor treatment efficacy, given the conclusion was based on self-report data third party corroboration should be sought. A quantitative study assessed school counsellors' ability to deliver a cognitive-behavioural treatment using a randomised controlled trial of 138 adolescents. Results found that adolescents in the intervention group reported significant mental health improvement compared to controls (Masia-Warner et al., 2016). Notwithstanding these studies, more research is needed to establish the treatment efficacy of school counsellors.

School counsellors are well-placed to provide mental health services to students, which perhaps explains why school counsellors are frequently accessed by Australian adolescents (Mission Australia, 2017). However, given the ratio of students to school counsellors in Australia the outcomes achieved by school counsellors are systematically limited. The potential effectiveness of school counsellors as a mental health service is affected by policy, organisational issues, resourcing, and local school directives (DeKruyf et al., 2013). For example, in NSW public schools, increased school funding can be obtained to support students

² In NSW, where the study was located, the ratio of school counsellors per school aged student is 1:1050 (Harris, 2013).

with various impairments such as intellectual disability (NSW DoE, 2020a). Consequently, school counsellors may engage in psychometric assessment to substantiate the educational impact of these disorders, instead of providing mental health treatment.

2.4.3 *Empirically supported mental health programs delivered in Australian schools*

There are relatively few evidence-based mental health school programs being used in Australia. Empirically supported school-based face-to-face interventions used in Australia include the: (1) Resourceful Adolescent Program; (2) Aussie Optimism Program: Positive Thinking Skills; (3) FRIENDS program; (4) Cool Kids program; and (5) the Penn Resiliency Program (Werner-Siedler et al., 2017). Empirically supported online programs for students used in Australia include: (a) MoodGYM; and (b) SPARX-R (Werner-Siedler et al., 2017). These programs have a manual available with instructions on how to deliver the program, can be delivered in the classroom during school hours as part of the wider school curriculum, and are supported by at least one randomised controlled trial demonstrating the program's effectiveness (Black Dog Institute, 2018).

However, intervention fidelity may be a problem with these approaches as their effectiveness and sustainability in the real-world school are frequently not examined (Paternite, 2005). Intervention fidelity describes whether an intervention was delivered as intended by the program developers and is important to consider as poor fidelity may explain why some interventions that appear to be effective in highly controlled trials have poorer outcomes when applied in real life contexts (Breitenstein et al., 2010). Case in point, most research regarding the efficacy of school-based treatments have examined experimental services implemented by highly trained study staff rather than by school counsellors or teachers under naturalistic school conditions (Sanchez et al., 2018).

2.4.4 *Mental health programs delivered in Australian schools without empirical support*

It is not within the scope of this study to provide a definitive account of the mental services delivered in Australian schools that lack empirical support. However, according to Roness and Hoagwood (2000), there are many services being used or paid for by schools for which there is little or no empirical evidence which continues as an ongoing issue in the Australian educational context (Clinton et al., 2018). Two pertinent examples are the National School Chaplaincy Program and the Rock and Water program.

The National School Chaplaincy Program was implemented by the Australian Government with the aim of supporting the wellbeing of students and school communities through the provision of pastoral care services and strategies delivered by chaplains (Australian Government Department of Education [AGDoE], 2019). The Australian Government has invested \$247 million (AUD) from 2019 to 2022 to fund the school Chaplaincy program (AGDoE, 2019) and has sought independent research to confirm the program's efficacy. The study reported that chaplaincy services are viewed positively by principals, students, and parents (Kantar Public, 2017). However, positive perceptions of the chaplaincy service do not equate with program efficacy. Moreover, significant methodological problems are apparent with the study including:

- (a) the study developed a survey instrument but does not report piloting the instrument.

Given that pilot studies assess the reliability and validity of an instrument (Bordens & Abbott, 2008), which is a critical step in instrument development, the omission of this information leaves significant questions regarding the validity and reliability of the instrument and data arising from it;

- (b) the study relies on cross-sectional data which limits the possible statistical analyses of obtained data and precludes causal inferences (Gravetter & Wallnau, 2007);

- (c) the nature of statistical analyses is not described in detail in the study's methodology. This information is important as it facilitates evaluation of the study's procedures, results, and conclusions (Burton, 2007). The lack of this detail limits confidence in the study; and,
- (d) while 2147 participants took part in the survey, only 134 participants were school students. Other respondents included chaplains ($n = 498$), principals ($n = 477$), and parents ($n = 1038$). Notwithstanding that the views of the latter participants are important, student perceptions regarding the efficacy of school-based mental health programs are arguably critical, yet they comprise only 6% of the sample.

These methodological issues preclude support for the efficacy of the Chaplaincy program, which is problematic given the program's cost, implementation, and reach into Australian schools.

The Rock and Water program aims to improve students' socioemotional adjustment and mental health outcomes, using physical activity as the base from which to deliver a psychosocial intervention (Ykema, 2012). The program is a widely used intervention that has received endorsement from the NSW Education Standards Authority and is taught to thousands of teachers annually (Ykema, 2012). However, the Rock and Water program is poorly evaluated and lacks an empirical basis of support (Mertens et al., 2018).

Adolescent mental health problems are a significant issue in the community and within the education system. However, despite significant economic resources being allocated to address adolescent mental health (AGDoE, 2019; NSW DoE, 2019), the efficacy of adolescent mental health services is questionable, and these services are often eschewed by Australian adolescents who typically prefer to seek informal help from friends and parents (Gray & Daraganova, 2018). School-based mental health services are utilised by adolescents more frequently than other mental health services, but often lack an empirical basis and have

questionable outcome efficacy. Despite these issues, existing school-based services are critical for adolescent mental health and should be adequately supported and resourced. To this end, physical activity-based interventions have growing recognition as improving mental health (Dale et al., 2019) and may be a viable strategy for addressing adolescent mental health across community and education contexts.

2.5 Physical activity and mental health

The idea that physical activity promotes mental health is not new. The ancient Greek physician Hippocrates recommended physical activity for the treatment of mental illness and more recently, the 19th century psychologist William James suggested physical activity is necessary for mental health (Dishman, 2005). However, while it is generally accepted that physical activity can have important psychological benefits (Biddle, 2005; Biddle & Mutrie, 2008) which is supported by a “convincing body” of research (Faulkner & Taylor, 2005, p. 2), there is arguably insufficient empirical evidence (Lam, 2016). Existing research has significant methodological problems (Mammen & Faulkner, 2013) and the mechanisms underpinning the relationship between physical activity and mental health are not well understood (Lam, 2016).

2.5.1 *Physical activity*

Physical activity, exercise, and sport are related but are conceptually distinct. While the terms are sometimes used interchangeably, physical activity should not be confused with exercise (WHO, 2020) or sport (WHO, 2011). Physical activity is an extremely broad term that captures many human behaviours. The term *physical* can be defined as relating to the body; and the term *activity* can be defined as a thing that a person or group does or has done (Brown, 1993). The WHO defines physical activity as bodily movement created by skeletal muscles that requires

the expenditure of energy (2020). Physical activities in daily life can be categorised diversely, including exercise, home activities, occupation, self-care, sport, and transport (Ainsworth et al., 2011). However, the term should be used carefully due to its broad meaning. While numerous physical activities may be beneficial for mental health, many are conceivably poor for both physical and mental health (e.g., smoking, alcohol consumption etc.). Notwithstanding this, in the current context the term physical activity assumes activities that potentially benefit mental health.

Exercise and sport are a subset of physical activity. Exercise refers to planned, structured, and repetitive physical activities and aims for the improvement or maintenance of physical fitness (WHO, 2020). Sport is also a diverse term (Coalter, 2005) that refers to organised competitive physical activity that aims to demonstrate and improve physical fitness (Sport England, 2004). The need to define these terms is evident when considering physical activities such as walking. Walking is a physical activity that might be categorised as exercise or sport, both, or neither depending upon the context it occurs in.

2.5.2 The evidence supporting physical activity as a route to improved mental health

There is a growing body of evidence that physical activity can have psychological benefits for youth (Dale et al., 2019). This includes the positive impact of physical activities on mental health disorders such as anxiety (Lam et al., 2016) and depression (Mammen & Faulkner, 2013; Rethorst et al., 2016). Similarly, physical activities have been found to positively affect behaviours related to mental health by improving sleep (Youngstedt & Frelove-Charton, 2005) and strengthening social inclusion (Coalter, 2005). Recent research has investigated the neurological mechanisms underlying the effect of physical activity on mental health, with the developing view that physical activity alters brain-derived neurotrophic factors such as dopamine, noradrenaline, and serotonin (Lam, 2016).

However, the research examining the mental health benefits of physical activity is methodologically limited (Mammen & Faulkner, 2013). This is important as the acceptance of physical activity as a mental health strategy and treatment by medical and mental health professionals will be based upon the strength of available evidence (Faulkner & Taylor, 2005). The types of studies often used to investigate physical activity and mental health significantly limit this research area. Randomised controlled trials facilitate comparison of treatment and control conditions and, are important for establishing causation and efficacy of interventions (Bryman, 2016). However, “such designs may not be well suited for the study of exercise and mental health” (Faulkner & Taylor, 2005, p. 5) and much of the available evidence is based on cross-sectional research designs which are unable to infer causation (Mammen & Faulkner, 2013). Other methodological concerns include the use of subjective measures and use of self-report measures (Mammen & Faulkner, 2013).

Current research only provides a limited understanding of the mechanisms underlying the relationship between physical activities and mental health (Lam, 2016; Lubans et al., 2016). While there is specific evidence that suggests the length of time and intensity of physical activity can affect mental health (Ahn & Fedewa, 2011), there is a paucity of research that examines the context of this relationship, especially in terms of broader psychosocial factors. Proposed mechanisms explaining the mental health outcomes resulting from physical activity include behavioural, neurobiological, and psychosocial processes (Lubans et al., 2016). The strongest evidence supports the role of psychosocial mechanisms, while few studies have investigated neurobiological or behavioural mechanisms (Lubans et al., 2016). However, it seems likely that a combination of these mechanisms may explain the effect of physical activity on mental health outcomes (Mammen & Faulkner, 2013). Whilst it is important to acknowledge the complex mechanisms associated with physical activity and mental health, this study does not aim to investigate or resolve these limitations.

Finally, the evidence supporting the mental health benefits of physical activity presents an interpretive problem. Positive outcomes are only a possibility because: (a) physical activity is only one of many things people do; (b) the nature and extent of any effects will depend upon the nature of the experience; (c) the effect will be determined by the frequency and intensity of participation and the degree of participant adherence over time; (d) positive effects cannot be assumed to generalise to other contexts; and (e) it is difficult to separate the effects of physical activity from other parallel social influences and developmental processes (Coalter, 2005). Notwithstanding this, it is important to note that similar concerns may be equally applicable to any mental health intervention.

2.5.3 The case for physical activities as a mental health strategy

There is significant support for using physical activities as a mental health strategy despite the limitations regarding this evidence. Regular physical activity is positively associated with mental health and wellbeing (Faulkner & Taylor, 2005; George et al., 2012), and youth who have low physical activity have been found to have poorer cognitive functioning and academic achievement skills (Hillman et al., 2017). This is an important observation supporting the use of physical activity in school-based interventions for adolescents.

Physical activity has been found to alter brain-derived neurotrophic factors such as dopamine, noradrenaline, and serotonin which are significant neuro-physiological factors underpinning mental health (Lam, 2016). Active people are nearly 45% less likely to report depressive symptoms, while people reporting no physical activity are twice as likely to develop anxiety disorders compared to those completing more than three hours of vigorous exercise a week (Booth et al., 2012). These characteristics suggest physical activity has inherent mental health promoting qualities, and it is proposed that physical activity may be a suitable medium from which to structure a psychosocial intervention.

Physical activities have many values, one of which lies in the transfer of behaviour and attitudes learned through participation in physical activities to other areas. Transferable behaviour and attitudes developed through physical activity can be referred to as life skills (Gould & Carson, 2008) and are learned through demonstration, modelling, and practice. The school-based context of a psychosocial intervention using physical activity provides significant opportunity for participants to transfer and practice life skills gained from an intervention across multiple: (1) school-based contexts including curriculum and social domains; and (2) non-school contexts including family, social, and work domains.

As noted previously, there are a variety of barriers impacting Australian adolescents engaging with mental health services. Physical activity could provide “a hook” (Hartmann, 2003, p. 124) to attract young people to integrated physical activity-based psychosocial interventions (Taylor & Faulkner, 2005) and may be a relatively simple and inexpensive way of improving mental health (Youngstedt & Freelove-Charton, 2005). Given the barriers impeding adolescents accessing mental health services, universal and targeted school-based delivery of psychosocial interventions using physical activity may have significant potential to fill a treatment gap. Additional benefits include keeping otherwise uninterested students in school, developing student athletes to serve as role models, and creating a sense of community through physical activities (Hartmann, 2003). The potential psychological benefits of physical activity outweigh the possibility of no effect or risk of harm (Mills et al., 2019).

Many types of physical activities might be used as a platform for improving mental health outcomes. Within this context, martial arts training warrants investigation as a physical activity medium. Martial arts training may achieve therapeutic goals through physical activity (Weiser et al., 1995). Previous studies report that martial arts training improves mental health outcomes (e.g., Finkenberg, 1990; Kurian et al., 1994; Lakes & Hoyt, 2004; Nosanchuk, 1981; Nosanchuk & MacNeil, 1989; Wargo et al., 2007), however as discussed below this research

has significant limitations. Traditional martial arts training is a unique form of physical activity that incorporates mechanisms that parallel mental health interventions (Burke et al., 2007; Fuller, 1988; Wargo et al., 2007; Weiser et al. 1995). These include emphasising personal and philosophical development, developing respect for others, and reinforcing appropriate behaviour (Nosanchuk, 1981). Martial arts training has the potential to fit within the primary and secondary levels of school-based mental health services by providing universal and targeted mental health programs that develop psychological strengths and wellbeing.

2.6 Defining martial arts: A complex and contested physical activity

The martial arts are a culturally complex physical activity that have contested definitions. Semantically, *martial* can be defined as relating to fighting or war; and *art* can be defined as a skill typically acquired through practice (Brown, 1993). Hence, the martial arts may be defined as any fighting skill acquired through practice. However, this definition lacks the nuanced meaning attributed to the term across multiple cultures (Maliszewski, 1992). How the martial arts are understood is paradoxical, as the term includes reference to aggression and combat while concurrently being viewed as a philosophical activity that promotes health (Burke et al., 2007) and personal development (Trulson, 1986). To adequately define and understand the *martial arts* it is important to consider popular, cross-cultural and academic perspectives of the martial arts.

2.6.1 *Popular, cross-cultural, and academic perspectives of the martial arts*

Martial arts exist across all cultures (Lorge, 2012) and could include reference to any “fighting art” (Donohue & Taylor, 1994, p. 13). While hundreds of types of martial arts have developed across different cultures (Theeboom & De Knop, 1999), popular culture typically uses the term

martial arts as a general phrase for many of the combat arts that have developed in East-Asian cultures (Burke et al., 2007; Clements, 2006). The paradox of martial arts training is highly visible from a popular context. Popular media including film, television, and computer gaming often depict the martial arts in extremely violent terms as a form of entertainment (Fuller, 1988). The increasing popularity of the martial arts has resulted in concerns being expressed by psychologists, law enforcement officials, and the public based on the assumption that martial arts training increases aggressive behaviour (Trulson et al., 1985).

However, a concurrent popular perspective suggests that the martial arts have a deeply pacifistic philosophy (Zivin et al., 2001) and promote psychological benefits such as increased well-being, self-esteem, and confidence (Daniels & Thornton, 1990). Ironically, the popular media also promote the virtues of martial arts training (e.g., Special Broadcasting Service, 2019; Sydney Morning Herald, 2019). While popular perceptions of the martial arts are mixed (Vertonghen & Theeboom, 2010), it is not clear whether this is a cause or effect of a poorly defined and understood phenomenon.

While the martial arts are a cross-cultural phenomenon (Lorge, 2012), the geographic association of the martial arts with East Asia (Armstrong, 1984; Burke et al., 2007; Clements, 2006; Moenig, 2015) suggests that cultural perspectives may be narrow. Given this perception, it is ironic that the etymology of the term *martial* can be traced to Latin wherein Mars referred to the planet and Roman god of war (Reid & Croucher, 1983). The popular association of the martial arts with East Asia arguably excludes the cultural ubiquitousness of martial arts training. Case in point: according to Moenig (2015) a cultural inconsistency regarding the martial arts is that Western activities associated with combat (e.g., boxing) are perceived negatively due to violent characteristics while Eastern martial arts have become fashionable and culturally approved.

Generally, the academic perspectives of the martial arts mirror popular and cross-

cultural understandings of the concept. There is a lack of academic consensus about how to define key terms (e.g., Judkins, 2016; Lorge, 2012) and as a result, a variety of theories, models, and frameworks have been applied to the study of martial arts. Disagreements even extend to the amount of martial arts research that exists, where some authors indicated growing interest (Vertonghen & Theeboom, 2010) or a significant research body examining the martial arts (Vlachos, 2015); while others suggest that research is limited and not definitive (Twemlow et al., 2008).

Research examining the martial arts arises from various disciplines. These include the:

- (a) history of martial arts (e.g., Lorge, 2012; Moenig 2015);
- (b) health and medical studies examining the physical health benefits and injury profiles resulting from martial arts training (e.g., Stephenson & Rossheim, 2018; Woodward, 2009);
- (c) science-based research examining the biological mechanics and physics underpinning the martial arts (e.g., Gavagan & Sayers, 2017; Miu et al., 2019);
- (d) sociological and cross-cultural research that has examined the societal function of martial arts training (e.g., Garcia & Spencer, 2014; Wacquant, 2004); and,
- (e) literary studies examining the role of martial arts in narrative (e.g., Chan, 2018; Tang, 2018).

2.6.2 *Martial arts: Operational definition*

How the term *martial arts* is defined and understood is complex, and ultimately determined by the culture, history, and intention given to the term across different milieus.

In the current study the term *martial arts* is operationally defined as:

- (1) a socially constructed human behaviour based on physical activity;
- (2) referring to the various skills and practices that originated as methods of combat or

self-defence (Lorge, 2012); and,

- (3) incorporating a psychological health and personal development dimension (Burke et al., 2007; Daniels & Thornton, 1990; Trulson, 1986).

2.7 Research examining the psychological outcomes from martial arts training

Research examining the psychological outcomes from martial arts training is limited (Moore et al., 2019a). Vertonghen and Theeboom (2010) conducted a literature search of online academic databases regarding this research, initially finding 380 articles. However, when the search used specific exclusionary criteria, including: (1) only using studies measuring socio-psychological outcomes of practising martial arts; and (2) excluding papers where the methodologies were not clearly presented or exhibited significant limitations; only 27 papers were found. While relevant publications have occurred since this systematic review (for example, Burt & Butler, 2011; Chen & Cheesman, 2013; Diamond & Lee, 2011; Jennings, 2014; Massey et al., 2013; Mastnak, 2017; Milligan et al., 2015; Milligan et al., 2016; Moore et al., 2019b; Moore et al., 2020; Reisherei et al., 2014; Wang et al., 2014; Weiss et al., 2017), the psychological outcomes from martial arts training remains a limited area of research and requires greater attention.

According to Vertonghen and Theeboom (2010) the studies reporting on the psychological outcomes from martial arts training mostly report positive effects, while few studies report negative effects (e.g., Endresen & Olweus, 2005). Although this may reflect a genuine positive outcome, the issue of possible bias should be considered. This is especially pertinent given the research base examining the psychological effects of martial arts training has significant methodological issues that limit the generalisability of findings (Tsang et al., 2008; Vertonghen & Theeboom, 2010). These include conceptual and definitional issues, reliance on cross-sectional research designs, small sample sizes, self-selection effects, reliance

on self-report measures without third party corroboration, limited use of follow-up measures, not taking gender differences into account, and issues controlling for the role of the instructor (Moore et al., 2020; Vertonghen & Theeboom, 2010).

The following sections review the research examining the effects of martial arts training on different psychological outcomes, ranging from aggression and personality to mental health; and discusses the case for considering martial arts training as an intervention strategy with adolescents. It is important to comment that there is limited literature regarding the psychological outcomes from martial arts training (Twemlow et al., 2008). Hence, it was necessary to include older references than might otherwise be anticipated.

2.7.1 *Research examining the effect of martial arts training on aggression*

Research examining the relationship between martial arts training and aggressive behaviour has produced inconsistent results. The martial arts are often presented as a way of regulating aggressive behaviour and reductions in aggression are often cited by research examining the effects of martial arts training (e.g., Daniels & Thornton, 1992; Delva-Tautilili, 1995; Hernandez & Anderson, 2015; Nosanchuk, 1981; Nosanchuk & MacNeil, 1989; Skeleton et al., 1991; Twemlow et al., 2008). This effect has also been reported for populations exhibiting problematic behaviour profiles (Trulson, 1986; Zivin et al., 2001). However, many of these studies are methodologically limited. For example, Delva-Tautilili (1995) and Zivin et al. (2001) each conducted controlled trials examining small sample sizes ($n = 42$ and $n = 60$ respectively) using quantitative survey methods, while Daniels and Thornton's (1992) and Nosanchuk's (1981) studies are limited by their cross-sectional designs. Some studies exhibit more significant methodological concerns, such as Trulson's (1986) study which exhibited the use of deception and power dynamics which may have created participant self-presentation bias that possibly confounded the study's results.

Other studies have reported that martial arts training appeared to increase aggression (e.g., Bjorkqvist & Varhama, 2001; Endresen & Olweus, 2005; Reynes & Lorant, 2004) or not fully supported reductions in aggressive behaviour (e.g., Daniels & Thornton, 1990). Some of this research was methodologically rigorous, such as Endresen and Olweus' (2005) longitudinal study of 477 participants, while other studies used weaker methodologies. For example, Reynes and Lorant (2004) conducted a controlled trial using quantitative survey procedures to examine a small sample ($n = 43$), while Bjorkqvist and Varhama's (2001) study used a cross-sectional design.

From a theoretical perspective, the results reporting that martial arts training reduced aggression are intriguing given that Bandura's (1973) theory of aggression suggests martial arts training might increase aggressive behaviour. While much of the research investigating the psychological effects of martial arts training lacks a coherent theoretical base (Fuller, 1988; Vertonghen & Theeboom, 2010), the theoretical orientation underpinning research examining the relationship between martial arts training and aggression suggests that multiple aspects of martial arts training should increase overall aggressiveness. Bandura's social cognitive theory and theory of aggressive behaviour suggested that the modelling and selective reinforcement that occurs during martial arts training may increase aggressive fantasy, disinhibit aggressive behaviour, and develop aggressive cognitive scripts that facilitate aggressive actions (Bandura, 1973, 1997). Research which has considered this relationship using the bipartite model of traditional versus modern martial arts has proposed that traditional martial arts training included several elements that may disinhibit aggressive behaviour including: (1) aggression is negatively sanctioned; (2) self-control and conflict avoidance is emphasised; and (3) dangerous contact during sparring is strongly sanctioned (Nosanchuk, 1981).

Two meta-analytic studies regarding the effects of martial arts training on aggressive behaviour have also produced inconsistent results. Harwood et al. (2017) examined nine studies

regarding the effects of martial arts training on aggressive behaviour. The authors reported that martial arts training can decrease aggressive behaviour and concluded that martial arts training may be a valuable intervention for youths exhibiting externalising behaviour issues. However, it appeared the meta-analysis may have interpreted results selectively producing a potentially biased result. The study reported where multiple effect sizes were available in a single study “only the larger effect size for the most relevant measure” were extracted for comparison (Harwood et al., 2017, p. 98). While this is likely to increase the chances of establishing statistical significance, the subsequent results are questionable; especially given that the authors do not report conducting a publication bias analysis (i.e., Classic Failsafe N or Trim analysis). Moore et al. (2020) examined seven studies regarding martial arts training on decreasing aggressive behaviour and reported the effect was not significant. The authors concluded that martial arts training did not have a discernible impact on aggressive behaviour. Further, the negative value for the lower limit of the reported confidence interval suggests the possibility that martial arts training increases aggressive behaviour cannot be rejected.

2.7.2 Research examining the effect of martial arts training on personality

The other significant psychological focus of martial arts research has investigated personality correlates. Some research has examined this relationship using the bipartite model of traditional versus modern martial arts (Vertonghen & Theeboom, 2010), which supported martial arts training having a positive influence on personality traits (Trulson, 1986). Length of training has often been found to have a positive impact on various personality traits of martial arts students (e.g., Duthie et al., 1978; Kurian et al., 1994; Layton, 1990; Richman & Rehberg, 1986), however given these studies are cross-sectional the results should be interpreted cautiously. Further, a more recent study was inconsistent with previous positive results. Wargo et al.’s (2007) controlled trial comparing forty-two yellow and black belt taekwondo students

using the Minnesota Multiphasic Personality Inventory, found no evidence for improved self-esteem being associated with length of training. However, this inconsistency should be considered cautiously given the 13-29-year gap between studies.

It should be noted that some conceptual overlap exists between research examining personality correlates and research examining martial arts and mental health.

2.7.3 *Martial arts and mental health*

Mental health can be conceptualised dichotomously as having a: (a) pathological basis (deficit model) which refers to the presence or absence of disease-based symptoms such as depression or anxiety; and (b) wellbeing basis (strengths-based model) which refers to the presence or absence of beneficial mental health characteristics such as resilience or self-esteem (Moore & Woodcock, 2017a). Of the many popular views regarding the martial arts, a dominant stereotype is that martial arts training promotes mental health (Burke et al., 2007) and personal development (Trulson, 1986). The “goal of gaining self-confidence through martial arts seems to be one of the major reasons why [people] today... practice martial arts” (Moenig, 2015, p. 152). However, few mental health professionals have considered using the martial arts to promote mental health and wellbeing (Macarie & Roberts, 2010), and the effect of martial arts training on mental health variables has received little research attention.

2.7.4 *Research examining the effect of martial arts training on mental illness*

Research has frequently reported that martial arts training has a positive effect on the pathological dimension of mental health. These effects include reductions in symptoms associated with anxiety and depression, improved sleep, and capacity to tolerate distress.

Some research has found training in the martial arts reduced symptoms associated with

anxiety. Training in tai-chi has been found to reduce anxiety in a geriatric population compared to a non-treatment condition (Li et al., 2004). Similar reductions have been associated with karate training (Layton, 1990) and a study examining populations exhibiting problematic behaviour profiles found significantly reduced anxiety following a six-month taekwondo program (Trulson, 1986). However, while the study conducted by Li et al. (2004) was a methodologically rigorous randomised controlled trial of 118 participants, the other results should be interpreted more cautiously due to their design limitations. For example, the results reported by Layton (1990) were based on a correlational design.

Other research found training in the martial arts reduced symptoms associated with depression. Male karate students were reported as being less prone to depression compared to reported norms for male college students (McGowan & Jordan, 1988), training in tai-chi was found to reduce depression in a geriatric population compared to a non-treatment condition (Chou et al., 2004), and a study examining taekwondo found participants exhibited improved mood immediately following martial arts training (Toskovic, 2001). However, these studies also exhibited design limitations. For example, the results reported by McGowan and Jordan (1988) were based on correlational data, while the results reported by Chou et al. (2004) were obtained from a controlled trial using quantitative survey method based on a sample of 14 participants.

Related factors associated with mental illness such as poor sleep and low distress tolerance have been found to improve from martial arts training; for example, Li et al. (2004) and Milligan et al. (2015) respectively. However, it should be noted that the study conducted by Milligan et al. (2015) exhibited several methodological problems, including not using a standardised and validated measure of distress.

2.7.5 *Research examining the effect of martial arts training on psychological strengths*

Research often reports that martial arts training promotes characteristics associated with the strengths-based dimension of mental health. As personal development is a goal of martial arts training (Trulson, 1986), it is unsurprising that many of these factors are associated with the self, including self-concept, self-confidence, self-efficacy, self-esteem, and self-regulation. Other strengths-based factors reported to improve from martial arts training include emotional wellbeing, life satisfaction, mental toughness, and general wellbeing.

Martial arts training has been reported as improving a variety of factors associated with the self. However, while typically positive the studies reporting on these factors exhibit various methodological limitations. In a series of discrete controlled trials, a group of 51 female participants reported higher self-concept compared to 49 control participants after studying taekwondo for eight weeks (Finkenberg, 1990). In an earlier controlled trial, 34 adolescent males exhibiting problematic behaviour profiles reported increased self-esteem following a six-month taekwondo program (Trulson, 1986). Given both studies used quantitative survey methods, a lack of randomised design and small sample sizes significantly limits the external validity of these findings. Further, as noted Trulson's (1986) study exhibited significant methodological concerns regarding deception and power dynamics. Studies with weaker designs have also reported positive results: (1) Ryan et al.'s (2015) controlled trial comparing a group of geriatric participants ($n = 12$) reported improved self-efficacy after training in a Chinese martial art, (2) correlational research of a group of 167 Iranian martial artists reported greater self-confidence and self-efficacy compared to non-martial artists (Reishehrei et al., 2014), and (3) a mindfulness-based martial arts program using a qualitative design found participants reported improved self-regulation post-program (Milligan et al., 2015; Milligan et al., 2016).

Strengths-based characteristics associated with wellbeing, including emotional

wellbeing, life satisfaction, and wellbeing; have been found to improve from martial arts training. A group of geriatric participants reported improved emotional wellbeing compared to a control group following 16 one-hour karate training sessions (Jansen & Dahmen-Zimmer, 2012). Cross-sectional studies have reported: (a) judo participation was positively correlated with life satisfaction and wellbeing (Matsumoto & Konno, 2005); and (b) more advanced mixed martial artists reported higher levels of mental toughness (Chen & Cheesman, 2013).

2.7.6 Systematic reviews and meta-analyses examining the martial arts and mental health

Several systematic reviews and meta-analyses have examined the literature base regarding the mental health benefits of martial arts training. Vertonghen and Theeboom's (2010) systematic review of the social-psychological outcomes of martial arts training suggested that while research frequently reported positive mental health effects from martial arts training, it was difficult to provide conclusive evidence regarding the psychosocial outcomes of martial arts training due to the methodological limitations of existing research. A related consideration is that the results from reported meta-analyses are typically positive, which raises concerns about potential publication bias.

A systematic review and meta-analysis examining tai-chi and mental health reported that 16 studies observed significant improvements in depression resulting from the practice of tai-chi (Wang et al., 2014). However, when the heterogeneity of the studies and issues regarding the use of control groups was considered, 13 of these studies were excluded from meta-analysis. Meta-analysis of the remaining three studies confirmed the improvement, finding significant differences in depression between the intervention and control groups. The authors also reported that eight studies observed improvements in anxiety but did not conduct meta-analyses due to differences and design limitations in the studies (Wang et al., 2014). It

should be noted that confidence in this analysis is limited given the meta-analytic results are based on a very small sample.

Cheng (2015) conducted a systematic review of the mental health effects resulting from baduanjin (a Chinese system of physical exercises and breathing control related to tai-chi). The review examined 28 studies and found that baduanjin training improved quality of life and mental health for a variety of participants; and noted a decrease in depressive symptoms for patients with mental disorders.

2.7.7 A systematic review and meta-analysis of the effects of martial arts training on the pathological and strengths-based dimensions of mental health

A systematic review and meta-analysis regarding the effects of martial arts training on the pathological and strengths-based dimensions of mental health was conducted as part of this study's literature review. The objectives of the systematic review and meta-analysis were to: (1) review martial arts-based interventions that had been conducted; and (2) conduct meta-analyses to ascertain the effectiveness of these interventions.

2.7.7.1 Methods. The meta-analysis reported on data extracted, synthesised, and analysed between January to July 2018. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA, Moher et al., 2009) guidelines were followed to ensure the transparent reporting. Studies were included in the meta-analysis if they met the following criteria:

1. Studies needed to examine martial arts as an intervention or activity resulting in a psychological outcome (i.e., studies had to report on a psychological or mental health related outcome resulting from the practice of martial arts training).

2. The study design needed to report results in terms of descriptive statistics (i.e., means and standard deviations) measured using standardised instruments that compared results between groups such as randomised controlled trials, controlled trials or pre-test/post-test designs.
3. Studies were published in peer reviewed scientific or medical journals as full-length articles.

No studies were excluded on the basis of the details of the martial arts intervention/activity (e.g., duration or intensity of training) or the characteristics of the examined groups. The primary outcome of interest in the meta-analysis included any psychological or mental health phenomena resulting from martial arts training. Specifically, the study considered wellbeing factors, internalising mental health issues, and aggression.

The search strategy included: electronic bibliographic databases; reference lists of key and selected articles; targeted internet searching using Google Scholar; and targeted internet searching of key organisation websites. This was initially carried out by the author using the following databases: the Cochrane Central Register of Controlled Trials (CENTRAL); EBSCO, Embase; ERIC; MEDLINE; PUBMED; and, ScienceDirect. The search terms were adjusted to meet the requirements of specific databases in terms of subject heading terminology and syntax. This search was based on the following terms: (1) martial arts (e.g., martial arts OR fighting arts OR combat sports); and, (2) mental health (e.g., mental health OR mental illness OR psychology OR psychosocial OR wellbeing).

After removing duplicate citations from the search, the abstract of each citation was screened by the author to determine whether it would be included in the meta-analysis. Secondary screening was conducted by doctoral supervisors. Potentially relevant citations were saved as full-text articles. If it was uncertain regarding whether a citation was appropriate, the full-text copy was obtained. Following this, the citation list was screened.

Data was initially extracted from full-text articles of selected studies and placed in tabulated form by the author. Data extraction was then cross-checked by doctoral supervisors. Articles included in the meta-analysis were assessed for methodological quality using a 10-point quality assessment scale derived from van Sluijs et al (2007). Appendix A lists (1) details of studies included in the meta-analysis, (2) the criteria for determining methodological quality, and (3) the results from the assessment of methodological quality.

Data analysis was conducted using Comprehensive Meta Analysis Version 3.3.070 software from Biostat Inc. (Engelwood, New Jersey, USA). The random effects model was employed for this analysis as the included studies were sampled from a universe of possible studies defined by the inclusion/exclusion criteria defined earlier in the paper. The results and conclusions apply to that universe. The main summary measure used by this study was difference in means and subsequent interpretation of effect sizes as reflected by Cohen's suggested small, medium, and large effect sizes, where d sizes are equal to 0.30, 0.50, and 0.80 respectively (Cohen 1996).

Publication bias refers to a methodological issue whereby not all completed studies are published and the selection process is not random. This results in 'bias', wherein the estimated treatment effect is likely to have resulted from a biased collection of studies that may overestimate the true treatment effect. To address publication bias, the Classic Fail Safe analysis and the 'Trim and Fill' method (Duval & Tweedie, 2000) which looks for missing studies in a symmetric funnel plot was applied.

2.7.7.2 Results. The study selection process is shown in Appendix A. The initial search retrieved more than 500,000 possible citations. The search parameters were subsequently refined to include only full text peer reviewed copies available online in each of the databases and in Google Scholar. This reduced the search number to 100,079 possible citations. Citations

were then refined using subject key terms. This excluded a further 69,245 citations. Following this, citations were cross-referenced electronically and 28,762 duplicate citations were removed. Two thousand and thirty three citations were subsequently excluded after abstract review found these papers did not report quantitative research examining psychological or mental health outcomes of martial arts training. Finally, 25 papers were excluded due to methodological limitations and inadequate reporting of descriptive statistics for calculation of effect sizes. Subsequently, 14 papers examining the psychological and mental health outcomes of martial arts training were included in the meta-analysis.

The final 14 studies in the meta-analysis included two randomised controlled trials, eight controlled trials, and four pre-test/post-test studies. The studies captured data from 2105 participants across nine countries. Only 29%, or four of the 14 studies, reported the theoretical frameworks used to inform their intervention design, and there was no homogeneity across these. Theoretical frameworks included mindfulness and the two-process model of cognitive control, models of self-concept and self-efficacy, social learning theory, and theories of aggression.

The wellbeing analysis is based on six studies that evaluated the effect of martial arts interventions on the wellbeing of participants aged 9 to 75 years. The internalising mental health analysis is based on four studies that evaluated the effect of martial arts interventions on the mental health of participants aged 14 to 72 years. The aggression analysis is based on seven studies that evaluated the effect of martial arts interventions on reducing the aggression of participants aged 8 to 24 years. In each study participants were assigned to either a martial arts focussed intervention or a control/comparison group (pre-post studies acted as their own controls) and the researchers recorded their wellbeing, internalising mental health, or aggression at the conclusion of the intervention period. The effect size is the standardised mean

difference (Cohen's d). Appendix A reports the effects of martial arts training on wellbeing, internalising mental health, and aggression.

2.7.7.3 Wellbeing analysis. The standardised difference in means for wellbeing was $d = 0.346$ (Moore et al., 2020). On average, participants who received a martial arts intervention exhibited more than a quarter of a standard deviation higher wellbeing than participants who did not receive a martial arts intervention. The confidence interval for the standardised difference in means ranged from 0.106 to 0.585. This showed that the mean effect size in the universe of studies could fall anywhere in this range. As the range does not include an effect size of zero, this indicated that the true effect size is probably not zero. The I^2 statistic demonstrates what proportion of the observed variance reflects differences in true effect sizes rather than sampling error. In this analysis, the I^2 was 59.51%.

Publication bias for the wellbeing analysis was assessed using the Classic Fail Safe analysis and the 'Trim and Fill' method. The Classic Fail Safe analysis showed this meta-analysis incorporated data from six studies and yielded a z-value of 5.06777 with corresponding 2-tailed $p < 0.0001$ for observed studies. The fail-safe N in this case was 35. This meant that the study would need to locate and include 35 'null' studies for a combined 2-tailed $p > 0.05$. The 'Trim and Fill' method suggested that one study was missing from the left of the mean and no studies from the right of the mean.

2.7.7.4 Internalising mental health analysis. The standardised difference in means for internalising mental health was $d = 0.620$ (Moore et al., 2020). On average, participants who received a martial arts intervention exhibited more than a half of a standard deviation higher mental health rating than participants who did not receive a martial arts intervention.

The confidence interval for the standardised difference in means ranged from 0.006 to 1.233 and the I^2 was 84.84%.

The Classic Fail Safe analysis showed this meta-analysis incorporated data from four studies and yielded a z-value of 1.95996 with corresponding 2-tailed $p = 0.05$ for the observed studies. The fail-safe N in this case was 23. The ‘Trim and Fill’ method suggested that no studies were missing from the left or right of the mean.

2.7.7.5 Aggression analysis. The standardised difference in means aggression was $d = 0.022$ (Moore et al., 2020). On average, participants involved in martial arts recorded minimally less aggression than those participants who did not participate in a martial art. The confidence interval for the standardised difference in means ranged from -0.191 to 0.236. In this analysis the I^2 proportion of the observed variance reflecting differences in true effects rather than sampling error was 58.12%.

The Classic Fail Safe could not be applied to this analysis due to the null hypothesis not being refuted. Following the ‘Trim and Fill’ method was the only test applied for publication bias. The random effects model suggested no studies are missing from the left or right of the mean.

2.7.7.6 Limitations. The inherent limitations within the research base examining the effects of martial arts training on mental health also limit this meta-analysis. For example, studies used in the meta-analysis exhibit various limitations including conceptual and definitional issues, small sample sizes, self-selection effects, and limited use of follow-up measures. Furthermore, the methodological quality of studies included in the meta-analysis varied significantly. For example, while nine studies in the meta-analysis met five or six criteria for methodological quality, one study only met three criteria while another met eight criteria.

None of the studies used in the meta-analysis reported power calculations, hence it is unclear whether their reported results were adequately powered to detect hypothesized relationships. In addition to this, the meta-analysis is limited by the small number of included studies and a lack of heterogeneity across studies included in the meta-analysis.

2.7.7.7 Conclusion. The meta-analysis found that martial arts training can improve psychological strengths and positively impact symptoms associated with internalising mental health issues (Moore et al., 2020). However, while a small positive effect in reducing aggression was observed, the meta-analysis was unable to reject the possibility that martial arts training does not increase aggressive behaviour. Although this evidence is insufficient to support a contraindication, a cautious approach is recommended regarding the use of martial arts training to reduce aggressive behaviour. The meta-analytic results showed that martial arts training improved wellbeing and reduced the symptoms associated with internalising mental health issues. These are important findings as they suggested that martial arts training may be an efficacious physical activity-based approach to improving mental health (Moore et al., 2020). Further, while positive, these results reveal a great deal of heterogeneity among the included studies.

2.7.8 *Martial arts and gender*

Gender differences are not effectively addressed in martial arts research and the existing research is inconsistent. For example, many studies only examine male participants (e.g., Endresen & Olweus, 2005; Kurian et al., 1994; Reynes & Lorant, 2004; Zivin et al., 2001) or smaller proportions of female participants (e.g., 25%: Jennings, 2014; 11%: Massey et al., 2013; 14%: Milligan et al., 2015; 21%: Milligan et al., 2016; 28%: Nowak et al., 2013; 29%: Vertonghen et al., 2014). According to Phillips (2011), martial arts training helps women

address emotional and mental health issues. However, support for this finding is inconsistent. For example, Vertonghen et al. (2014) observed no significant differences between gender, while other studies reported negative effects on female participants when compared to males (Bjorkqvist & Varhama, 2001) or a control group (Vertonghen & Theeboom, 2010), and a recent quasi-experimental study of 193 participants reported positive effects for female participants while no benefits were found for male participants (Weiss et al., 2017).

Several studies have not found statistically significant pre-post intervention differences for females participating in martial arts training (Lakes & Hoyt, 2004; Twemlow et al., 2008). These studies suggested this may be related to females reporting significantly less aggression and behaviour problems compared to males prior to intervention. Twemlow et al. (2008) queried whether the failure to establish gender differences was related to the use of gender specific aggression, for example females may use relational aggression which was not addressed by their study; while Lakes and Hoyt (2004) suggested explanations of gender differences may include: (a) differential reactions to martial arts training for males and females; (b) differential reactions to the (male) instructor; and (c) differential reactions to the co-educational nature of the classes. Further research is needed before concluding whether martial arts training is more or less effective for females than males (Lakes & Hoyt, 2004).

2.7.9 *Martial arts and education*

Limited research has considered the relationship between martial arts training and mental health in school-based settings. Zivin et al. (2001) found that school-based martial arts effectively reduced violent behaviour. However, while the study used a controlled trial, it exhibited methodological weaknesses including not using random assignment and using a quantitative survey approach to examine a sample of 60 participants. Other school-based research has found that martial arts training can aid executive function development, with

greater gains being exhibited by older primary school male students (Diamond & Lee, 2011). It is particularly pertinent for this study that the studies conducted by Lakes and Hoyt (2004) and Twemlow et al. (2008), which found gender differences regarding the effects of martial arts participation, were conducted in school-based settings. This suggests there is significant utility in examining the relationship between martial arts training and mental health in schools, as studies can be controlled in institutional settings in ways that would be difficult in commercial (martial arts club) settings.

2.8 Martial arts training as a school-based intervention for adolescents

This study proposed to conceptualise martial arts training as a school-based psychosocial intervention for adolescents. While the underlying case for physical activity as a general mental health strategy has been discussed and evidence regarding the relationship between martial arts training and mental health outcomes has been reviewed; other relevant considerations include: (a) conceptualising the martial arts as a complementary therapy; and (b) views regarding the use of martial arts training as a therapeutic intervention.

2.8.1 *Complementary therapy*

Physical activities and martial arts training may be conceptualised within the context of complementary or alternative therapies. However, this is dependent upon the definitions used when considering these approaches. Complementary and alternative treatments for mental health embody a wide range of practices that are not traditionally considered as a psychological therapy or standard mental health treatment (Solomon & Adams, 2015). According to Deligiannidis and Freeman (2016), one view is that complementary approaches refer to treatments that are consistent with Western concepts, while alternative approaches are

philosophically distinct from Western concepts. However, the NSW Department of Health (2015) proposed that complementary therapies are used with conventional medicine, while alternative therapies are used instead of conventional medicine. Following the latter definition, this study investigated whether (and to what extent) martial arts training could be used as a complementary therapy in association with conventional mental health treatments.

While many complementary therapies are proposed for treating psychological disorders, research on these techniques is limited, especially in child and adolescent populations (Simkin & Popper, 2014). This may explain why traditional clinicians often hold negative views of these approaches (Deligiannidis & Freeman, 2016). However, given the barriers impeding adolescents from accessing mental health services, it is important to consider the context of complementary therapies, as these approaches are frequently used in Australia (Reid et al., 2016; Solomon & Adams, 2015) and are used more than conventional therapies by people diagnosed with anxiety and depression (van der Watt et al., 2008).

Clearly martial arts training is not a standard or established treatment for mental health issues. However, the use of physical activities, such as martial arts training in a school-based context, may have the potential to engage adolescents in a psychosocial intervention. Consequently, the limitations regarding research examining the use of complementary therapies should be addressed. This includes using stronger research designs such as randomised controlled trials with adequate controls (Deligiannidis & Freeman, 2016; Leventhal, 2013), larger sample sizes, adequate follow-up, and information regarding participant attrition and researcher blinding (van der Watt et al., 2008). These issues are notably similar to the methodological limitations of research examining the relationship between mental health and physical activity (more generally) and martial arts training (more specifically). Further, it is important to improve traditional clinicians' awareness of the evidence supporting the use of complementary approaches, such as physical activity, to address

mental illness (Glowacki et al., 2019). The support of traditional clinicians is critical regarding whether these types of approaches receive endorsement for use, both generally and within education systems.

2.8.2 *Does martial arts training have potential as a therapeutic intervention?*

Several authors have suggested that martial arts training exhibits similarities to psychological therapy (Burke et al., 2007; Fuller, 1988; Wargo et al., 2007; Weiser et al. 1995), and may be a useful therapeutic approach (Woodward, 2009). However, other researchers have suggested that martial arts training has a negative impact on mental health (Endresen & Olweus, 2005). Little research has considered the application of martial arts training as a psychological intervention (Macarie & Roberts, 2010) and discussion of the evidence regarding this issue necessitates reference to older literature. According to Weiser et al. (1995), martial arts training parallels psychological therapy as both develop self-understanding. Similarly, Burke et al. (2007) proposes martial arts training and psychological therapy both lead to growth and self-actualisation. From a psychological perspective, martial arts training may be viewed as a formalised system of human potential training that provides practical models and mechanisms of psychological interventions (Fuller, 1988). Specific intervention level similarities have been suggested between: (a) Rational Emotive Behaviour Therapy and the Samurai bushido code; (b) strategic family therapy and aikido; and (c) Feldenkrais method and aikido (Fuller 1988).

There is limited contemporary research supporting or opposing martial arts training as a therapeutic intervention to-date. Süle (1987) used martial arts training with a clinical population of nine patients suffering from schizophrenia, reactive depression, or neurotic anxiety; occurring five times a week for one month. Re-evaluation of the patients found decreased aggression and anxiety, and increased self-confidence, self-control, and sociability. However, the small and specific nature of the sample size limits the external validity of this

study. Heckler (1984) systematically applied martial arts principles to individual psychotherapy, using basic aikido to inform a remedial system of bodywork and movement therapy. However, empirical evaluations were not made. More recently, a quasi-experimental study of 193 participants diagnosed with PTSD found that female participant symptoms decreased following a six-week aikido-based intervention, however no benefits were found for male participants (Weiss et al., 2017). Another recent study reported no evidence to support the use of martial arts training as a therapeutic intervention (Strayhorn & Strayhorn, 2009). However, as the study used data from a large-scale longitudinal survey it was unable to provide analysis of baseline, post-intervention, and follow-up data to provide an evaluation of intervention efficacy. Arguably, the evidence to-date regarding positive, negative, or neutral findings is insufficient to determine the potential of martial arts training as a therapeutic intervention.

Martial arts training may function and produce therapeutic outcomes for various reasons. The martial arts may achieve therapeutic goals through a physical route (Weiser et al., 1995). While martial arts training is “not a replacement for talking therapy... what it does, that traditional therapy cannot do, is put you back in your body” (Guthrie, 1995, p. 115). According to Fuller (1988), martial arts training is similar to other somatic therapies (such as Alexander Technique and structural integration) and proceeds from the premise that emotional and interpersonal difficulties can be recognised in the body and resolved through physical exercise and kinaesthetic communication.

The martial arts may also complement conventional psychological therapy as training may produce problems that can be worked on in therapy. Training in the martial arts may arouse feelings that are difficult to suppress; and because feelings are expressed physically, they are easier for non-verbal patients to identify, translate into words, and address in psychological therapy (Weiser et al., 1995). Related to this, it should also be noted that there can be

considerable difficulty in motivating some adolescent clients to participate in abstract verbal therapy (Twemlow & Sacco, 1998). Martial arts training may provide a more engaging intervention for this population and enable systematic prosocial influences on individuals who might be resistant to conventional therapy. Given the noted barriers impeding adolescents accessing mental health services, a martial arts-based psychosocial intervention may have potential to engage adolescents in therapeutic activity.

However, several authors have recommended a contraindication, suggesting that martial arts training should not be used therapeutically with people exhibiting aggressive behaviour who might use techniques inappropriately (Coalter, 2005; Weiser et al., 1995). This is an important consideration in a school-based context given several studies have investigated school-based martial arts training with samples comprised of students exhibiting aggressive behaviour (Trulson, 1986; Zivin et al, 2001).

2.9 Theoretical orientation

2.9.1 *Epistemological*

While there are many ways to acquire knowledge about behavioural phenomena, the explicit epistemological approach underpinning this study is contextualised by scientific methodology and carnal sociology. While this epistemological dichotomy may appear mutually exclusive, using scientific method as a primary methodology, contextualised from the perspective of carnal sociology acknowledges the relationship between objective and subjective knowledge.

Scientific method involves the: (1) observation of phenomena; (2) formation of tentative explanations regarding cause and effect; (3) observation and/or experimentation to rule out alternative explanations; and (4) further testing and refinement of explanations (Bordens & Abbot, 2008). This methodology is commonly constructed as an objective process

where *objective* is defined as detached, unbiased, and existing independently (Lloyd, 1995). However, it has also been proposed that scientific objectivity does not imply that factors such as human reason, interests, or values play no role in objective science (Hanna, 2004).

Carnal sociology is an epistemological approach that attempts to situate itself at the “point of production” (Garcia & Spencer, 2014, p. 1) rather than being detached from the phenomena under observation. This approach is critical of statistical methods where researchers are conceived as detached, unbiased, and existing independently with no first-hand knowledge of their topic (Wacquant, 2014). According to Wacquant (2014) it is “epistemologically... impossible” (p. 22) to research many social phenomena without first-hand knowledge.

Rather than being mutually exclusive, the dichotomous fusion of scientific method and carnal sociology creates the potential for a more robust and comprehensive understanding of the effects of martial arts training on mental health outcomes.

2.9.2 *Martial arts framework*

This study developed a martial arts theoretical framework based on: (1) the basic characteristics of martial arts training (Donohue & Taylor, 1994); (2) the bipartite distinction between traditional and modern martial arts (Donohue & Taylor, 1994; Nosanchuk & MacNeil, 1989); and (3) the integrative combat model (Vey, 2010).

According to Donohue and Taylor (1994), there is no standard theoretical framework or classification of the martial arts and little agreement regarding the classification process. Table 2.1 has been adapted from Donohue and Taylor (1994) and lists a variety of characteristics used to create more complex classification schemes. These elements can be used individually or combined to categorise different martial arts. However, many of these elements could be viewed on a continuum, rather than as discrete categories. For example, although

Table 2.1. *Characteristics used to classify the martial arts*

Characteristics	Elements
Physical attributes	(a) Weapon versus unarmed combat (b) Distance (range) involved in combat (c) Strike versus grappling orientation (d) Linear versus circular movement (e) Hard (strike oriented) versus soft (redirection)
Functional classification	(a) Potential damage (b) Potential usefulness
Goal definition	(a) Internal goal definition (b) External goal definition
Training systems	(a) Finite versus open ended training (b) Codified versus evolving techniques
Cultural classification	(a) Country of origin (b) Social group association
Historical classification	(a) Time of origin (b) Genealogical orientation
Philosophical classification	(a) Internal concepts (b) External concepts

some martial arts may emphasise circular movement, they may also incorporate linear movement. While most of the listed elements are self-explanatory, the components of *philosophical classification* require further definition. Martial arts typically contain varying internal philosophies (Donohue & Taylor, 1994) which includes values such as sporting character, honour and responsibility, pacifism, nationalism and sacrifice, and civic

responsibility. External philosophies, religions, and ethical systems have also been applied to martial arts. For example, Buddhism was linked to Shaolin martial arts in China, Christianity was linked to medieval knights in Europe, and neo-Confucianism was linked to kenjutsu in Japan (Donohue & Taylor, 1994).

The bipartite system is a common classification system used in martial arts research and appears to have evolved from the Japanese terms *jutsu* and *do*, which can be respectively translated as “art” and “way” (Donohue & Taylor, 1994, p. 29). In this context, the term *martial arts* can be applied to systems of combat and self-defence, whereas the term *martial ways* have an association with systems of combat but a primary goal of psychological and personal development (Maliszewski, 1992). Many studies examining the mental health outcomes of martial arts training used a bipartite system distinguishing between traditional (or internal) and modern (or external) martial arts. This distinction is based upon classification of the following elements (Nosanchuk & MacNeil, 1989):

- (1) relative importance of patterns compared to technical instruction, drill, and sparring;
- (2) degree to which aggressive contact to the head and other vital areas during sparring is negatively sanctioned;
- (3) measure of respect to the instructor, school, and fellow students; and,
- (4) importance of meditation and philosophy.

Traditional martial arts emphasise the importance of patterns and non-aggressive aspects of martial arts including psychological and philosophical components, while modern martial arts emphasise competition and aggression (Twemlow et al., 2008).

The integrative combat model (Vey, 2010) proposes that martial arts can be conceptualised as a hierarchical three tier model. The model includes a basic physical layer, technical layer, and systems layer. The physical layer refers to the basic elements of a martial

art such as stances, blocking, striking, and kicking. The technical layer integrates the basic elements in the forms of patterns, sparring, and self-defence. The systems layer integrates the technical elements, providing summary descriptions of different types of martial arts. The integrative combat model is useful for describing the elements of the specific martial art used in the current research, and can facilitate comparison across different martial arts.

2.9.3 *Health model*

The absence of an explicit health model is a significant methodological limitation of previous research examining the relationship between martial arts and mental health. Various mental health models exist including the biomedical, biopsychosocial, and salutogenic models. The biomedical model focuses on the biological causes of ill health excluding consideration of other influencing factors (Deacon, 2013), whereas the biopsychosocial model considers the connection between biology, psychology, and socio-environmental factors (Comer, 2007). These are the dominant models of mental health and are based on the homeostatic assumption that normal health reflects the tendency towards a relatively stable equilibrium and that the dysregulation of homeostatic processes causes ill-health (Antonovsky, 1987; Kuchroo et al., 2012).

The salutogenic model suggests an alternative approach to mental health based on the assumption that heterostasis is characteristic of living organisms (Antonovsky, 1987). Heterostasis is the conceptual opposite of homeostasis, suggesting that normal health reflects the tendency towards instability (Antonovsky, 1987). A primary component of this model is a multidimensional health continuum where individuals range on a continuum from wellbeing to pathology.

These models can be considered dichotomously as having an underlying: (1) pathological deficit model, which refers to the presence or absence of disease based symptoms

such as depression or anxiety; and (2) wellbeing strengths-based model, which refers to the presence or absence of beneficial mental health characteristics such as resilience or self-efficacy. The deficit model is typically considered as the dominant mental health model (APA, 2013), however mental health is more than the absence of mental illness (WHO, 2018) and considering mental health from a wellbeing perspective accords with current trends in psychology (Moore & Woodcock, 2017b). The dichotomy of the pathological and wellbeing approaches may be more usefully represented as a continuum (Mittelmark & Bull, 2013), which reflects that mental health promotion should address both mental illness and actions that improve psychological well-being (WHO, 2018). This study examined both aspects of the mental health continuum, but was particularly interested in the strengths-based model which was operationalised through the wellbeing characteristics of resilience and self-efficacy.

2.9.4 *Resilience framework*

Resilience is a complex construct (Kaplan, 2006) that is difficult to define (Forbes & Fikretoglu, 2018). This complexity is evident in the varying operational definitions of resilience which include hardiness, optimism, competence, self-esteem, social-skills, achievement, and absence of pathology in the face of adversity (Prince-Embury, 2007). Resilience is often defined as the attainment of positive outcomes despite significant adversity, risk, or stress (Goldstein & Brooks, 2006; Naglieri & LeBuffe, 2006) and is typically considered from the strengths-based perspective of mental health (Moore & Woodcock, 2017b). Resilience can be conceptualised as a multi-level construct that includes: (a) protective processes; (b) the interaction of protection and risks; and (c) conceptual tools used in predictive models (Elias et al., 2006). Examining resilience in terms of protective factors offers a viable means of measuring the construct (Fuller, 2006) and recent research has suggested specific

resilience factors may have greater efficacy in developing resilience-based interventions (Moore & Woodcock, 2017a).

Health agencies have suggested that resilience is determined by a variety of factors including:

- (1) individual, biological, and psychological characteristics;
 - (2) relationships with family and peers; and,
 - (3) environmental influences such as those in the school and the broader community
- (VicHealth, 2015).

Resilience is not static and can change as individuals interact with and respond to people in their lives and environments (Evans-Whipp & Gasser, 2018). While this might create opportunities to promote resilience in young people (Masten, 2009), research has not determined whether resilience interventions can teach or promote resilience (Forbes & Fikretoglu, 2018).

According to Bernard (1993), resilient youth usually possess three main characteristics including social competence, autonomy, and optimism. Close relationships between adolescents and their parents have also been found to promote resilience (Masten, 2018; Masten & Shaffer, 2006). This is supported by research finding family factors such as warm relationships and positive home environments were associated with greater resilience (Bowes et al., 2010).

Several characteristics in martial arts training have been suggested as mechanisms that promote resilience although these have not been explicitly investigated. These include the use of breath training, meditative techniques, and use of models and metaphors to promote resilience (Bell, 2008). The current study proposed that martial arts training uses learning processes consistent with Bandura's (1977) social cognitive theory which promotes social competence, autonomy, and optimism; leading to greater resilience.

2.9.5 *Social cognitive theory*

Social cognitive theory suggests that knowledge can be acquired through the observation of others in the context of social interactions, experiences, and media influences; and explains human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural, and environmental influences (Bandura, 1977). Social cognitive theory has been one of the few theoretical orientations used to examine the psychological effects of martial arts practice. James and Jones (1982) suggested that the processes in martial arts training are reminiscent of social learning mechanisms (i.e., instruction, observation, modelling, imitation, and social reinforcement). In this context, social cognitive theory may be important for explaining the learning processes in the martial arts and could suggest factors contributing to the mental health outcomes resulting from martial arts training. However, in the context of Bandura's theory of aggressive behaviour, aspects of social cognitive theory raise concerns about the psychological effects of martial arts practice.

The theory has several components including:

- (1) modelling – where learning occurs through the observation of models. Effective observational learning includes attention, retention, motor reproduction, and motivation processes (Bandura, 1977);
- (2) outcome expectancies – to learn a modelled behaviour the potential outcome of that behaviour must be understood. When repeating (or not repeating) a behaviour the observer anticipates similar outcomes, such as rewards or punishment (Bandura, 1977); and,
- (3) self-efficacy – refers to the extent to which an individual believes that they can perform a behaviour required to produce a particular outcome (Bandura, 1977).

Research has found that higher self-efficacy is associated with improved mental health (Bavojdan et al., 2011). Given that previous research has found a positive association between higher self-efficacy and martial arts training (Reishehrei et al., 2014; Ryan et al., 2015), self-efficacy may be an important mechanism underpinning the potential of martial arts training to promote mental health.

Several sub-factors are conceptualised as contributing to self-efficacy: mastery experience, vicarious experience, social or verbal persuasion, and emotional arousal (Loo & Choy, 2013). According to Usher and Pajares (2006): (a) mastery experience refers to judgments of competence based on previous attainment in a related task; (b) vicarious experience refers to the observation of another person's attainment in a related task; (c) social or verbal persuasion refers to feedback, judgments, and appraisals provided by significant others about engaging in the task; and (d) emotional arousal describes the emotion or physical sensation one experiences while performing a particular task. Bandura (1977) noted the differential effect of the sub-factors and suggested that mastery experience may have the greatest influence on self-efficacy, which is supported by quantitative research (Loo & Choy, 2013). Further, the mastery dimension of self-efficacy is of interest given conceptual overlap with resilience (Prince-Embury, 2007).

2.9.6 *Theory of change*

The study's theory of change considers two distinct characteristics within the martial arts intervention: skill mastery and social mechanisms. However, these characteristics are proposed very cautiously, given that the quantitative design of the study only allows for speculation regarding the causal mechanisms associated with the study's potential intervention effects (Moore et al., 2021). Further, the study does not examine the possible differential effect regarding these mechanisms of change.

Mastery of skills is proposed as an important characteristic underpinning the study's potential effects. Traditional martial arts emphasise mastering techniques (King & Williams, 1997). Technical practice refers to the basic elements of martial arts training (Vey, 2010), which includes stances, blocks, punching, and kicking. Developing mastery of these techniques is a significant aspect of the intervention and is proposed as a causal mechanism affecting the study's outcomes. It is important to note that mastery is a salient component of resilience (Prince-Embury, 2007) and self-efficacy (Loo & Choy, 2013).

Social mechanisms are also proposed as an important characteristic underpinning the study's outcomes. This had the potential to be facilitated through the intervention's (1) psychoeducation component, which aimed to develop social understanding and improve relationships; and (2) modelling, practice and reinforcement of social behaviour arising during the intervention's physical activity. Additionally, other social phenomena such as development of an in-group identity (Kurzban & Leary, 2001) and group superordinate goals (Sherif et al., 1961) may have affected the study's outcomes. Developing relationships with peers is an important aspect of resilience (Prince-Embury, 2007; VicHealth, 2015) and the elements of social cognitive theory (i.e., modelling, outcome expectancies, and self-efficacy) are relevant here. Development of social self-efficacy is important when considering self-efficacy in children and adolescents (Muris, 2001).

2.9.7 *Summary: Theoretical orientation*

The theoretical framework of this study is based on an underlying epistemological perspective combining scientific method and carnal sociology. The study's explicit theoretical framework is based on: (1) the bipartite martial arts model (emphasising traditional martial arts) which assumes that martial arts training can be classified according to the criteria outlined in Section 2.9.2; and (2) a dichotomous health framework which incorporates a pathological deficit model

and wellbeing strengths-based model, which is conceptualised from a continuum perspective. The study's primary focus was the wellbeing strengths-based model, which was operationalised using the theoretical frameworks of resilience and social cognitive theory (self-efficacy). This study cautiously proposed a theory of change based around skill mastery and social mechanisms. Figure 2.1 outlines the theoretical framework of the study.

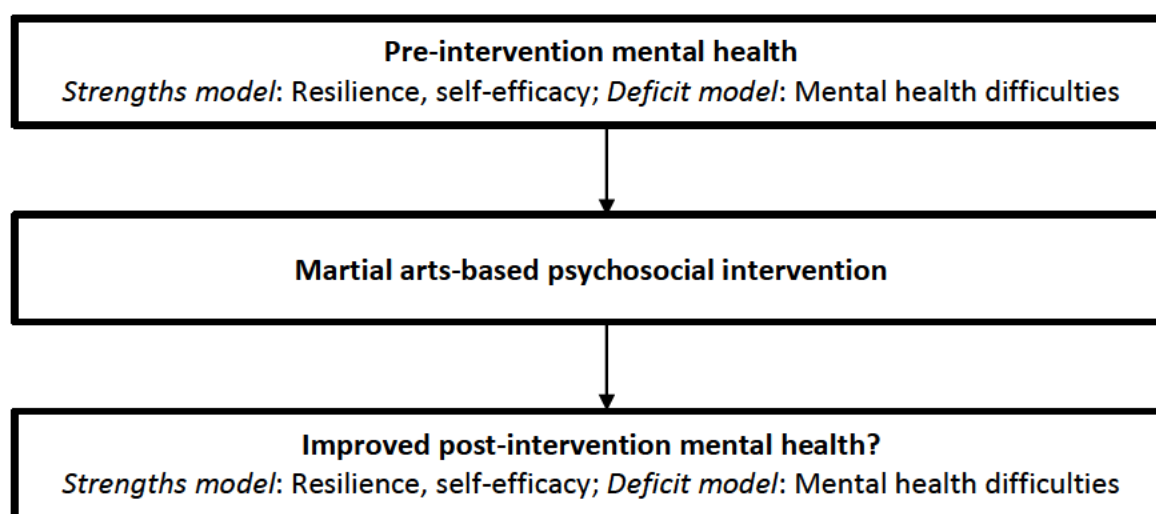


Figure 2.1. Theoretical framework of the study

2.10 Aims of the study and research questions

This study aimed to investigate the following question: to what extent are martial arts-based psychosocial interventions an efficacious strategy to improve adolescent mental health in a school-based setting? This is consistent with the Sustainable Development Goals proposed by the United Nations (2015) for promoting health and wellbeing (SDG-3) and quality education (SDG-4). Based on the literature review including identified gaps, methodological issues, and theoretical orientation; the following questions were proposed for investigation:

- (a) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' resilience at post-intervention and follow-up?

- (b) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' self-efficacy at post-intervention and follow-up?
- (c) To what extent does participation in a 10-week martial arts-based intervention affect adolescents' mental health difficulties at post-intervention and follow-up?
- (d) To what extent do demographic co-variates have any effect on the intervention outcomes?
- (e) To what extent did the intervention program engage adolescent participants?

2.11 Summary

Mental health is a significant health, social, and economic issue; and the mental health issues confronting Australian adolescents are of particular concern in the literature. While a range of formal mental health services support adolescents including health, school, telephone counselling, and online services; the impact of these services is limited. Barriers such as stigma, expense, poor mental health literacy, and accessibility impede adolescents accessing services, who typically prefer to use informal supports. Further, the efficacy of mental health services is somewhat questionable. Although school-based mental health services may be especially well placed to provide support and are frequently accessed by adolescents, these services are inconsistent and often lack an empirical basis.

Physical activities are generally accepted as promoting important psychological benefits. While there is a growing body of empirical evidence supporting this, existing research exhibits significant methodological problems and the mechanisms underpinning the relationship between physical activity and mental health are not well understood. Despite these issues, physical activities have significant potential as a mental health strategy and require further investigation.

Martial arts training is a unique type of physical activity that may promote mental health. Martial arts are a complex cultural phenomenon and in the current study martial arts were operationally defined as: (1) a socially constructed human behaviour based on physical activity; (2) referring to the various skills and practices that have originated as a method of combat or self-defence; and (3) incorporating a psychological health and personal development dimension.

Research examining the psychological outcomes from martial arts training is limited, focusing on aggression and personality correlates. Studies examining the outcomes of martial arts training on mental health tend to report positive effects regarding mental illness such as anxiety and depression; and promoted characteristics associated with wellbeing and mental health strengths. However, numerous methodological issues limit the generalisability of this research including conceptual and definitional issues, reliance on cross-sectional research designs, small sample sizes, self-selection effects, reliance on self-report measures without third party corroboration, limited use of follow-up measures, and not accounting for gender differences. Notwithstanding this, martial arts training may have the potential to function as a mental health strategy that uses physical activity as a “hook” (Hartmann, 2003, p. 124) to deliver psychosocial interventions.

This study examined a different route to improving adolescent mental health by investigating the relationship between mental health and martial arts training. The relationship was examined using a theoretical framework based on: (1) the bipartite martial arts model (emphasising traditional martial arts); and (2) a dichotomous health framework which incorporates a pathological deficit model and wellbeing strengths-based model. The study’s primary focus was the wellbeing strengths-based model, which was operationalised using the theoretical frameworks of resilience and social cognitive theory (self-efficacy). When considered with the case for physical activities as a mental health strategy; with particular

regard to martial arts training, which is a unique physical activity that potentially improves mental health outcomes; this suggests why martial arts training provides new insights for addressing adolescent mental health in school-based settings.

CHAPTER 3

METHODS

3.1 Overview

The primary aim of scientific research is to build an organised body of knowledge and to develop valid and reliable explanations regarding the phenomena being investigated (Bordens & Abbott, 2008). While there are different types of explanations for phenomena, such as faith-based explanations and common-sense explanations, scientific explanations incorporate a blend of characteristics that differentiate these from other types. By distinction, scientific explanations are: (1) *empirical* – based on evidence derived from systematic observation; (2) *rational* – consistent with established facts and following logical rules; (3) *testable* – can be verified through direct observation; (4) *parsimonious* – explain phenomena in the simplest terms; (5) *general* – have broad explanatory properties; (6) *tentative* – not fixed but stated provisionally; and, (7) *rigorously evaluated* (Bordens & Abbott, 2008).

It is critical to document the specific methods and methodology that underpin and operationalise a given study. This provides scientific research with transparency, allows for evaluation of a study's validity and reliability, and facilitates replication. This chapter describes the methods used for the study presented in this thesis. Firstly, the study design and sampling procedures are reviewed, which is then followed by a detailed description of the intervention program evaluated by the study. The study's outcome measures are then examined, and the chapter concludes with a discussion of the data collection procedures and data analysis used for the study. Methodological justification for these design choices is synthesised throughout the chapter.

3.2 Study design

The study was a 10-week, secondary school-based intervention that was evaluated using a randomised controlled trial design. Ethics approval was sought and obtained from Macquarie University's Human Research Ethics Committee (HREC), the NSW DoE, and the Catholic Education Diocese of Parramatta. The research was registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12618001405202). The study protocol was reviewed by school psychologists employed by the NSW DoE. The design, conduct, and reporting of this study adhered to the Consolidation Standards of Reporting Trials (CONSORT) guidelines for a randomised controlled trial (Schulz et al., 2010).

There are many methods of technique and procedure to operationalise scientific research and each of these has strengths and weaknesses that should be considered when developing a scientific investigation. These methods are never just “neutral tools” (Bryman, 2016, p. 17), rather they reflect the researcher's epistemological and ontological position. A central epistemological issue in the social sciences is whether social phenomena can be examined using the same principles and methods that are used in the natural sciences (Bryman, 2016). This study was grounded in the *positivist* epistemological position that social phenomena can be examined using natural science methods (Davies & Hughes, 2014) and the *objectivist* ontological assertion that phenomena “have an existence that is independent of social actors” (Bryman, 2016, p. 29) which are governed by rules and structures that can be objectively tested and understood (Davies & Hughes, 2014). This is reflected in the quantitative methodology used to investigate the study's research aims and questions.

3.2.1 Study design: A quantitative approach

In the broadest sense, scientific research can be undertaken using quantitative, qualitative, or mixed method approaches. A quantitative approach was selected for the study as this

methodology best facilitated the investigation of the study's research aims and questions. Quantitative methodology can be used to assess an intervention's efficacy, identify factors influencing an outcome, and promote understanding of outcome predictors (Field, 2013). A significant strength of quantitative research is that descriptive and inferential statistical procedures are widely available and highly standardised (Bordens & Abbott, 2008). This provides a degree of objectivity that makes this the "best approach" for theory testing (Creswell, 2009, p. 18) and due to its focus on instruments and procedures quantitative methods are highly replicable (Bryman, 2016).

Notwithstanding these strengths, quantitative methods have various limitations. Measurement error is a common issue affecting quantitative research, which refers to the difference between the true value of a variable and its observed or measured value (Bordens & Abbott, 2008). While this has the potential to affect a researcher's ability to draw conclusions regarding relationships between variables, the problem is addressed by assessing the validity and reliability of quantitative data (Field, 2013). An additional critique is that quantitative approaches may have an artificial and false sense of accuracy (Bryman, 2016) and do not lend themselves to all research situations (Bordens & Abbott, 2008). From an interpretivist and constructivist epistemological perspective the reliance on instruments and procedures used by quantitative research methods creates a static and disconnected view of social phenomena (Bryman, 2016). Despite these limitations, the strengths of quantitative methodology make this the most suitable approach to investigate the study's research aim and questions.

3.2.2 Study design: Experimental research design

Research designs are strategies of inquiry that operationalise the broader theoretical and philosophical approaches to scientific research by specifying the direction and procedures used in a study (Creswell, 2009). This study employed an experimental design. Experimental

research is often considered to be the “yardstick” (Bryman, 2016, p. 52) of quantitative research given its capacity to determine the cause of a given phenomenon (Bordens & Abbott, 2008) and was an appropriate design to use in this study as it is effective for assessing intervention efficacy (Creswell, 2009). Experimental designs systematically manipulate variables to measure their effect on an outcome with the aim of inferring causal relationships among phenomena (Field, 2013). This is achieved by manipulating an independent variable for a treatment condition (i.e., experimental group) while not manipulating the variable for a non-treatment condition (i.e., control group), which allows for comparison between or within these groups (Field, 2013).

All research designs have limitations. Experimental designs cannot be used if a hypothesised causal variable cannot be manipulated (Bordens & Abbott, 2008). For example, it might be unethical to manipulate certain variables. A further weakness of experimental approaches is that increasing control of extraneous variables restricts the generalisability of experimental findings (Bordens & Abbott, 2008). Ironically, increasing the level of control in an experiment decreases its generality to real world settings. However, given the capacity of experimental design to determine intervention efficacy this was the most appropriate design choice for the study.

3.3 Sampling and recruitment

Random sampling is the “optimal” method to ensure that the results from a given sample generalise to a broader population (Bordens & Abbott, 2008, p. 159) and was used in this research to increase the likelihood that the study’s sample was representative of a population of adolescents. Random sampling minimises sampling error, which refers to a difference between the sample and population (Bryman, 2016). This study used cluster sampling, which is a two-stage random sampling process that is often used when true large-scale random

sampling is impossible (Davies & Hughes, 2014). Cluster sampling begins by considering groupings of population units that are known as clusters (Bryman, 2016). Simple random sampling or assignment then occurs within these groups.

3.3.1 *School recruitment*

Randomisation was based on cluster sampling using socio-educational status (SES) to determine the study's cohorts. SES was determined using the Index of Community Socio-educational Advantage (ICSEA) which was reported by the Australian Curriculum, Assessment and Reporting Authority (ACARA, 2018). According to ACARA (2018), ICSEA refers to family characteristics including parental education and occupation, and the socio-economic background of the school location. ICSEA³ data for SES has been used as a proxy for socio-economic status in this study.

Seventy-two government and Catholic secondary schools in the Greater Sydney urban area of NSW, Australia were invited to participate in the study. All invited schools were sent an initial email that invited participation in the study (see Appendix C). Schools that responded to the initial email were pooled. Follow-up phone contact to discuss school participation was conducted using systematic sampling, based on every 6th school on the list. While ensuring that SES was normally distributed, the first five schools that consented were recruited into the study. In all cases, school principals were the initial point of contact. After schools had agreed to participate other members of each school's executive staff (including deputy principals, head welfare/wellbeing teachers and year advisors) provided logistical support for the study regarding recruitment of participants and school level organisation including timetabling and use of school facilities.

³ An ICSEA score of 1000 refers to the average SES value. Scores around 900 indicate low SES, while scores around 1100 indicate high SES (ACARA, 2018).

3.3.2 *Sample size calculation*

A practical consideration regarding samples is the size of the sample needed to determine whether that sample is appropriate for research objectives (Davies & Hughes, 2014) and practical in terms of access to participants, time, cost, and the need for precision (Bryman, 2016). Statistical power calculations were used to determine adequate sample size. Statistical power refers to the ability of a test or study to find an effect assuming it exists in a population (Gravetter & Wallnau, 2007). When power and alpha levels are set, it is possible to estimate the sample size required to detect the minimum effect deemed appropriate (Field, 2013).

Power calculations were conducted to determine the sample size required to detect changes in mental health related outcomes resulting from martial arts training. Statistical power calculations assumed baseline-post-test expected effect size gains of $d = 0.3$, and were based on 90% power with alpha levels set at $p < 0.05$. The minimum completion sample size was calculated as $N = 234$ (experimental group: $n = 117$, control group: $n = 117$). As participant drop-out rates of 20% are common in school-based randomised controlled trials (Wood et al., 2004), the maximum proposed sample size of the study was $N = 293$ (experimental group: $n = 147$, control group: $n = 146$).

3.3.3 *Participant recruitment*

All students in grades 7 and 8 (target age range 12-14 years) at participating schools were invited to participate in the study. Participant and caregiver information and consent forms were provided to students. The study required informed consent from potential participants and their caregivers (see Appendix C). Two follow-up letters were subsequently distributed to students at one-week intervals. The author responded to email and phone contact from

caregivers who requested further details about the program. Concurrent martial arts training was an exclusion criteria for participation in the study, however prior experience of martial arts training was not an exclusion criteria.

Baseline assessment at participating schools was conducted after the initial recruitment processes. Participants were then randomly assigned to the experimental or control group. Due to the nature of the intervention participants were not blinded to the allocation. Randomisation of participants into the experimental and control conditions was conducted using bias-coin randomisation, which creates comparable groups and prevents bias in the allocation of participants to the study's treatment conditions (Berchiolla et al., 2019). Bias-coin randomisation sequentially forces the assignment of participants towards balance by accounting for the history of previous allocations (Berchiolla et al., 2019). This was performed by a researcher not directly involved in the study who was blinded to school and participant identity. The blinded researcher generated an allocation sequence using a computer software package of their choosing not revealed to the author of this dissertation. Following random assignment, the experimental group received the intervention after which post-intervention measures assessed the experimental and control groups. A 12-week follow-up assessment was conducted post-intervention.

During the study design process the researchers decided that the control group would receive the same intervention after administration of follow-up measures. The decision to use a waitlist control was based on ethical and pragmatic grounds. First, withholding treatment from study participants is ethically problematic (APA, 2018). Consequently, the researchers employed a study design in which the experimental and control groups received the intervention while maintaining the experimental features of the study. Second, it was pragmatic to provide the intervention program to the control group (compared to a non-treatment or

alternate treatment group) as this arguably provided a greater incentive for schools to participate in the study. Students in the waitlist condition attended their usual school activity.

3.4 Methods: Intervention program

The intervention was a bespoke program that was delivered in a face-to-face group format onsite at participating schools. The intervention included 10 x 50-60-minute sessions, once per week for 10 weeks. While the space used in participating schools varied (e.g., school hall, gym or dance studio), they were similar insofar as providing an indoor space for a group of participants to engage in physical activities. Each intervention session included two distinct components⁴: (1) psycho-education group-based discussion; and (2) martial arts program. Table 3.1 provides a basic overview of the intervention program. Details of the psycho-education intervention component and the martial arts intervention component follow.

3.4.1 Intervention component: *Psycho-education program*

While group-based discussion is common at the start of martial arts programs, the study's intervention program incorporated an explicit psycho-education component that was developed for the program by a psychologist (author), and was reviewed by the higher degree research supervisors, Macquarie University's HREC, and multiple NSW DoE school counsellors and psychologists (with whom the intervention protocol was discussed and revised during individual and group consultation on multiple occasions). Table 3.2 provides an overview of the core elements of the psycho-education delivered as group based discussion in each session.

⁴ When developing the study, a full factorial design was considered to examine the differential effects of these components. However, this approach was discounted considering the resources required and the burden on school and participant. Furthermore, it is also proposed that the multi-component intervention is consistent with the delivery of traditional martial arts training.

Table 3.1. *Wellbeing warriors: Basic program*

Item	Activity	Time (minutes)
1.	Salutation	1
2.	Psycho-education	10
3.	Warm up/stretching	10
4.	Technical practice	10
5. (a) ¹	Patterns practice	10
5. (b) ¹	Sparring – Sticking hands	10
6.	Meditation	5
7.	Salutation	1
Total time (minutes):		47 ²

¹5(a). or 5(b). will occur interchangeably during the program.

²Most secondary schools in NSW have lessons between 50-60 minutes, hence 47 minutes fits within the school timetable.

It should be noted that as group-based discussion is an open-ended process, it was anticipated that minor differences would emerge across intervention settings.

3.4.2 *Intervention component: Martial arts program*

3.4.2.1 Rationale. The main component of the intervention program was martial arts-based training. While there are hundreds of types of martial arts that have developed across different cultures (Theeboom & De Knop, 1999), several factors were considered when selecting a martial art on which to base the intervention. These included: (a) prior research

Table 3.2. *Wellbeing warriors program: Psycho-education sessions*

Session	Topic	Points to include in discussion
1.	What are the martial arts?	(a) Respect; (b) authority and rules; and (c) privacy (re group discussion).
2.	Goal-setting	(a) Why are goals important?; and (b) developing goal statements.
3.	Self-image (concept)	(a) What we think about ourselves is important; (b) being kind to yourself; and (c) trying not to take yourself too seriously!!
4.	Problem solving	(a) Identify the problem; and (b) breaking a problem into parts.
5.	Aggression vs courage	(a) What is courage?; (b) is there a place for aggressive behaviour?; (c) assertiveness vs aggression; and (d) dealing with anger.
6.	Self-esteem and resilience	(a) Improving how we feel about ourselves; and (b) how to be more resilient?
7.	Bullying	(a) What is bullying?; and (b) how should I deal with it?
8.	Self-care/caring for others	(a) How do you look after yourself (i.e., physical, psychological)?; and (b) looking after others?
9.	Values, optimism, & hope	(a) What is important in your life?; (b) what do you value?; and (c) the importance of optimism and hope: perspective (i.e., glass half full/empty).
10.	Grading week	(a) Hard work and achieving goals; and (b) taking pride in achievements.

finding the martial art improved mental health; (b) the martial art incorporated a traditional (or internal) martial arts philosophy; (c) the appeal of the martial art to potential participants; and (d) the practicality of the chosen martial art in a school-based setting. The intervention program's martial arts component was primarily adapted from the Korean martial arts form, taekwondo.

As discussed in the literature review, research suggested different martial arts are associated with improving mental health including karate, mixed martial arts, tai chi, and taekwondo. While research regarding the effects of martial arts training on mental health is limited, numerous studies have found an association between taekwondo improving mental health and promoting psychological strengths (e.g., Finkenberg, 1990; Kurian et al., 1994; Lakes & Hoyt, 2004; Nosanchuk, 1981; Nosanchuk & MacNeil, 1989; Wargo et al., 2007).

As taekwondo is based on traditional (internal) martial arts (Ahn et al., 2009), it incorporates a focus on: (1) developing respect for others; (2) negatively sanctioning aggressive behaviour; and (3) incorporating personal and philosophical development (Nosanchuk, 1981) which includes focusing on self-control, relaxation, and mindfulness. Taekwondo may appeal to potential participants in terms of popular culture, as it is recognisable as an Olympic sport and is frequently referenced in entertainment media (McMaster, 2018). Additionally, from a functional perspective, taekwondo is primarily a sport (Ahn et al., 2009; Capener, 1995; Moenig, 2015) and is a good fit with the NSW DoE (n.d.) *Sport Safety Guidelines* regarding martial arts, which emphasises safety, self-control, and responsibility.

Given these characteristics, a traditional taekwondo model was deemed suitable for the development of a school-based mental health program as it incorporates an emphasis on self-development, health promotion and character building, and has a specific replicable curriculum.

3.4.2.2 Overview. The intervention program was delivered by a registered psychologist with six years' experience who was also a 2nd Dan/level black-belt taekwondo instructor with five years' experience. Materials used during the intervention included martial arts belts (white and yellow) and martial arts training equipment (including strike paddles and strike shields).

The intervention program was essentially an adapted version of the beginner (white and yellow belt) taekwondo curriculum (Johnston, 2011). Each participant was provided a white belt upon commencing the program which was worn during training sessions. Although martial arts uniforms are typically worn for traditional martial arts training, participants trained in physical education uniforms as this was practical and minimised program costs. Shoes were not worn during training sessions. During the 10-week program the participants engaged in progressive skill development and were formally graded from a white to yellow belt at completion of the intervention program. The final intervention session concluded the program with a formal martial arts grading. Participants were: (1) awarded a yellow belt based upon successful demonstration of martial arts techniques (stances, blocks, punching, and kicking) and the movement pattern learnt during the program; or (2) awarded a certificate of participation if they did not demonstrate the required martial arts techniques to receive the grade of yellow belt. It is important to note that aggressive physical contact was not part of the intervention program. While sparring is arguably an important element of martial arts training, it was not considered as a necessary component of the intervention. In taekwondo, white belt level martial artists do not engage in contact sparring and an alternative activity based on the tai-chi sticking hands exercise was included in the intervention program as a substitute.

While it was desirable for participants to attend all 10 sessions to achieve intervention dose, it was unrealistic to assume all sessions would be attended. According to Legrand et al. (2012) determining an adequate intervention dose in health promotion programmes can be based on level of participation and whether participants did well. In the current study,

intervention dose was assumed if participants completed the formal grading and were awarded a yellow belt or certificate of participation.

3.4.2.3 Martial arts program description. The martial arts component of the intervention was based on a standardised curriculum incorporating seven activities (Johnston, 2011). These were a salutation, warm up exercises, stretching, technical practice, patterns practice, sparring, and meditation. Patterns practice and sparring were rotated in alternate sessions, while the other activities occurred in every session. A description of the activities follows:

(1) *Salutation* – The salutation is intended as a sign of respect where the training group and instructor bow to each other. During the salutation the training group is organised in rows and columns facing the instructor. The salutation begins and concludes each intervention session.

(2) *Warm up* – Warm up activities are an important element of any physical exercise as they minimise risk of injury (Woods et al., 2007). Active warm up activities were used including non-specific activities such as jogging and gradual warm-up activities that mimic subsequent activities in the intervention (Woods et al., 2007). The latter used large muscle groups and gradually increased in intensity.

(3) *Stretching* – Stretching is an important element of physical exercise as it minimises the risk of injury (Woods et al., 2007). Incorporating stretching is also a requirement of the NSW DoE (2020c) *Sport Safety Guidelines* regarding risk minimisation during physical activities. Static stretching is a method of slow and deliberate movement that can be used to lengthen different muscles and has significant empirical support for reducing muscle related injury (Woods et al., 2007). Each stretch was maintained for around, “20 seconds to facilitate connective tissue plastic elongation” (Woods et al., 2007, p. 1091). Activities included the demonstration and guided practice of stretches targeting the hamstring, triceps, and quad muscle groups.

(4) *Technical practice* – Technical practice refers to the basic elements of martial arts training (Vey, 2010), which includes stances, blocks, punching, and kicking. Activities included demonstration and guided practice of techniques.

Stances refers to standing positions and are the most basic element of martial arts training. Stances include attention stance, ready stance, natural stance, front-forward stance, back stance, horse-riding stance, and relax stance.

Blocks are defensive arm and hand movements based on ready, front-forward, or back stance. Blocks include lower block, upper block, inside block, and outside block.

Punching is based on traditional martial arts practice. Punching occurred from horse riding stance. Participants were taught how to safely make a fist (i.e., [a] hold open palm hand in the air, [b] curl fingers to make a fist, then [c] curl thumb around bottom of fingers. It is an important safety consideration that fingers are not held over the thumb).

Kicking refers to traditional taekwondo martial arts practice. Kicking occurred from a natural stance. Kicks included front (groin) kick, round house kick, and push kick. Instruction included using correct technique (i.e., lifting knee before extending lower leg to kick) and contact points (i.e., instep for front and roundhouse kicks, and heel for push kick).

Punching and kicking techniques were completed in stationary or moving positions against imagined or physical objects (such as strike paddles or strike shields).

(5) *Patterns practice* – Patterns are an important component of traditional martial arts training. A pattern is a choreographed sequence of movements consisting of combinations of various defensive and offensive elements (i.e., blocks, kicks, and punches) performed as though defending against one or more imaginary attackers. Patterns can also be considered as a moving

meditation (Cox, 1993). Participants learnt the beginner pattern, Taegeuk 1 (Johnston, 2011), using modelling and guided practice.

(6) *Sparring* – Sparring is an important element of martial arts training. The program substituted the tai-chi sticking hands exercise as an alternative to traditional martial arts sparring. This involved two participants standing opposite each other with both hands (i.e., palms) touching. The manifest purpose of the activity was to either: (a) push the opposing participant over; or (b) lure the opposing participant to exert too much force and lose balance. The latent purpose of the activity was to promote balance and develop an understanding that physical power (size) does not always determine an outcome.

(7) *Meditation* – A simple definition refers to meditation as the practice of focusing attention (Maliszewski, 1992) on a single point of reference. In martial arts this often involves focusing on breathing, bodily sensations, or on a word or phrase. Meditation involves turning attention away from distracting thoughts and focusing on the present moment. In martial arts training meditation can occur while stationary, or while practising patterns which is often referred to as a moving meditation (Cox, 1993). The intervention program incorporated meditation as a stationary breath focusing exercise. The meditation component was explained to participants as being aimed to promote relaxation and self-control.

3.5 Risk management

Psychological and physical risks arising from the intervention program were assessed as minor by Macquarie University's HREC, the NSW DoE, and the Catholic Education Diocese of Parramatta. While no specific psychological risks were anticipated from participation in the intervention, some risk may have been present due to random characteristics arising from the sample. Given the intervention involved physical activities and training there was a minor risk of participant injury. However, it should be noted that previous research has found that martial

arts training is low risk compared to other sports and that most martial arts injuries are minor (Woodward, 2009).

Risks were minimised and managed as follows:

- (1) Psychological – risks were managed through observation of participants during the intervention, and caregivers and teaching staff were requested to monitor participants in other locations. Participants were given information regarding how to access support services including the school counsellor and other relevant school staff, and psychological services such as Headspace and telephone/online support services (e.g., Kids Helpline); and,
- (2) Physical – the NSW DoE (n.d.) *Sport Safety Guidelines* for martial arts was consulted regarding minimising risk. The intervention included specific recommended safety strategies to minimise risk including no physical contact or contact sparring, appropriate stretching, progressive skill development, and ensuring ice and first aid kits were available.

3.6 Instrument and outcome measures

The following section lists the standardised scales that were considered for use by the study, followed by a detailed description of the scales selected for use. Principles informing selection included: (a) that the scales reported on relevant constructs (i.e., resilience, self-efficacy, mental health difficulties); (b) balancing maximising data collection against the least number of scale items to minimise respondent fatigue and respondent bias; (c) that the scales were standardised and normed for children and adolescents; and (d) availability of independent reports regarding acceptable reliability and validity data. The outcomes examined in the study were measured using Likert scale questionnaires. A Likert scale provides statements to which participants indicate degrees of agreement or disagreement (Bordens & Abbott, 2008).

The study used standardised tests as this increased the validity and reliability of data as such instruments have been developed and normed using larger samples and have been piloted

to ensure test items measure what is intended (Cohen & Swerdlik, 2005). Further, using surveys reduces the potential for experimenter bias and expectancy effects, which may be more apparent when using interview or qualitative methods (Bordens & Abbott, 2008).

3.6.1 *Study instrument: Descriptive items*

Age, school grade, gender, and spoken language were self-reported from demographic information on the questionnaire's cover page.

3.6.2 *Measures of resilience, self-efficacy, and mental health difficulties*

Table 3.3 lists instruments measuring resilience, self-efficacy, and mental health difficulties that were considered for use in the study. As well as providing an overall (total) summary for resilience, self-efficacy, and mental health difficulties, the study considered that it was important to examine several aspects of these constructs. For resilience these were achievement, competence, social-skills, family relationships, and broader environmental influences (Prince-Embury, 2006; VicHealth, 2015). For self-efficacy these were emotional, mastery, and social characteristics (Usher & Pajares, 2006), especially within a school-based context. For mental health difficulties these were behavioural, mood, and peer deficits, which broadly represents many mental health issues (APA, 2013).

3.6.3 *Study instrument: Outcome measures included in the study*

Instruments selected for inclusion in the study were the Child and Youth Resilience Measure (CYRM) (Ungar & Liebenberg, 2011), Self-Efficacy Questionnaire for Children (SEQC) (Muris, 2001), and Strengths and Difficulties Questionnaire (SDQ) (Goodman, 2005).

Table 3.3. *Measures of resilience, self-efficacy, and mental health difficulties*

Instrument (Author)	Construct	No. Items	No. Factors	Adolescent Age Normed	Validity	Reliability
Academic Resilience Scale (Cassidy, 2016)	Resilience	30	3	No	Yes	Yes
Achenbach System of Empirically Based Assessment (Achenbach, 2009)	Mental health	113	11	Yes	Yes	Yes
Brief Resilience Scale (Smith et al., 2008)	Resilience	6	1	No	Yes	Yes
Conners-3 (Conners et al., 2008)	Mental health	108	11	Yes	Yes	Yes
Children's Self-Efficacy Scale (Bandura, 2006)	Self-efficacy	56	8	Yes	Yes	Yes
Child and Youth Resilience Measure (Ungar & Liebenberg, 2011)	Resilience	28	4	Yes	Yes	Yes

General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995)	Self-efficacy	10	1	Yes	Yes	Yes
General Self-Efficacy Scale (Romppel et al., 2013)	Self-efficacy	6	1	Yes	Yes	Yes
Kessler Psychological Distress Scale (Kessler et al., 2003)	Mental health	10	1	Yes	Yes	Yes
New General Self-Efficacy Scale (Chen et al., 2001)	Self-efficacy	8	1	No	Yes	Yes
Resilience Scale for Adults (Friborg et al., 2003)	Resilience	33	6	No	Yes	Yes
Resilience Scale for Children and Adolescents (Prince-Embury, 2007)	Resilience	64	4	Yes	Yes	Yes
Strengths and Difficulties Questionnaire (Goodman, 2005)	Mental health	25	5	Yes	Yes	Yes
Self-Efficacy Questionnaire for Children (Muris, 2001).	Self-efficacy	28	4	Yes	Yes	Yes

3.6.3.1 Child and Youth Resilience Measure (Ungar & Liebenberg, 2011). The CYRM is a 28-item instrument that measures various aspects of children's and adolescents' resilience. The scale measures total resilience and three sub-scales: individual capacities and resources, relationships with primary caregivers, and contextual factors. The individual capacities and resources sub-scale has 11 items, the relationships with primary caregiver sub-scale has seven items, and the contextual factors sub-scale has 10 items. The sub-scales are added to compute the total resilience scale. The CYRM was used in the study as it efficiently operationalised the theoretical aspects of resilience in a valid and reliable manner. While there are other valid measures of resilience, they are either significantly longer (e.g., Resilience Scale for Children and Adolescents, Prince-Embury, 2007) which has the potential to impact response bias, or significantly shorter (e.g., Brief Resilience Scale, Smith et al., 2008) and does not provide more nuanced information about resilience. Validation of the CYRM has been performed across multiple countries and the instrument has been normed on an English-speaking sample of 408 adolescents with an age range of 11 to 19 years (Jefferies et al., 2019). The self-report version of the CYRM was used which has satisfactory internal consistency⁵ ($\alpha = .66$ to $.81$) (Sanders et al., 2017) and good construct validity. Items are scored on a 5-point Likert scale with 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = a lot. Examples of CYRM items include: (1) I have people I look up to; and (2) I feel supported by my friends. See Appendix D for a complete copy of the CYRM.

3.6.3.2 Self-Efficacy Questionnaire for Children (Muris, 2001). The SEQC is a 24-item instrument that measures various aspects of children's and adolescents' self-efficacy. The

⁵ While an acceptable size regarding Cronbach's alpha is debated by statisticians (DeVellis, 2003), an alpha of .65 to .80 is often considered to be satisfactory in the social-sciences (Vaske, 2008).

questionnaire measures total self-efficacy and three sub-scales: academic self-efficacy, social self-efficacy, and emotional self-efficacy. Each sub-scale comprises eight items that are added to compute the total self-efficacy scale. Self-efficacy can be operationalised across many domains and there are various measures of the construct. The SEQC was used in the study as it effectively operationalises self-efficacy for adolescents in an educationally relevant context. Validation of the SEQC has been performed across multiple countries and the instrument has been normed on an English-speaking sample of 697 adolescents with a mean age of 14.79 years ($SD = 1.82$, Suldo & Shaffer, 2007). The SEQC scales have satisfactory internal consistency ($\alpha > 0.70$) (Minter & Pritzker, 2015). Items are scored on a 5-point Likert scale with 0 = not at all, 1 = a little, 2 = somewhat, 3 = quite a bit, and 4 = very well. Examples of SEQC items includes: (1) How well can you become friends with other children?; and (2) How well can you control your feelings?. See Appendix D for a complete copy of the SEQC.

3.6.3.3 Strengths and Difficulties Questionnaire (Goodman, 2005). The SDQ is a 25-item instrument that measures various aspects of children's and adolescents' behaviour. The questionnaire measures total difficulties and five sub-scales: emotional difficulties, conduct difficulties, hyperactivity difficulties, peer difficulties, and pro-social behaviour. Each sub-scale comprises five items and the four difficulty scales (i.e., emotional, conduct, hyperactivity and peer difficulties) were added to compute the total difficulties scale. The SDQ is a psychometric screening tool commonly used in clinical settings by psychologists and is currently on the examination list of recommended psychometric tools for the Australian Psychology registration exam (Psychology Board of Australia, 2019). Validation of the SDQ has been performed across multiple countries including Australia, where the instrument was normed on a random sample consisting of 910 youth aged 7-17 years (Mellor, 2005). The English language self-report version of the scale was used which has satisfactory internal

consistency ($\alpha = 0.76$) (Muris et al., 2004) and good convergent validity. Items are scored on a 3-point Likert scale with 0 = not true, 1 = somewhat true, and 2 = certainly true. Examples of SDQ items include: (1) I have one good friend or more; and (2) I am kind to younger children. See Appendix D for a complete copy of the SDQ.

3.7 Data collection

Data were collected at three points during the study period: baseline (pre-intervention), post-intervention, and 12-week follow-up. During data collection participants were withdrawn from regular classes in small groups (baseline), or the groups in which they completed the program (post-intervention and follow-up). This enabled the researchers to explain, monitor, and provide assistance while participants completed the survey. Participants were reminded that the assessment was confidential and that they could discontinue the assessment at any point. Instructions given to participants included: (a) an explanation of rating scales; and (b) how to make corrections if necessary. Surveys were then given to participants. Upon completion, the surveys were placed into a locked box to ensure confidentiality.

3.8 Data analysis

Statistical analysis of the study's outcome measures was conducted using Statistical Package for the Social Sciences version 25 (IBM SPSS Statistics, 2017). The data were examined regarding its reliability and validity, summarised using descriptive statistics, and then analysed and interpreted using inferential statistics. Items to be included in the scale variables were added and computed to create composite scores for baseline, post-intervention, and follow-up data.

3.8.1 *Validation and reliability*

While rudimentary, the validity and reliability of scientific research are important criteria for evaluating research quality (Bryman, 2016; Creswell, 2009) and determining the generality of findings (Bordens & Abbott, 2008). Validity refers to judgements about how well the observations and findings used in research measure what is intended (Cohen & Swerdlik, 2005; Davies & Hughes, 2014) and is important for determining whether the inferences and actions arising from results are appropriate. Reliability refers to whether the results observed in a study are repeatable (Bryman, 2016) and is concerned with the dependability and consistency of a given measure across situations (Bordens & Abbott, 2008).

The collected psychometric test data were consolidated into sub-scale variables using factor analysis which provided an indication of the content validity of the study's sub-scale variables. Factor analysis is a statistical technique that examines large numbers of scale items to determine whether there is a tendency for groups of scale items to be interrelated (Bryman, 2016), and can be conducted using exploratory or confirmatory techniques. Exploratory factor analysis is often used to determine how scale items cluster together and helps simplify a large set of variables, whereas confirmatory factor analysis is used to determine how variables might relate to an underlying process (Tabachnick & Fidell, 2001). Exploratory factor analysis was used to simplify scale items for the study.

Psychometric scales comprise multiple items as this enables assessment of internal consistency. According to Robinson (2017), a minimum of three to four scale items are needed to assess internal consistency and will reliably yield convergent solutions in factor analysis. The reliability of the variables determined from factor analysis were evaluated by considering Cronbach's alpha. Cronbach's alpha is the most commonly used (Field, 2013) and preferred measure of internal consistency (Cohen & Swerdlik, 2005). Conceptually, Cronbach's alpha

refers to the mean of all possible split-half correlations (Cohen & Swerdlik, 2005) and is equivalent to examining every permutation of paired scale items (Field, 2013).

Pearson's correlations were used to examine relationships among the study's measures and sub-scales, providing an indication of convergent and discriminant validity. Correlations are a commonly used technique for demonstrating instrument validity (Gravetter & Wallnau, 2007). The outcomes of the CYRM and SEQC were evaluated for convergent validity using Pearson's correlations as these instruments measure the strengths-based variables of resilience and self-efficacy which are conceptually related. The outcomes of the CYRM and SEQC were also compared with the SDQ and evaluated for discriminant validity using Pearson's correlations as these instruments measure contrasting mental health strength and deficit concepts.

3.8.2 Hypothesis testing and Type 1 and Type 2 errors

While theory and research questions provide a general direction for a study, hypotheses state specific predictions about phenomena that can be tested (Field, 2013). Hypothesis testing states two opposing hypotheses: the null hypothesis and alternate hypothesis (Gravetter & Wallnau, 2007). The null hypothesis (H_0) predicts that an independent variable will not affect a dependent variable, while the alternate hypothesis (H_1) predicts that an independent variable will affect a dependent variable (Field, 2013). Consistent with the view that it is more practical to demonstrate that a hypothesis is false (Gravetter & Wallnau, 2007), this study's hypotheses are evaluated in terms of the null hypothesis (H_0).

As hypothesis testing is an inferential process using limited information to reach a general conclusion (Gravetter & Wallnau, 2007), decisions regarding hypothesis testing can be incorrect. These are referred to as Type 1 and Type 2 errors. A Type 1 error occurs when a null hypothesis is rejected when it was true, and a Type 2 error occurs when a null hypothesis is not

rejected that was actually false (Bordens & Abbott, 2008). The consequences of a Type 1 error are generally considered more serious than a Type 2 error (Gravetter & Wallnau, 2007).

This study used criterion alpha (α -level) to address the probability of committing a Type 1 error (Gravetter & Wallnau, 2007). Criterion alpha is a specific form of statistical significance, which by convention is usually set at $\alpha < .05$, which means there is a 5% chance that sampling error could have produced the observed effect (Bordens & Abbott, 2008). While it is impossible to determine the exact probability of a Type 2 error (Gravetter & Wallnau, 2007), it is suggested that the maximum acceptable probability of a Type 2 error is .2 which is referred to as criterion beta (β -level) (Field, 2013).

3.8.3 *Descriptive and inferential statistics*

Measures of central tendency were calculated to provide descriptive summaries of the sample's (experimental and control) responses to the outcome measures at baseline, post-intervention, and follow-up time points. Data obtained from the outcome measures used Likert scales which were treated as continuous variables. Mean (M) values and standard deviations (SD) were calculated and reported as these are commonly used metrics in scientific research (Cohen & Swerdlik, 2005; Field, 2013). Additionally, mean differences were calculated and reported regarding inferential statistics analysing variance between and within groups. Given that no single statistic is sufficient to establish scientific validity (Tong, 2019), this approach was taken to facilitate additional interpretation of statistical data.

Univariate analysis of variance (ANOVA) was used to examine differences between dependent variables when comparing the experimental and control conditions at baseline and post-intervention (i.e., between-groups design), while repeated measures ANOVA was used to examine differences in dependent variables for the experimental group at baseline, post-intervention and follow-up (i.e., within-subjects design). Analysis of variance is “the statistical

test of choice” when an experiment includes more than two sample means (Bordens & Abbott, 2008, p. 428). As noted by Bathke et al. (2018), this analysis could occur as separate univariate ANOVAs or as a multivariate ANOVA, with either being a “good strategy” (p. 348). Analyses in this study were performed as separate univariate ANOVAs. The *F*-ratio is used in analysis of variance as a measure of the ratio of explained variation and variation explained by unsystematic factors (Field, 2013) and is used to determine the significance of results (Bordens & Abbott, 2008).

Regression is a statistical technique used to find the best fitting straight line or model for a set of data (Gravetter & Wallnau, 2007). Regression is closely related to correlational techniques which determine the direction and degree of a relationship; however, regression analysis provides more detailed exploration of the relationship among variables and facilitates the prediction of variable values (Bordens & Abbott, 2008). The *F*-ratio is used in regression analysis as a measure of variation (similar to ANOVA), while R^2 indicates how much variance is explained by the regression model (Field, 2013). Regression was used in the study to provide a more detailed analysis of the relationship between the demographic characteristics of the sample and the study’s outcome variables.

The chi-square test is a non-parametric statistic that uses sample data to examine hypotheses about the proportion of population distribution and determines whether sample proportions fit population proportions (Gravetter & Wallnau, 2007). The chi-square test generally uses Pearson’s chi-square test of independence which examines whether two categorical variables are associated (Field, 2013). Chi-square was used in the study to examine demographic differences regarding participants’ post-program martial arts participation.

3.8.4 *Evaluation and interpretation of results*

According to Betensky (2019), the context of a study's research design and intended application should be considered instead of interpreting a study's results in isolation. Rather than analysing single statistics to establish scientific validity (Tong, 2019), data from this study was analysed and interpreted: (1) using a battery of tools including statistical significance, effect size, and mean differences; and (2) considering the validity and reliability of these results. These interpretations were underpinned by the context of the research design and its application.

The study followed social science convention and reported statistical significance and effect size, while noting that analysis based on standardised thresholds of interpretation may be problematic (Field, 2013; Pogrow, 2019; Wasserstein et al., 2019). Statistical significance (p -value) refers to whether observed differences between samples are probably reliable rather than resulting from chance (Bordens & Abbott, 2008). In the social sciences convention holds that differences are significant at a minimum of $p < .05$, or less than a 5% possibility that an observed difference is due to chance (Field, 2013). Significance values of $p < .01$ and $p < .001$ are also commonly used thresholds. The specific p -value chosen is an arbitrary decision, and nothing about the process guarantees correct decisions (Bruce & Bruce, 2017). According to Bordens and Abbott (2008), a lower p value allows greater confidence in decisions about results, but does not mean that the result is any more reliable.

While examination of statistical significance offers a starting point for evaluating data, the following caveats should be considered regarding p -values. First, conclusions should not be based solely on significance levels (Wasserstein et al., 2019). Whether a finding is or is not statistically significant does not mean an association or effect does or does not exist (Wasserstein et al., 2019). Second, statistical significance does not mean a finding has scientific, clinical or practical importance. This confusion typically arises from the common

meaning of the term *significance* (Bordens & Abbott, 2008) and it is important to note that small and unimportant effects can be statistically significant while large and important effects may not (Field, 2013). A related consideration is the limitation imposed by the arbitrary use of significance thresholds. While $p = .049$ and $p = .051$ may not be “categorically different”, the former is statistically significant while the latter is not (Wasserstein et al., 2019, p. 1).

Effect sizes are an objective and typically standardised measure of the size of an effect (Field, 2013). Commonly used effect size values include Cohen’s d , Hedge’s g , Pearson’s r , and Eta squared η^2 (or partial Eta squared η_p^2). While the use and reporting of effect sizes has become a standard in the social sciences, relying on effect size to determine the effectiveness and practical significance of interventions may be as misleading as using p -values (Pogrow, 2019). This is especially evident when using thresholds to evaluate effect sizes. According to Funder and Ozer (2019) this approach is “nonsensical but widely used” (p. 157) in the social sciences (e.g., Richardson, 2011). Thresholds of effect size interpretation are based on Cohen’s categories of *small* ($d = 0.2$), *medium* ($d = 0.5$) and *large* ($d = 0.8$) (Pogrow, 2019). However, these terms are arguably meaningless without a frame of reference (Funder & Ozer, 2019). While the minimum threshold for effect size to claim practical significance is typically set at $d = 0.2$ (Pogrow, 2019), smaller effect sizes are more likely to be realistic while large effect sizes may overestimate the actual effect found in a large sample (Funder & Ozer, 2019). As noted by Prentice and Miller (1992), small effects can yield large impacts in universal school-based mental health interventions and produce meaningful improvements at the population level (Werner-Siedler et al., 2017).

This study has used a potentially more meaningful approach by considering the practical significance of findings by interpreting data meaningfully in context (Funder & Ozer, 2019). Rather than relying on the potentially arbitrary values of statistical significance and effect sizes based on threshold interpretation, the study compared observed effect sizes and

mean differences to the context of previous research. This facilitates meaningful interpretation of statistical information through analysis of actual differences in the data (Pogrow, 2019). Following Tong's (2019) assertion that no single statistic is sufficient to establish scientific validity, this study used a battery of tools; including statistical significance, effect size, and mean differences; considered with the context of previous research for making inferential judgements about research findings. This presents a strong basis for evaluating research outcomes.

3.9 Summary

This chapter described the methods underpinning the study. Theoretically, the research is grounded from the positivist perspective that social phenomenon can be examined using natural science methods, which was operationalised in the study through a quantitative and experimental research design. Sampling and recruitment procedures were described to provide information about the generalisability of the study's results. The intervention program evaluated by the study was described in detail to facilitate replication of the research. Information regarding outcome measures and data collection was then provided. The chapter concluded with a description and rationale of the data analysis used in the research including validity and reliability, descriptive and inferential statistics, and interpretation of results.

CHAPTER 4

RESULTS

4.1 Overview

The results described in this chapter address the study's research questions and hypotheses. The chapter is structured in three parts reporting the study's: (1) sample characteristics; (2) instrument validity and reliability; and (3) descriptive and inferential statistics for the study's outcome measures. Research question one investigated how participation in the 10-week martial arts-based intervention affected adolescents' resilience at post-intervention and follow-up. Post-intervention outcomes were examined using univariate ANOVA and follow-up outcomes were examined using repeated measures ANOVA. Research questions two and three considered how participation in the 10-week martial arts-based intervention affected adolescents' self-efficacy and mental health difficulties respectively at post-intervention and follow-up. Both research questions were examined using univariate ANOVA and repeated measures ANOVA as per research question one. Research question four considered the effect of demographic co-variables on the intervention outcomes and was investigated using regression analysis. Research question five examined whether the intervention program engaged participants and used chi-square analysis to consider demographic differences.

4.2 Sample characteristics

During the recruitment phase of the study, invitations were sent to 72 NSW Government and Catholic secondary schools. This sampling frame was based on all the NSW Government and Catholic secondary schools in a particular school district in an urban region of NSW. The

school response rate⁶ to this invitation was 49%. Systematic sampling of the 35 secondary school that self-selected to participate in the study was then conducted, based on every 6th school on the list. The first five schools that were subsequently invited agreed to participate in the study. However, in the instance of a school declining to participate the next school arising from systematic sampling would have been selected.

Participants were recruited from schools with low ($n = 1$; ICSEA percentile = 11%), middle ($n = 3$; ICSEA percentile = 62%⁷) and high ($n = 1$; ICSEA percentile = 81%) SES, based on school ICSEA indices (ACARA, 2018). All students aged between 12-14 years in grades 7 and 8 ($N = 1341$) at participating schools ($n = 5$) were invited to participate in the study. Concurrent martial arts training was an exclusion criterion for participation in the study, however prior experience of martial arts training was not an exclusion criterion. Thirteen ($n = 13$) students were excluded from recruitment due to this criterion.

The participant response rate during recruitment was 21%. Two-hundred and eighty-three ($N = 283$) participants were recruited and completed the baseline assessment. The mean age of participants at baseline was 12.76 ($SD = .68$). Two-hundred and forty-three ($N = 243$) participants completed the intervention program (experimental group: $n = 125$, control group: $n = 118$), which indicates the study had a drop-out rate of 14% at follow up assessment. The mean age of participants completing the program was 12.62 ($SD = .65$). Gender, age, grade, and language characteristics were self-reported by participants when completing demographic items on the study measures. Three ($n = 3$) participants reported “other” for gender at follow-up. Given this comprised 1% of the sample, this aspect of gender was excluded from analysis. Socio-educational status was based on indices reported by ACARA (2018). Figure 4.1 provides

⁶ Response rates were calculated based on the numerator being the number of schools or students consenting to participate and the denominator being the total number invited.

⁷ Average ICSEA value for the three middle SES schools included in the study.

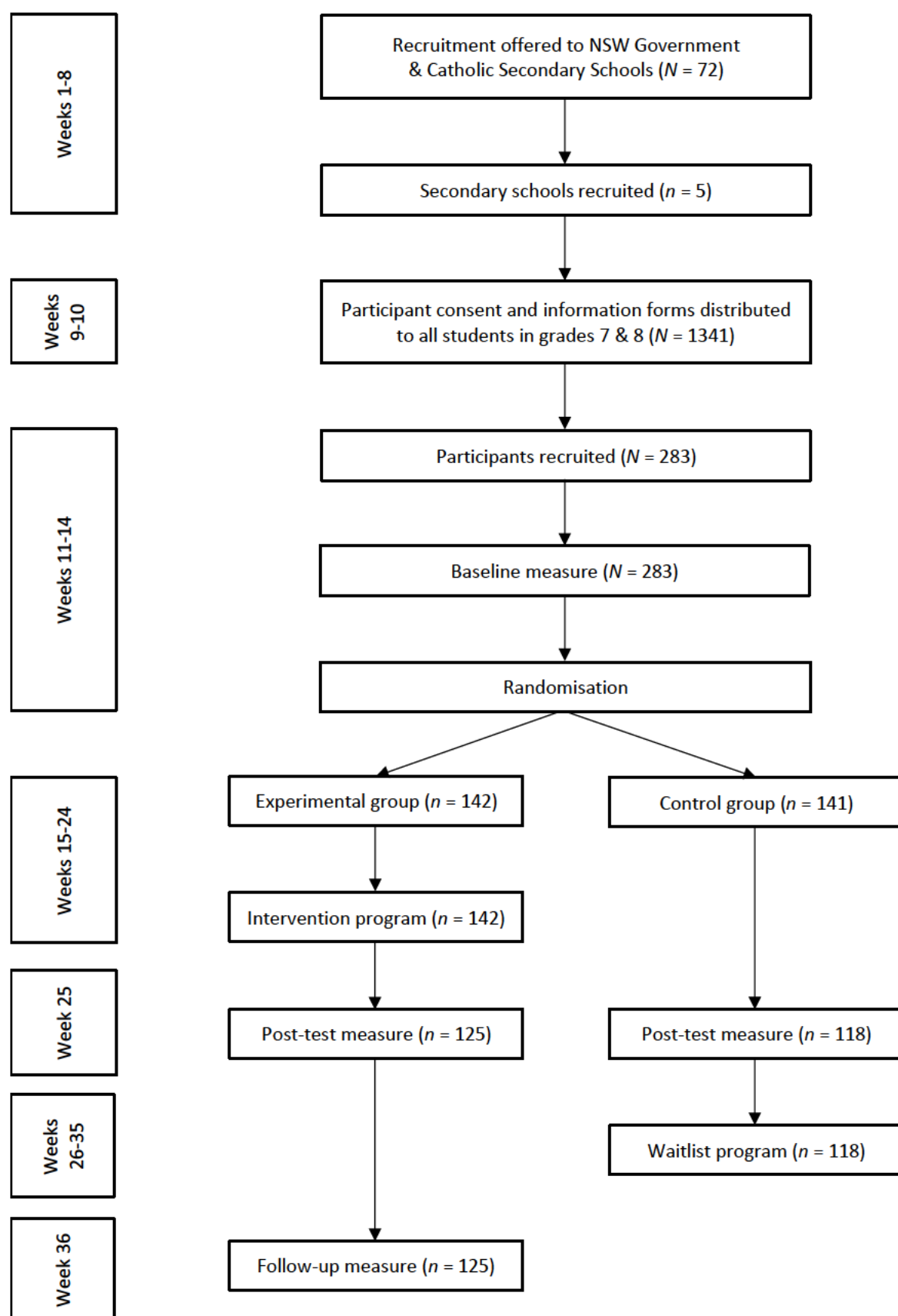


Figure 4.1. Flowchart of study

a flow chart of the study and Table 4.1 provides demographic information for participants at baseline and follow-up time-points.

Table 4.1. *Demographic characteristics of sample at baseline and follow-up*

Characteristic		Baseline		Follow-up	
		<i>N</i> = 283		<i>N</i> = 243	
		<i>n</i>	(%)	<i>n</i>	(%)
Gender	Female	143	(50.5)	125	(51.4)
	Male	136	(48.0)	115	(47.3)
	Other	4	(1.5)	3	(1.3)
Age	12	111	(39.2)	107	(44.0)
	13	133	(46.9)	115	(47.3)
	14	39	(13.8)	21	(8.7)
Grade	7	192	(67.8)	161	(66.3)
	8	91	(32.2)	82	(33.7)
Language	English	251	(88.7)	224	(92.1)
	CALD	32	(11.3)	19	(7.9)
SES ^a	Higher	155	(54.8)	131	(53.9)
	Lower	128	(45.2)	112	(46.1)

Note. *N* = total number of participants in sample. *n* = number of participants. SES = socio-educational status. CALD = culturally and linguistically diverse.

^aHigher and lower SES was determined by a natural break in the ICSEA data to maintain as close as possible to an even division.

4.3 Scale validity and reliability data

The validity and reliability of the CYRM (Ungar & Liebenberg, 2011), SEQC (Muris, 2001) and SDQ (Goodman, 2005) were assessed using a variety of statistical measures including factor analysis which assessed the study's content validity, Cronbach's alpha which assessed the study's internal consistency, and Pearson's correlation which assessed the study's convergent and discriminant validity.

4.3.1 *Content validity and internal consistency of the study scales*

Exploratory factor analysis was used to examine whether individual scale items validly represented the overall constructs (i.e., resilience, self-efficacy, and mental health difficulties) and sub-level constructs in the scales. The initial extraction method used principal component analysis and a Varimax (orthogonal) rotation was applied to the pattern matrix. A scree plot was used to determine the number of factors. Varimax rotation separates the variables as much as possible, which minimises cross-loadings and to makes sense of the data. Non-orthogonal rotation was also used; however this process did not improve the outcome. According to Field (2013), this is an appropriate method for conducting a factor analysis. Following this, Cronbach's alpha was used to determine whether the revised scales arising from factor analysis were consistent at an inter-item level. Baseline, post-intervention, and follow-up levels of internal consistency for the CYRM, SEQC, and SDQ are reported in Table 4.2.

The CYRM converged in three factors during factor analysis. For the individual capacities and resources sub-scale 12 factors converged across baseline, post-intervention, and follow-up measures. Two items (items 8 and 25⁸) did not converge during factor analysis and were discarded from the sub-scale, while three additional items (items 16, 19, and 28)

⁸ See Appendix D for detail of scale items.

Table 4.2. *Internal consistency for CYRM, SEQC, and SDQ across baseline, post-intervention, and follow-up time points*

Instrument	Sub-scale	Alpha α (No. items)		
		Baseline	Post-intervention	Follow-up
CYRM	Individual	.83 (12)	.87 (12)	.85 (12)
	Relation	.80 (6)	.81 (6)	.75 (6)
	Context	.73 (6)	.74 (6)	.73 (6)
	Total resilience	.89 (28)	.91 (28)	.89 (28)
SEQC	Academic	.84 (7)	.84 (7)	.84 (7)
	Social	.76 (7)	.81 (7)	.80 (7)
	Emotional	.81 (7)	.85 (7)	.84 (7)
	Total self-efficacy	.89 (24)	.91 (24)	.90 (24)
SDQ	Emotion	.72 (5)	.73 (5)	.72 (5)
	Behaviour	.82 (9)	.82 (9)	.81 (9)
	Prosocial	.63 (5)	.54 (5)	.68 (5)
	Total difficulties	.72 (25)	.76 (25)	.74 (25)

Note. CYRM = Child and Youth Resilience Measure. SEQC = Self-Efficacy Questionnaire for Children. SDQ = Strengths and Difficulties Questionnaire.

converged during factor analysis and were included in the sub-scale. The internal consistency for the revised individual capacities and resources sub-scale was satisfactory across time-points ($\alpha = .83, .87, .85$ respectively). For the relationship with primary caregiver sub-scale item 26 did not converge across baseline, post-intervention, and follow-up measures and was discarded from the sub-scale. Following this, the internal consistency for the revised sub-scale was satisfactory across time-points ($\alpha = .80, .81, .75$ respectively). Multiple items did not converge across time-points for the contextual factors sub-scale (items 1, 3, 16, 19, and 28) and were discarded from the sub-scale. Additionally, item 26 converged during factor analysis and was included in the sub-scale. The internal consistency for the revised contextual factors sub-scale was satisfactory across time-points ($\alpha = .73, .74, .73$ respectively). Internal consistency for the CYRM total resilience scale was satisfactory across baseline, post-intervention, and follow-up measures ($\alpha = .89, .91, .89$ respectively).

The SEQC converged in three factors during factor analysis. For the academic self-efficacy sub-scale, item 1 did not converge across baseline, post-intervention, and follow-up measures and was discarded from the sub-scale. The internal consistency for the revised sub-scale was satisfactory across time-points ($\alpha = .84, .84, .84$ respectively). Two items (items 8 and 23) did not converge across time-points for the social self-efficacy sub-scale and were discarded from the scale, while an additional item (item 18) converged and was included. The internal consistency for the revised social self-efficacy sub-scale was satisfactory across time-points ($\alpha = .76, .81, .80$ respectively). For the emotional self-efficacy sub-scale, item 18 did not converge across time-points and was discarded from the sub-scale. The internal consistency for the revised sub-scale was satisfactory across time-points ($\alpha = .81, .85, .84$ respectively). Internal consistency for the SEQC total self-efficacy scale was satisfactory across baseline, post-intervention, and follow-up measures ($\alpha = .89, .91, .90$ respectively).

The SDQ converged in four factors during factor analysis (the conduct and hyperactivity sub-scales converged in one factor which was renamed behaviour difficulties – this term was used to clearly distinguish from other SDQ sub-scales). All items converged for the emotional difficulties sub-scale across baseline, post-intervention, and follow-up measures. The internal consistency for emotional difficulties was satisfactory across time-points ($\alpha = .72, .73, .72$ respectively). For the behaviour difficulties sub-scale item 22 did not converge across baseline, post-intervention, and follow-up measures and was discarded from the study. Following this, the internal consistency for the revised behaviour difficulties sub-scale was satisfactory across time-points ($\alpha = .82, .82, .81$ respectively). Multiple items did not converge across time-points for the peer problems sub-scale (items 6, 11, 14, and 19) and were discarded from the study. As only one item converged for peer difficulties, the sub-scale was deemed problematic and discarded from the study. All items converged for the prosocial behaviour sub-scale across time-points. However, internal consistency for prosocial behaviour was not satisfactory ($\alpha = .63, .54, .68$ respectively) and the sub-scale was discarded from the study. Internal consistency for the SDQ total problems scale was satisfactory across baseline, post-intervention, and follow-up measures ($\alpha = .72, .76, .74$ respectively).

4.3.2 *Convergent and discriminant validity of study scales*

Pearson's correlation provided a measure of the relationship between the variables of each scale, which can be used to examine the convergent and discriminant validity of the study's scales. Table 4.3 reports baseline Pearson's correlations, Table 4.4 reports post-intervention Pearson's correlations, and Table 4.5 reports follow-up Pearson's correlations.

Convergent validity was examined by correlating the relationship between separate strengths-based mental health scales (CYRM & SEQC). These were positively correlated

Table 4.3. *Relationship of strengths-based and deficit-based mental health factors: Baseline Pearson's correlations*

	SDQ	SDQ	CYRM	CYRM	CYRM	CYRM	SEQC	SEQC	SEQC	SEQC
	Behaviour	Total	Individual	Relation	Context	Total	Academic	Social	Emotional	Total
SDQ Emotion	.25***	.70***	-.24***	-.07	.06	-.14*	-.23***	-.28***	-.54***	-.45***
SDQ Behaviour		.78***	-.43***	-.30***	-.25***	-.46***	-.64***	-.28***	-.32***	-.52***
SDQ Total			-.40***	-.21**	-.08	-.33***	-.48***	-.35***	-.44***	-.54***
CYRM Individual				.51***	.39***	.87***	.46***	.73***	.55***	.75***
CYRM Relation					.39***	.75***	.37***	.36***	.26***	.42***
CYRM Context						.71***	.33***	.28***	.19**	.34***
CYRM Total							.54***	.62***	.46***	.69***
SEQC Academic								.33***	.41***	.73***
SEQC Social									.56***	.79***
SEQC Emotional										.83***

Note. CYRM = Child and Youth Resilience Measure. SEQC = Self-Efficacy Questionnaire for Children. SDQ = Strengths and Difficulties Questionnaire.

* $p < .05$. ** $p < .01$. *** $p < .001$ (2-tailed).

Table 4.4. *Relationship of strengths-based and deficit-based mental health factors: Post-intervention Pearson's correlations*

	SDQ	SDQ	CYRM	CYRM	CYRM	CYRM	SEQC	SEQC	SEQC	SEQC
	Behaviour	Total	Individual	Relation	Context	Total	Academic	Social	Emotional	Total
SDQ Emotion	.32***	.73***	-.30***	-.15*	-.12	-.25***	-.25***	-.28***	-.46***	-.38***
SDQ Behaviour		.79***	-.22***	-.08	-.08	-.18**	-.47***	-.08	-.17**	-.29***
SDQ Total			-.28***	-.12	-.08	-.21**	-.37***	-.17**	-.26***	-.31***
CYRM Individual				.59***	.39***	.89***	.47***	.65***	.48***	.66***
CYRM Relation					.41***	.79***	.40***	.51***	.32***	.51***
CYRM Context						.68***	.39***	.35***	.39***	.46***
CYRM Total							.55***	.65***	.50***	.70***
SEQC Academic								.48***	.45***	.77***
SEQC Social									.61***	.85***
SEQC Emotional										.83***

Note. CYRM = Child and Youth Resilience Measure. SEQC = Self-Efficacy Questionnaire for Children. SDQ = Strengths and Difficulties Questionnaire.

* $p < .05$. ** $p < .01$. *** $p < .001$ (2-tailed).

Table 4.5. *Relationship of strengths-based and deficit-based mental health factors: Follow-up Pearson's correlations*

	SDQ	SDQ	CYRM	CYRM	CYRM	CYRM	SEQC	SEQC	SEQC	SEQC
	Behaviour	Total	Individual	Relation	Context	Total	Academic	Social	Emotional	Total
SDQ Emotion	.35***	.72***	-.32***	-.15*	-.10	-.26***	-.20**	-.27***	-.47***	-.39***
SDQ Behaviour		.80***	-.40***	-.25***	-.23***	-.39***	-.58***	-.24***	-.28***	-.45***
SDQ Total			-.41***	-.23***	-.15*	-.36***	-.43***	-.33***	-.38***	-.46***
CYRM Individual				.57***	.39***	.88***	.41***	.62***	.43***	.62***
CYRM Relation					.36***	.76***	.34***	.47***	.25***	.45***
CYRM Context						.70***	.33***	.33***	.33***	.41***
CYRM Total							.48***	.60***	.43***	.64***
SEQC Academic								.39***	.46***	.76***
SEQC Social									.53***	.79***
SEQC Emotional										.84***

Note. CYRM = Child and Youth Resilience Measure. SEQC = Self-Efficacy Questionnaire for Children. SDQ = Strengths and Difficulties Questionnaire.

* $p < .05$. ** $p < .01$. *** $p < .001$ (2-tailed).

across baseline, post-intervention, and follow-up measurement conditions. The strongest positive correlations were observed for the: (a) CYRM individual capacities sub-scale and SEQC social self-efficacy sub-scale (baseline: $r = .73$, post-intervention: $r = .65$, follow-up: $r = .62$.); (b) CYRM individual capacities sub-scale and SEQC total self-efficacy sub-scale (baseline: $r = .75$, post-intervention: $r = .66$, follow-up: $r = .62$.); (c) CYRM total sub-scale and SEQC social self-efficacy sub-scale (baseline: $r = .62$, post-intervention: $r = .65$, follow-up: $r = .60$.); and (d) CYRM total sub-scale and SEQC total self-efficacy sub-scale (baseline: $r = .69$, post-intervention: $r = .70$, follow-up: $r = .64$.).

Discriminant validity was examined by correlating the relationship between the strengths-based mental health scales (CYRM & SEQC) and deficit-based mental health scale (SDQ). Strengths-based mental health factors were negatively correlated with deficit-based mental health factors across baseline, post-intervention, and follow-up measurement conditions. The negative relationship between the SEQC academic self-efficacy sub-scale and SDQ behaviour problems sub-scale was consistently the strongest negative correlation across measurement conditions (baseline: $r = -.64$, post-intervention: $r = -.47$, follow-up: $r = -.58$.).

4.4 Resilience

Univariate ANOVA, repeated measures ANOVA, and regression analysis was used to examine the effects on resilience from participation in the 10-week martial arts-based intervention. Details of results include: (1) descriptive statistics (means and standard deviations); (2) inferential results and effect sizes; and (3) mean differences and confidence intervals.

4.4.1 Resilience outcomes for the experimental and control groups at baseline and post-intervention time points

Univariate ANOVA was used to compare the intervention effects on the experimental and control groups across baseline and post-intervention timepoints by examining the adjusted intervention difference. Compared to the control group, the experimental group's resilience and related sub-factors improved post-intervention. A summary of descriptive statistics for resilience factors is reported in Table 4.6.

Overall, martial arts training improved the experimental group's total resilience and the observed difference had a significant effect compared to the control group, $F(1, 238) = 37.15$, $p < .001$, $\eta_p^2 = .14$. This effect was also found for related sub-factors. Compared to the control group, the intervention condition had a significant effect on the experimental group's: (a) individual capacities and resources, $F(1, 238) = 24.89$, $p < .001$, $\eta_p^2 = .10$; (b) relationship with their primary caregiver, $F(1, 238) = 22.02$, $p < .001$, $\eta_p^2 = .09$; and (c) contextual factors, $F(1, 238) = 22.21$, $p < .001$, $\eta_p^2 = .09$.

4.4.2 Resilience outcomes for the experimental group at baseline, post-intervention, and follow-up time points

Repeated measures ANOVA was used to compare the effects for the experimental group across baseline, post-intervention, and follow-up conditions. The experimental group's resilience and related sub-factors improved at follow-up. A summary of descriptive statistics for resilience factors is reported in Table 4.7.

Total resilience: The assumption of sphericity was violated, $\chi^2(2) = 14.35$, $p < .01$; consequently, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity($\varepsilon = .91$). The results demonstrated that martial arts training had a significant effect

Table 4.6. *CYRM descriptive statistics for the experimental and control groups: (a) baseline and post-intervention time points: means and standard deviations, and (b) adjusted intervention difference: means, standard deviations, mean differences and confidence intervals comparing conditions*

Resilience scale	Condition	Baseline		Post-intervention		Adjusted intervention difference				
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Mdif</i>	<i>SE</i>	95% CI
Individual	Experimental	2.88	.65	3.04	.56	0.14	.57			
	Control	3.03	.59	2.73	.70	-0.30	.83	.38*	.08	.23, .52
Relations	Experimental	3.12	.70	3.18	.65	0.03	.76			
	Control	3.05	.73	2.73	.78	-0.32	.90	.41*	.09	.24, .59
Context	Experimental	2.50	.76	2.62	.72	0.11	.73			
	Control	2.38	.77	2.18	.71	-0.21	.73	.38*	.08	.22, .53
Total resilience	Experimental	2.89	.52	3.01	.44	0.11	.48			
	Control	2.90	.56	2.62	.61	-0.28	.72	.39*	.06	.27, .52

Note. *Mdif* = Mean difference. Significance has used Bonferroni adjustment for multiple comparisons.

* The mean difference is significant at the .05 level.

Table 4.7. *CYRM descriptive statistics for the experimental condition at baseline, post-intervention, and follow-up time point: (a) means and standard deviations; and (b) mean differences and confidence intervals comparing time points*

Resilience scale	Baseline					Post-intervention					Follow-up				
	<i>M</i>	<i>SD</i>	<i>Mdif^a</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^b</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^c</i>	<i>SE</i>	95% CI
Individual	2.88	.65				3.04	.56				3.17	.57			
			.16*	.05	.03, .29			.13	.07	-.04, .29			.28*	.07	.11, .46
Relations	3.12	.70				3.18	.65				3.24	.61			
			.06	.07	-.12, .23			.07	.08	-.13, .26			.12	.08	-.07, .31
Context	2.50	.77				2.62	.72				2.78	.74			
			.12	.07	-.04, .28			.16	.09	-.06, .39			.28*	.09	.07, .49
Total resilience	2.89	.52				3.01	.44				3.12	.48			
			.12*	.05	.01, .23			.11	.06	-.03, .25			.23*	.06	.09, .38

Note. *Mdif* = Mean difference. Confidence intervals used Bonferroni adjustment for multiple comparisons.

^aBaseline to post-intervention mean difference. ^bPost-intervention to follow-up mean difference. ^cBaseline to follow-up mean difference.

* The mean difference is significant at the .05 level.

on participants' total resilience, $F(1.83, 224.52) = 9.25, p < .001, \eta_p^2 = .07$. Contrasts revealed a significant baseline-post-intervention effect, $F(1, 123) = 7.34, p < .01, \eta_p^2 = .06$; and a significant post-intervention-follow-up effect, $F(1, 123) = 3.92, p < .05, \eta_p^2 = .03$.

Individual capacities and resources: Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 14.61, p < .01$; therefore, degrees of freedom were corrected using Hyunh-Feldt estimates of sphericity ($\varepsilon = .91$). The results demonstrated that the experimental condition had a significant effect on participants' individual capacities and resources, $F(1.82, 224.13) = 9.51, p < .001, \eta_p^2 = .07$. Contrasts found a significant baseline-post-intervention effect, $F(1, 123) = 8.53, p < .01, \eta_p^2 = .07$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = 3.56, p > .05, \eta_p^2 = .03$.

Relationship with primary caregiver: Based on Mauchly's test the assumption of sphericity was satisfied, $\chi^2(2) = 2.47, p < .05$. The results showed that the intervention program did not have a significant effect on participants' relationship with primary caregiver, $F(2, 246) = 1.21, p > .05, \eta_p^2 = .01$. Contrasts revealed a non-significant baseline-post intervention effect, $F(1, 123) = 0.59, p > .05, \eta_p^2 = .005$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = 0.65, p > .05, \eta_p^2 = .005$.

Contextual factors: The assumption of sphericity was violated, $\chi^2(2) = 16.67, p < .001$; subsequently degrees of freedom were corrected using Hyunh-Feldt estimates of sphericity ($\varepsilon = .90$). The results indicated that the experimental condition had a significant effect on participants' contextual factors, $F(1.80, 221.10) = 5.86, p < .01, \eta_p^2 = .05$. Contrasts exhibited a non-significant baseline-post-intervention effect, $F(1, 123) = 3.11, p > .05, \eta_p^2 = .03$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = 3.21, p > .05, \eta_p^2 = .03$.

4.4.3 *The effect of demographic co-variables on resilience outcomes*

Regression analysis was used to examine the effect of demographic co-variables on resilience outcomes arising from participation in the 10-week martial arts-based intervention. This was examined using post-intervention data, as valid follow-up comparisons between the intervention and control groups were not available. A pattern of regression predictors was observed across the regression models for the CYRM. In model 1, model 2 and model 3 for each regression, the intervention condition (i.e., experimental or control group) was the only significant predictor of the intervention outcome. However, in model 4 the intervention condition and either: (a) SES; or (b) language; moderated the outcome. Socio-educational status was the most frequent predictor of outcomes, improving the model fit three times.

The demographic variables gender, grade, and age did not significantly predict resilience or resilience sub-scales. However, socio-educational status significantly predicted the outcome for: (a) individual capacities and resources, $F(6, 233) = 5.31, p < .001, R^2 = .10$, adding statistically to the prediction for this sub-scale, $B = .25, p < .001$; (b) relationship with primary caregiver, $F(6, 233) = 5.65, p < .001, R^2 = .11$, adding statistically to the prediction for this sub-scale, $B = .21, p < .01$; and (c) total resilience, $F(6, 233) = 7.29, p < .001, R^2 = .14$, adding statistically to the prediction for total resilience, $B = .21, p < .01$. Additionally, language significantly predicted the outcome for contextual factors, $F(6, 233) = 4.56, p < .001, R^2 = .08$, adding statistically to the prediction for this sub-scale, $B = -.15, p < .05$. Tables E.1 to E.4 summarise the regression models for resilience and are reported in Appendix E.

4.5 Self-efficacy

The effects of participation in the 10-week martial arts-based intervention on self-efficacy was examined using univariate ANOVA, repeated measures ANOVA, and regression analysis.

Details of results include: (1) descriptive statistics (means and standard deviations); (2) inferential results and effect sizes; and (3) mean differences and confidence intervals.

4.5.1 Self-efficacy outcomes for the experimental and control groups at baseline and post-intervention time points

Compared to the control group, univariate ANOVAs examining the adjusted intervention difference found the intervention improved the experimental group's self-efficacy and related sub-factors. A summary of descriptive statistics for self-efficacy factors is reported in Table 4.8.

Overall, martial arts training improved the experimental group's total self-efficacy. Analysis of adjusted mean difference indicated the intervention improved the experimental group's self-efficacy compared to the control group, $F(1, 238) = 28.23, p < .001, \eta_p^2 = .11$. This effect was also found for related sub-factors. Compared to the control group, the intervention condition had a significant effect on the experimental group's: (a) academic self-efficacy, $F(1, 238) = 17.67, p < .001, \eta_p^2 = .07$; (b) social self-efficacy, $F(1, 238) = 17.61, p < .001, \eta_p^2 = .07$; and (c) emotional self-efficacy, $F(1, 238) = 21.93, p < .001, \eta_p^2 = .08$.

4.5.2 Self-efficacy outcomes for the experimental group at baseline, post-intervention, and follow-up time points

The intervention improved the experimental group's self-efficacy and related sub-factors. A summary of descriptive statistics for self-efficacy factors is reported in Table 4.9.

Total self-efficacy: The assumption of sphericity was violated, $\chi^2(2) = 11.77, p < .01$, consequently degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .93$). The results demonstrated that martial arts training had a significant effect on

Table 4.8. *SEQC descriptive statistics for the experimental and control groups: (a) baseline and post-intervention time points: means and standard deviations, and (b) adjusted intervention difference: means, standard deviations, mean differences and confidence intervals comparing conditions*

Self-efficacy scale	Condition	Baseline		Post-intervention		Adjusted intervention difference				
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Mdif</i>	<i>SE</i>	95% CI
Academic	Experimental	2.56	.75	2.77	.68	0.22	.80			
	Control	2.45	.78	2.40	.72	-0.07	.79	.34*	.08	.18, .50
Social	Experimental	2.60	.76	2.87	.65	0.27	.66			
	Control	2.80	.59	2.62	.69	-0.19	.77	.33*	.08	.17, .48
Emotion	Experimental	2.21	.80	2.63	.71	0.41	.88			
	Control	2.34	.73	2.26	.79	-0.09	.83	.42*	.09	.25, .60
Total self-efficacy	Experimental	2.44	.61	2.74	.52	0.30	.62			
	Control	2.54	.52	2.42	.59	-0.12	.66	.36*	.07	.23, .49

Note. *Mdif* = Mean difference. Significance has used Bonferroni adjustment for multiple comparisons.

* The mean difference is significant at the .05 level.

Table 4.9. *SEQC descriptive statistics for the experimental condition at baseline, post-intervention, and follow-up time point: (a) means and standard deviations; and (b) mean differences and confidence intervals comparing time points*

Self-efficacy scale	Baseline					Post-intervention					Follow-up				
	<i>M</i>	<i>SD</i>	<i>Mdif^a</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^b</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^c</i>	<i>SE</i>	95% CI
Academic	2.56	.75				2.77	.68				2.86	.70			
			.20*	.08	.02, .39			.10	.09	-.11, .31			.30*	.09	.07, .53
Social	2.60	.76				2.87	.65				2.92	.67			
			.27*	.06	.12, .42			.05	.08	-.15, .26			.32*	.09	.10, .55
Emotion	2.21	.80				2.63	.71				2.66	.73			
			.42*	.08	.23, .61			.03	.09	-.18, .24			.45*	.09	.22, .67
Total self-efficacy	2.44	.61				2.74	.52				2.81	.55			
			.30*	.06	.17, .44			.07	.07	-.09, .23			.37*	.07	.19, .55

Note. *Mdif* = Mean difference. Confidence intervals used Bonferroni adjustment for multiple comparisons.

^aBaseline to post-intervention mean difference. ^bPost-intervention to follow-up mean difference. ^cBaseline to follow-up mean difference.

* The mean difference is significant at the .05 level.

participants' total self-efficacy, $F(1.86, 228.52) = 18.21, p < .001, \eta_p^2 = .13$. Contrasts revealed a significant baseline-post-intervention effect, $F(1, 123) = 29.00, p < .001, \eta_p^2 = .19$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = 1.09, p > .05, \eta_p^2 = .009$.

Academic self-efficacy: Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 7.66, p < .05$; therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .96$). The results demonstrated that the experimental condition had a significant effect on participants' academic self-efficacy, $F(1.91, 235.38) = 6.39, p < .01, \eta_p^2 = .05$. Contrasts found a significant baseline-post-intervention effect, $F(1, 123) = 7.28, p = .01, \eta_p^2 = .06$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = 1.24, p > .05, \eta_p^2 = .01$.

Social self-efficacy: The assumption of sphericity was violated, $\chi^2(2) = 26.98, p < .001$; and degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .85$). The results showed that the intervention program had a significant effect on participants' social self-efficacy, $F(1.69, 207.76) = 9.33, p < .001, \eta_p^2 = .07$. Contrasts revealed a significant baseline-post-intervention effect, $F(1, 123) = 19.47, p < .001, \eta_p^2 = .14$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = .40, p > .05, \eta_p^2 = .003$.

Emotional self-efficacy: The assumption of sphericity was satisfied, $\chi^2(2) = 4.80, p > .05$. The results indicated that the experimental condition had a significant effect on participants' emotional self-efficacy, $F(2, 246) = 16.48, p < .001, \eta_p^2 = .07$. Contrasts exhibited a significant baseline-post-intervention effect, $F(1, 123) = 27.69, p < .001, \eta_p^2 = .19$; and a non-significant post-intervention-follow-up effect, $F(1, 123) = .11, p > .05, \eta_p^2 = .001$.

4.5.3 *The effect of demographic co-variables on self-efficacy outcomes*

A pattern of regression predictors was observed across the regression models for the SEQC. In model 1, model 2 and model 3 for each regression, the intervention condition (i.e., experimental or control group) was the only significant predictor of the intervention outcome. However, in model 4, the intervention condition and SES moderated the outcome for three of four regressions.

Gender, grade, age, and language did not significantly predict self-efficacy outcomes. However, socio-educational status significantly predicted the outcome for: (a) social self-efficacy, $F(6, 233) = 4.15, p < .01, R^2 = .07$, adding statistically to the prediction for this sub-scale, $B = .25, p < .001$; (b) emotional self-efficacy, $F(6, 233) = 4.02, p < .01, R^2 = .07$, adding statistically to the prediction for this sub-scale, $B = .19, p < .01$; and (c) total self-efficacy, $F(6, 233) = 5.53, p < .001, R^2 = .10$, adding statistically to the prediction for total self-efficacy, $B = .23, p < .001$. Tables E.5 to E.8 summarise the regression models for self-efficacy and are reported in Appendix E.

4.6 Mental health difficulties

As for resilience and self-efficacy, the effects of participation in the 10-week martial arts-based intervention on mental health difficulties was examined using univariate ANOVA, repeated measures ANOVA, and regression analysis. Details of results include: (1) descriptive statistics (means and standard deviations); (2) inferential results and effect sizes; and (3) mean differences and confidence intervals.

4.6.1 Mental health difficulties outcomes for the experimental and control groups at baseline and post-intervention time point

The intervention did not decrease the experimental group's mental health difficulties. Compared to the control group, univariate ANOVAs examining the adjusted intervention difference found the intervention did not decrease the experimental group's total difficulties, $F(1, 230) = .01, p > .05, \eta_p^2 = .000$; emotional difficulties, $F(1, 236) = .63, p > .05, \eta_p^2 = .003$; or behaviour difficulties, $F(1, 234) = 3.14, p > .05, \eta_p^2 = .01$. A summary of descriptive statistics for mental health difficulties is reported in Table 4.10.

4.6.2 Mental health difficulties for the experimental group at baseline, post-intervention, and follow-up time point

The intervention did not decrease participants' total problems or related sub-factors. Mauchly's test indicated that the assumption of sphericity had been violated for emotional difficulties, $\chi^2(2) = 21.42, p < .001$; behaviour difficulties, $\chi^2(2) = 23.94, p < .001$; and total difficulties, $\chi^2(2) = 21.64, p < .001$. Degrees of freedom were corrected using Hyunh-Feldt estimates of sphericity for emotional difficulties ($\varepsilon = .87$), behaviour difficulties ($\varepsilon = .86$), and total difficulties ($\varepsilon = .87$). The results showed that martial arts training did not have a significant effect on participants' emotional difficulties, $F(1.75, 214.61) = 0.15, p > .05, \eta_p^2 = .001$; behaviour difficulties, $F(1.72, 207.53) = 1.42, p > .05, \eta_p^2 = .01$; or total difficulties, $F(1.74, 210.42) = 1.67, p > .05, \eta_p^2 = .01$. A summary of descriptive statistics for mental health difficulties is reported in Table 4.11.

Table 4.10. *SDQ descriptive statistics for the experimental and control groups: (a) baseline and post-intervention time points: means and standard deviations, and (b) adjusted intervention difference: means, standard deviations, mean differences and confidence intervals comparing conditions*

Difficulties scale	Condition	Baseline		Post-intervention		Adjusted intervention difference				
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>Mdif</i>	<i>SE</i>	95% CI
Emotional	Experimental	.70	.51	.67	.48	-.03	.46			
	Control	.73	.51	.73	.50	-.01	.52	-.04	.05	-.15, .06
Behavioural	Experimental	.72	.41	.71	.42	-.01	.43			
	Control	.72	.46	.63	.39	-.10	.49	.09	.05	-.01, .19
Total difficulties	Experimental	.82	.23	.81	.24	.14	.21			
	Control	.80	.24	.78	.24	.14	.26	.00	.02	-.04, .05

Note. *Mdif* = Mean difference.

Table 4.11. *SDQ descriptive statistics for the experimental condition at baseline, post-intervention, and follow-up time point: (a) means and standard deviations; and (b) mean differences and confidence intervals comparing time points*

Difficulties scale	Baseline					Post-intervention					Follow-up				
	<i>M</i>	<i>SD</i>	<i>Mdif^a</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^b</i>	<i>SE</i>	95% CI	<i>M</i>	<i>SD</i>	<i>Mdif^c</i>	<i>SE</i>	95% CI
Emotional	.70	.51				.67	.48				.69	.47			
			-.03	.04	-.13, .07			.02	.06	-.11, .16			-.003	.06	-.15, .14
Behaviour	.72	.41				.71	.42				.64	.42			
			-.01	.04	-.10, .08			-.07	.05	-.20, .06			-.08	.05	-.21, .06
Total Difficulties	.82	.23				.81	.24				.78	.23			
			-.01	.02	-.06, .04			-.04	.03	-.10, .03			-.04	.03	-.11, .02

Note. *Mdif* = Mean difference. Confidence intervals used Bonferroni adjustment for multiple comparisons.

^aBaseline to post-intervention mean difference. ^bPost-intervention to follow-up mean difference. ^cBaseline to follow-up mean difference.

4.6.3 *The effect of demographic co-variates on mental health difficulties outcomes*

Socio-educational status significantly predicted the outcome for emotional difficulties, $F(6, 233) = 2.62, p < .05, R^2 = .04$, adding statistically to the prediction for emotional difficulties, $B = -.17, p < .05$. However, generally the study's demographic variables did not significantly predict emotional, behavioural, or total difficulties. While SES moderated total difficulties, $B = -.18, p < .01$, SES did not significantly predict the outcome for total difficulties, $F(6, 231) = 1.61, p > .05, R^2 = .02$. Tables E.9 to E.11 summarise the regression models for mental health difficulties and are reported in Appendix E.

4.7 Post-program engagement

Participants' post-program martial arts participation was used to determine whether the intervention program engaged participants. Post-program martial arts participation was examined regarding participants': (a) reported intent to continue martial arts training; and (b) reported enrolment in martial arts training since completing the program. Participant responses were further examined using chi-square analysis.

Post-program intent to continue martial arts training: The experimental group was asked whether they would like to continue practising martial arts after completing the program. Of the 125 participants who completed the intervention condition, 92 (74%) reported they would like to continue the program or participate in another martial art-based program after the intervention. Chi-square analysis of covariates found no significant differences for age, $\chi^2(3) = 0.85, p > .05$; grade, $\chi^2(1) = 0.09, p > .05$; gender, $\chi^2(1) = 1.96, p > .05$; cultural background, $\chi^2(5) = 8.30, p > .05$; or SES, $\chi^2(3) = 7.31, p > .05$.

Follow-up martial arts training enrolment: Of the 125 participants who completed the intervention condition, 18 (14%) reported they had taken up martial arts training since

completing the program. This was evenly divided across high and low SES participants. Chi-square analysis of covariates found no significant differences for age, $\chi^2(3) = 3.87, p > .05$; grade, $\chi^2(1) = 1.94, p > .05$; gender, $\chi^2(1) = 4.16, p > .05$; cultural background, $\chi^2(5) = 1.21, p > .05$; or SES, $\chi^2(3) = 3.87, p > .05$.

4.8 Summary

This chapter presented the study's results, including quantitative data regarding the study's demographic characteristics, validity and reliability of the study's instruments, and descriptive and inferential statistics addressing the study's research questions.

The participant response rate during recruitment was 21%. Two-hundred and eighty-three ($N = 283$) participants were recruited and completed the baseline assessment. The study had a 14% drop-out rate, and the intervention program was completed by 243 participants.

The validity and reliability of the study's scales were assessed by examining content validity (factor analysis), internal consistency (Cronbach's alpha), and convergent and discriminant validity (Pearson's correlation). Based on factor analysis and Cronbach's alpha, aspects of the SDQ were discarded from the study. The CYRM and SEQC were found to be robust measures. Overall, the study's scales exhibited a high degree of convergent and discriminant validity.

Descriptive and inferential statistics showed that the study's intervention had a significant impact on participants' resilience and self-efficacy, while the intervention did not appear to affect participants' mental health difficulties. Univariate analysis of variance found that participants' resilience was the most improved wellbeing factor, while repeated measures ANOVA found that participants' self-efficacy was the most improved wellbeing factor. Regression analysis consistently found that SES predicted intervention outcomes. Finally, 74% of the experimental group reported they would like to continue the intervention or participate

in a similar program. Chi-square analysis found participant engagement was not significantly affected by demographic co-variates.

CHAPTER 5

DISCUSSION

5.1 Overview

This study shows that martial arts (taekwondo) training had a positive effect on participants' resilience and self-efficacy. However, the intervention did not appear to affect participants' mental health difficulties. Socio-educational status was the only demographic co-variate that moderated these results. Gender did not affect the intervention outcomes which indicates that both males and females potentially benefit from martial arts-based interventions. Participant engagement was high. This chapter discusses these results in detail. The study's research questions are addressed sequentially and are synthesised with previous research while considering explanations for the intervention's effects. The practical significance and implications arising from the results are considered. Overall, the study's findings suggest that martial arts-based psychosocial interventions are an efficacious strategy to improve adolescent mental health in school-based settings.

5.2 To what extent does participation in a 10-week martial arts-based intervention affect adolescents' resilience outcomes?

Research question one examined how participation in the 10-week martial arts-based intervention affected adolescents' resilience at post-intervention and follow-up. The study's results show that the intervention positively affected the experimental group's resilience. This effect was stronger at post-intervention than follow-up.

5.2.1 *Adolescents' resilience outcomes at post-intervention*

The experimental group's resilience significantly improved post-intervention compared to the control group. Significant post-intervention adjusted mean differences were found between the experimental and control groups for total resilience and all resilience sub-scales. However, the largest post-intervention adjusted mean difference was observed for the relationship with primary caregiver sub-scale, and the largest observed effect size was found for total resilience. This suggests these aspects of resilience were more strongly affected by the intervention.

Previous research of the effect of martial arts training on psychological strengths has not specifically considered resilience outcomes. However, the results are broadly consistent with previous research findings that martial arts training was associated with improving psychological strengths such as self-esteem (Trulson, 1986), self-regulation (Milligan et al., 2015; Milligan et al., 2016), and wellbeing (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005). It is not possible to make direct comparisons due to limitations regarding how resilience data were reported by these studies.

The study found greater post-intervention adjusted mean differences for total resilience, the relationship with primary caregiver sub-scale and the contextual factors sub-scale compared to the overall weighted mean difference reported by a systematic review and meta-analysis examining the relationship between martial arts training and wellbeing (Moore et al., 2020). Although this is not a direct comparison given conceptual differences between resilience and wellbeing (i.e., resilience was conceptualised by the study as a component of wellbeing), this is an important finding which supports the efficacy of the intervention to improve resilience, and by inference, wellbeing.

Similarly, the post-intervention mean differences supporting the efficacy of the intervention to improve resilience were greater than the overall weighted mean difference reported by a systematic review and meta-analysis examining the effect of physical activity on

wellbeing (Rodriguez-Ayllon et al., 2019). This is an interesting finding as it infers that martial arts training is more effective than other types of physical activity in promoting wellbeing in a general sense. However, as per the previous paragraph, it is important to consider this comparison cautiously given conceptual differences between the studies. Overall, these results indicate that the martial arts-based intervention positively affected participants' resilience outcomes. Thus, the null hypothesis (H_0) that the martial arts-based intervention did not affect resilience at post-intervention is rejected.

5.2.2 *Adolescents' resilience outcomes at follow-up*

The experimental group exhibited several statistically significant changes for resilience across baseline, post-intervention, and follow-up measures. Total resilience was arguably the strongest resilience outcome as significant effect sizes were measured at post-intervention and follow-up. The individual capacities and resources sub-scale had the largest observed effect size post-intervention but did not have a significant effect at follow-up. Neither the post-intervention or follow-up conditions were statistically significant for the relationship with primary caregiver or contextual factors sub-scales. The last findings are an interesting difference compared to the univariate findings for adolescents' post-intervention resilience outcomes.

Examining the mean differences for total resilience and the resilience sub-scales shows that all the resilience sub-scales improved at post-intervention and follow-up. The strongest improvements were observed when comparing baseline to follow-up mean differences which was consistent for total resilience and the other resilience sub-scales. The individual capacities and resources sub-scale and total resilience also exhibited significant improvements when comparing baseline to post-intervention mean differences.

As noted, previous research investigating the effects of martial arts training on

wellbeing has not examined resilience outcomes. Consistent with the study's results comparing the experimental and control groups, these results generally support the experimental group's levels of resilience improving across baseline, post-intervention, and follow-up measures. This was more demonstrable when considering mean differences across measurement conditions compared to effect size. Broadly the results are consistent with previous research findings that martial arts training improved wellbeing (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005; Milligan et al., 2015; Milligan et al., 2016; Trulson, 1986).

The study generally found poorer mean differences at post-intervention and follow-up for all the resilience sub-scales compared to the overall weighted mean difference found by a systematic review and meta-analysis examining the relationship between martial arts training and wellbeing (Moore et al., 2020). The largest mean differences observed in the current study were consistently found for the baseline to follow-up measurement condition across all the resilience sub-scales. These mean differences were slightly smaller than the weighted mean difference found by the systematic review and meta-analysis (Moore et al., 2020). While still supporting the efficacy of the intervention to improve participants' resilience, this result is not as strong as the univariate findings.

Compared to the overall weighted mean difference reported by a systematic review and meta-analysis examining the effect of physical activity on wellbeing (Rodriguez-Ayllon et al., 2019), the study found smaller baseline to post-intervention mean differences and larger baseline to follow-up mean differences. While this is not a conclusive result, it is generally supportive of the view that martial arts-based training may have a greater effect on aspects of resilience compared to other forms of physical activity. Overall, these results indicate that the martial arts-based training program used for the intervention positively affected participants' resilience outcomes. Thus, the null hypothesis (H_0) that the martial arts-based intervention did not affect resilience at follow-up is rejected.

5.2.3 *Explanations for the intervention's effects on resilience*

Martial arts training clearly improved the experimental group's levels of resilience. Given that the construct total resilience is comprised of several resilience sub-scales it is unsurprising from a psychometric perspective that the total resilience scale generally had the largest effect sizes for resilience. This is consistent with results for other factorial constructs, such as full-scale intelligence, which tend to have stronger psychometric properties compared to their factorial constituents (e.g., Wechsler, 2014).

Resilience is a complex construct and there are many elements in the intervention program incorporated from resilience literature that could result in improving resilience outcomes. Elements that are highly relevant to the intervention include modelling, changing negative scripts, establishing realistic goals, developing self-discipline, encouraging participants to learn from mistakes, and encouraging problem solving (Brooks, 2006). Additionally, other social psychological constructs may have utility in explaining the intervention effects. Participants in the intervention program may have benefited from the development of an in-group identity (Kurzban & Leary, 2001) as participants in the intervention program functioned as a distinct group within the school-based setting. Related to this, the resilience intervention effect may also have benefited from the development of group superordinate goals (Sherif et al., 1961).

When considering effect sizes for total resilience and the resilience sub-scales, it is notable that resilience appeared to have a stronger intervention effect when comparing the univariate findings to repeated measures findings. This suggests that the intervention effect for resilience was stronger at post-intervention and diminished over time. Additionally, the observed differences for adolescents' relationship with primary caregiver and contextual factors sub-scales across univariate and repeated measures analyses are intriguing. While the

reasons for this are unclear, it is possible that this is an artefact of differences within the statistical models (i.e., one result compares between groups whereas the other compares within groups).

When the intervention group's follow-up data were analysed some of the differential findings regarding resilience were surprising. The importance of the relationship with primary caregivers is often emphasised in resilience literature (Bowes et al., 2010; Gordon & Song, 1994; Martinek & Hellison, 1997), however this was the weakest resilience effect in the study. This could suggest that the intervention setting (i.e., school-based context) did not readily transfer the intervention effects to the home setting. Conversely, the stronger results for the individual capacities and resources sub-scale may be explained by the intervention program's focus on skill development, which is consistent with research highlighting the importance of mastery in resilience development (Prince-Embury, 2007).

5.3 To what extent does participation in a 10-week martial arts-based intervention affect adolescents' self-efficacy outcomes?

Research question two investigated how adolescents' self-efficacy at post-intervention and follow-up was affected by participation in a 10-week martial arts-based intervention. The study's results show that the intervention had a positive effect on the experimental group's self-efficacy. However, contrasting with the results for resilience, the effect for self-efficacy was stronger when considering the repeated measures findings compared to the univariate findings.

5.3.1 *Adolescents' self-efficacy outcomes at post-intervention*

The experimental group's levels of self-efficacy significantly improved post-intervention compared to the control group, although effect sizes were generally smaller than for resilience

outcomes. Across the self-efficacy sub-scales, the largest observed effect size was reported for total self-efficacy. Significant post-intervention adjusted mean differences were found between the experimental and control groups for total self-efficacy and all self-efficacy sub-scales. The largest adjusted mean difference post-intervention was observed for emotional self-efficacy. It should be noted that at baseline assessment there was a statistically significant mean difference between the experimental and control groups for social self-efficacy, hence this post-intervention effect is less notable than for the other sub-scales. Overall, this result is consistent with previous research findings that martial arts training has a positive effect on self-efficacy outcomes (Reishehrei et al., 2014; Ryan et al., 2015). However, it is not possible to make direct comparisons due to limitations regarding how self-efficacy data were reported by these studies.

The study found greater post-intervention mean differences for academic and emotional self-efficacy, slightly poorer total self-efficacy, and poorer social self-efficacy compared to the overall weighted mean difference found by a systematic review and meta-analysis examining the relationship between martial arts training and wellbeing (Moore et al., 2020). This finding supports the efficacy of the intervention to improve aspects of self-efficacy.

Additionally, the study found greater post-intervention mean differences for all self-efficacy sub-scales compared to the overall weighted mean difference reported by a systematic review and meta-analysis examining the effect of physical activity on wellbeing (Rodriguez-Ayllon et al., 2019). Like resilience, this is an interesting finding as it suggests that martial arts training is more effective than general physical activity in promoting wellbeing in a broad sense. However, it is important that this comparison is considered tentatively, given differences between the studies. The results show that the martial arts-based training program used for the intervention positively affected participants' self-efficacy outcomes. Thus, the null hypothesis (H_0) that the martial arts-based intervention did not affect self-efficacy at post-intervention is rejected.

5.3.2 *Adolescents' self-efficacy outcomes at follow-up*

The experimental group exhibited statistically significant improvements for self-efficacy across baseline, post-intervention, and follow-up measures. Contrasting with the study's results comparing the experimental and control groups, repeated measures of the experimental group across all of the study's time-points found that the intervention most strongly affected self-efficacy. When follow-up data for the experimental group were incorporated into the analysis, emotional self-efficacy was found to have the broadest positive outcome from the martial arts intervention. Total self-efficacy had the largest effect size reported by the study, however, it was only significant post-intervention. A similar pattern was evident for the other self-efficacy sub-scales, which were also significant at post-intervention but not follow-up.

Examination of mean differences for total self-efficacy and the self-efficacy sub-scales indicates that all the self-efficacy sub-scales improved at post-intervention and follow-up. The strongest improvements were observed when comparing baseline to follow-up mean differences, which was observed for all the self-efficacy sub-scales. This indicates that the intervention's impact on self-efficacy did not diminish post-intervention and exhibited a stronger impact at follow-up. The largest mean differences were observed for emotional self-efficacy, which were apparent for the baseline to post-intervention condition and baseline to follow-up condition. While direct comparisons with previous studies is not possible due to limitations regarding how self-efficacy was reported by previous research, the current results support previous findings that martial arts training has a positive effect on self-efficacy outcomes (Reishehrei et al., 2014; Ryan et al., 2015).

The study found greater mean differences for total self-efficacy and emotional self-efficacy for the baseline to follow-up measurement condition; and emotional self-efficacy for the post-intervention to follow-up condition, compared to the overall weighted mean difference

found by a systematic review and meta-analysis examining the relationship between martial arts training and wellbeing (Moore et al., 2020). This finding supports the efficacy of the intervention to improve self-efficacy. The mean differences for the other self-efficacy sub-scales and conditions were slightly smaller.

When compared to the overall weighted mean difference observed by a systematic review and meta-analysis examining the effect of physical activity on wellbeing (Rodriguez-Ayllon et al., 2019), the study found greater mean differences for the baseline to post-intervention and baseline to follow-up conditions for total self-efficacy and the self-efficacy sub-scales. However, it was interesting that there were no significant changes between post-intervention and follow-up. This suggests that changes from the intervention were held during the three months following, which may indicate that the strength of the intervention's impact on self-efficacy was maintained. The comparison with Rodriguez-Ayllon et al. (2019) suggests martial arts training is more effective than physical activity in promoting wellbeing in a general sense, but given differences between the studies this should be regarded cautiously. Based on these results, the null hypothesis (H_0) that the martial arts-based intervention did not affect self-efficacy at follow-up is rejected.

5.3.3 *Explanations for the intervention's effects on self-efficacy*

Martial arts training clearly improved the experimental group's reported levels of self-efficacy. Similar to resilience, it is unsurprising that the construct total self-efficacy generally had the largest effect sizes for self-efficacy. Again, this is consistent with other factorial constructs where higher level factors tend to have stronger psychometric properties compared to their factorial constituents (e.g., Wechsler, 2014).

Different elements of the sources of self-efficacy (Loo & Choy, 2013; Usher & Pajares, 2006) may have contributed to participants' improved levels of self-efficacy following martial

arts training. As the intervention focused on skill development, participants' self-efficacy may have improved due to mastery experience. This is a parsimonious explanation supported by Bandura's (1977) view that mastery experience has a significant influence on self-efficacy. However, other elements of self-efficacy were used in the intervention and may also have facilitated improved self-efficacy. Modelling (vicarious experiences) and verbal persuasion were used as a teaching and learning strategy and as part of the intervention's psychoeducation component. This may have facilitated improved self-efficacy. The intervention also attempted to promote emotional regulation (emotional and physiological states) through psychoeducation and meditative processes (i.e., breath focusing exercises), which may also have contributed to improving participants' self-efficacy.

It is also important to consider that self-efficacy is one of several components from social cognitive theory (Bandura, 1977) and consequently explaining improved self-efficacy may be a function of interactions between components of this model. While self-efficacy was the measured outcome in the study, the intervention program explicitly incorporated other components of social cognitive theory including modelling and outcome expectancies. The learning processes underpinning the physical activities in the intervention program emphasised: (a) modelling – which included observation and motor reproduction of martial arts techniques; and (b) outcome expectancies – where learning martial arts techniques was extrinsically reinforced. Reinforcement occurred through instructor feedback and verbal praise, and the longer-term motivational incentive of grade promotion (i.e., promotion from a white belt to yellow belt). This process may have led to a mastery orientation that facilitated stronger intervention effects for self-efficacy.

Unlike resilience, the intervention effects for self-efficacy appeared stronger when the experimental group's outcomes incorporated follow-up measures, both in terms of effect sizes and mean differences for total self-efficacy and the self-efficacy sub-scales. Further, it is

important to note that the intervention effects for self-efficacy generalised across academic, social, and emotional self-efficacy. The intervention effects on social and emotional self-efficacy may be explained due to the supportive social context of the intervention and through psychological knowledge gained through the psychoeducational component of the intervention. While improved academic self-efficacy from the intervention is very positive, the reasons for this effect are less apparent. Possible explanations for improved academic self-efficacy include: (1) transference across self-efficacy domains; and (2) a location effect insofar as the school-based context of the intervention facilitated improved academic self-efficacy arising from improved overall self-efficacy.

5.4 To what extent does participation in a 10-week martial arts-based intervention affect adolescents' mental health difficulties outcomes?

Research question three considered how participation in the 10-week martial arts-based intervention affected adolescents' mental health difficulties at post-intervention and follow-up. The study's results show that the martial arts-based intervention did not significantly affect mental health difficulties.

5.4.1 *Adolescents' mental health difficulties outcomes at post-intervention*

The mental health difficulties outcomes for the experimental group did not exhibit statistically significant changes when compared to the control group. Based on adjusted mean differences, the experimental group reported slightly better levels of emotional difficulties post-intervention and slightly poorer levels of behavioural difficulties and total difficulties post-intervention. However, post-intervention differences between the groups were minimal and not significant.

These results do not support previous studies that found martial arts training decreased symptoms associated with mental illness, such as anxiety (Layton, 1990; Li et al., 2004; Trulson, 1986), depression (Chou et al., 2004; McGowan & Jordan, 1988; Toskovic, 2001), sleep (Li et al., 2004), or distress tolerance (Milligan et al., 2015). Although three of these studies (i.e., Chou et al., 2004; Milligan et al., 2015; Trulson, 1986) examined clinical samples, the other studies examined more general non-clinical samples. Hence, a distinction between clinical and non-clinical samples does adequately explain the lack of differences observed in the current study, which may be related to sample bias in some previous studies. A related caution regarding interpreting these findings is that the results may be camouflaged by the participants who did not exhibit any difficulties in the first place.

Compared to the overall weighted mean difference found by a systematic review and meta-analysis examining the effect of martial arts training on internalising mental health issues (Moore et al., 2020), the study found poorer post-intervention mean differences for emotional difficulties, behaviour difficulties, and total difficulties. This suggests the intervention did not affect mental health difficulties, however, sample issues may have moderated the result. This is discussed below when considering explanations for the intervention's effects on mental health difficulties. Compared to the overall weighted mean difference reported by a systematic review and meta-analysis examining the effect of physical activity on mental health (Rodriguez-Ayllon et al., 2019), the study found poorer post-intervention mean differences for all mental health difficulties sub-scales. Based on these results, the null hypothesis (H_0) that the martial arts-based intervention did not affect mental health difficulties at post-intervention is not rejected.

5.4.2 *Adolescents' mental health difficulties outcomes at follow-up*

The mental health difficulties outcomes for the experimental group did not exhibit statistically

significant changes across baseline, post-intervention, and follow-up measures. When examining mean differences, the experimental group consistently reported slightly better levels of emotional difficulties, behavioural difficulties, and total difficulties across time points. However, differences across measurement conditions were minimal and not significant.

Similar to the results comparing mental health difficulties for the experimental and control groups, these results do not support previous studies that found martial arts training decreased symptoms associated with mental illness (Chou et al., 2004; Layton, 1990; Li et al., 2004; McGowan & Jordan, 1988; Milligan et al., 2015; Toskovic, 2001; Trulson, 1986). Compared to the overall weighted mean difference found by a systematic review and meta-analysis examining the effect of martial arts training on internalising mental health issues (Moore et al., 2020) the current intervention reported poorer post-intervention and follow-up mean differences for all the mental health difficulties sub-scales. Similar to the post-intervention results for mental health difficulties, the effect of sample issues may have moderated the results. Compared to the overall weighted mean difference reported by a systematic review and meta-analysis examining the effect of physical activity on mental health (Rodriguez-Ayllon et al., 2019), the current intervention reported poorer post-intervention and follow-up mean differences for all the mental health difficulties sub-scales. Consequently, the null hypothesis (H_0) that the martial arts-based intervention did not affect mental health difficulties at follow-up is not rejected.

5.4.3 *Explanations for the intervention's effects on mental health difficulties*

The lack of observed intervention effects regarding mental health difficulties is intriguing given previous findings, but may be explained by a variety of factors including sample issues, scale issues, as well as consideration of the null hypothesis. Considering the null hypothesis is important as it is possible that martial arts training does not have a significant effect on mental

health difficulties.

Differences between this study's effects on mental health difficulties and previous findings might be related to sample differences. The current study randomly recruited from a normal population, while some previous studies that reported improved mental health recruited from targeted pathological populations (i.e., Chou et al., 2004; Milligan et al., 2015; Trulson, 1986). Given the potential for sample bias in previous research, for example Trulson's (1986) study which recruited from a sample of males diagnosed with behaviour disorders, these studies were more likely to detect changes in mental health difficulties. In this sense, the current study may not have had the same capacity to detect changes to participants' mental health issues compared to previous research that recruited from targeted pathological samples. This does not preclude the possibility that the study's intervention may produce a significant impact upon those with mental health difficulties or having specific needs, rather if results from previous studies were due to sample bias they may not be comparable to the current results.

Although the SDQ demonstrated good overall validity and reliability, it is prudent to note that the instrument exhibited minor issues during factor analysis and measures of internal consistency. During factor analysis two of the SDQ sub-scales (conduct and hyperactivity) converged as one scale which was examined in the study as the behaviour problems sub-scale. Additionally, the peer problems sub-scale did not converge across baseline, post-intervention, and follow-up measures during factor analysis, and internal consistency for the prosocial sub-scale was poor. Both sub-scales were discarded from the study. Consequently, it is important to consider whether scale issues contributed to the results regarding mental health difficulties.

5.5 To what extent do demographic co-variables have any effect on the intervention outcomes?

The effect of demographic co-variables across the study's mental health outcomes was

addressed by research question four. While the co-variables age, grade, and gender did not influence participants' outcomes for resilience and self-efficacy, SES exhibited a significant influence across multiple aspects of resilience and self-efficacy, while language background had a minor effect. Demographic co-variables did not significantly influence mental health difficulties.

5.5.1 Resilience

Regression analysis found that the intervention significantly explained most of the variance in the models across the resilience scales. For total resilience, the individual capacities and resources sub-scale, and relationship with primary caregiver sub-scale; only the intervention condition explained a significant proportion of the variance in model 1, model 2, and model 3. Gender, grade, age, and language background did not significantly improve the models. However, SES improved the fit in model 4 and predicted a greater proportion of the variance regarding these resilience outcomes.

For the contextual factors sub-scale, the intervention condition explained a significant proportion of the variance in model 1, model 2, and model 3. Gender, grade, age, and SES did not significantly improve the models. However, language background improved the fit in model 4, but did not predict significantly more variance regarding this outcome.

The effect of demographic covariates on mental health outcomes resulting from martial arts training has received little attention in previous research. However, the role of gender has been examined in this regard. The current results support previous research finding no significant differences between gender (Vertonghen et al., 2014), and does not support research where females did not exhibit psychological benefits from martial arts training (Lakes & Hoyt, 2004; Twemlow et al., 2008). This is a positive result that suggests martial arts training may have benefits irrespective of gender.

5.5.2 *Self-efficacy*

The intervention significantly explained most of the variance in the models across the self-efficacy scales. For total self-efficacy and the social self-efficacy and emotional self-efficacy sub-scales, the experimental condition explained a significant proportion of the variance in model 1, model 2, and model 3. Gender, grade, age, and language background did not significantly improve the models. However, SES improved the fit in model 4 and predicted a greater proportion of the variance regarding these outcomes. For academic self-efficacy, none of the demographic covariates significantly improved the model fit and only the intervention condition explained model variance.

As noted for resilience, the effect of demographic covariates on mental health outcomes resulting from martial arts training has received little attention in previous research. The current results support previous research finding no significant differences between gender (Vertonghen et al., 2014) and suggests martial arts training may have benefits irrespective of gender.

5.5.3 *Mental health difficulties*

The intervention program's outcomes for mental health difficulties were not significantly affected by demographic co-variables. While the model fit was improved when: (a) SES was introduced to emotional difficulties and total difficulties; and (b) language background was introduced to behavioural difficulties; the influence of demographic co-variables did not significantly alter the study's outcomes for mental health difficulties.

5.5.4 *Explanations for the effect of demographic factors*

Age, grade, and gender did not have an impact on the intervention's mental health outcomes, which suggests that martial arts training may have mental health benefits irrespective of these covariates. It is important to comment on gender as previous research has been inconsistent regarding this. For example, Guthrie (1995) and Weiss (2017) reported positive effects for females, Lakes and Hoyt (2004) and Twemlow et al. (2008) reported that females did not benefit from martial arts training, while Bjorkqvist and Varhama (2001) reported negative effects for females. This study's results found that females did not exhibit different mental health outcomes compared to males, which can be interpreted as a positive result insofar as martial arts training may provide mental health benefits irrespective of gender.

It was interesting that language background predicted responses to the contextual factors resilience sub-scale, however an explanation for this may be apparent in a close examination of the items for this sub-scale. The culturally and linguistically diverse participants in the program reported high degrees of spiritual beliefs. Given that the scale items for the contextual factors sub-scale loaded on spiritual beliefs, it is unsurprising that language background improved the prediction regarding this aspect of resilience.

Socio-educational status was the only demographic factor that affected the mental health outcomes from the intervention broadly and consistently, where higher SES appeared to be related to better mental health outcomes. Higher SES is associated with better mental health literacy (Jimenez et al., 2012) and more positive attitudes towards mental health treatment (Villatoro et al., 2018). Together with greater economic resources this may affect how individuals identify and respond to mental health problems. This is somewhat consistent with epidemiological research suggesting health varies by SES, which may be explained by people with lower SES having higher frequencies of negative health behaviours and difficulties accessing health care (National Center for Health Statistics, 2012). Access to the intervention

program is not a plausible explanation for this effect given that the intervention was provided to all participants. However, it was observed during the implementation of the intervention that program compliance was greater in schools reporting higher SES. Attitudes towards mental health treatment and intervention compliance, which could be interpreted as a positive or negative health behaviour, may parsimoniously explain SES as a predictor of the intervention's mental health outcomes.

5.6 To what extent did the intervention program engage adolescent participants?

Intervention fidelity

Participant engagement in the intervention was examined by research question five. This was assessed through analysis of participant drop-out and post-program engagement, which provides an indication of intervention fidelity. Whether the intervention program engaged adolescent participants was assessed using several indicators of participant responsiveness. First, the attrition rate of participants at follow-up was smaller than the 20% drop-out rate commonly observed in randomised controlled trials (Wood et al., 2004) which suggests participants perceived the intervention as relevant. However, it should be noted that the intervention occurred during participants' school lesson time, which may have moderated attrition rates. Participants who were in the control group exhibited a greater drop-out rate compared to the experimental group. While not a large difference, this was nonetheless interesting and may reflect a structural reason for participant attrition. Post-program engagement was very encouraging, with the majority of participants reporting they would like to continue practising martial arts post-program. A smaller proportion of participants reported they had taken up martial arts training at follow-up. Chi-square analysis found that there were no significant demographic differences regarding reported intentions. These results show that the intervention program successfully engaged participants and suggests that martial arts-based

interventions may have broad practical utility engaging participants. Thus, the null hypothesis (H_0) that the martial arts-based intervention did not engage participants is rejected.

Intervention fidelity refers to whether the intervention was delivered as intended by the program developers and was in line with the program model (Breitenstein et al., 2010). It is important to consider intervention fidelity, as poor fidelity may explain why some interventions that appear to be effective in highly controlled trials fail to yield the same outcomes when applied in real life contexts (Breitenstein et al., 2010). While there are different measures of intervention fidelity, participant responsiveness may be an especially important factor for examining intervention fidelity (Carroll et al., 2007). Participant responsiveness refers to whether participants view an intervention as being relevant and assumes that the uptake of an intervention depends on its acceptability to participants (Carroll et al., 2007). Based on participant engagement, the intervention program appears to have good fidelity.

5.6.1 *Explanations for participant attrition and post-program engagement*

The intervention reported a low level of participant attrition and a high level of intent regarding continuing martial arts training post-program. This suggests the intervention was engaging and relevant for participants. A parsimonious explanation regarding this is that grounding the intervention in physical activities (i.e., martial arts training) was enjoyable and successfully engaged participants. Further, the study's positive mental health outcomes may have mitigated participant attrition and encouraged participants to continue martial arts training post-program. If participating in martial arts training improved participants' subjective experience of psychological strengths this may have encouraged ongoing participation. It should also be noted that participant response bias may have affected this result, however the risk of response bias was minimised given the anonymous nature of the study's survey instruments.

The take-up of martial arts training at follow-up was also encouraging, although the

actual rate of take up was smaller than reported intent post-program. Demographic differences did not appear to influence post-program engagement. Two issues may explain the difference between intent and actual take up. Firstly, financial cost may have affected participants' ability to engage in taking up martial arts training; secondly, self-selection bias may have also impacted participants' take up of martial arts training.

5.7 Practical significance of findings

The study's results are generally positive regarding martial arts training improving overall resilience, self-efficacy, and related sub-factors. According to various authors, a major limitation of research examining the relationship between mental health and: (a) martial arts training (Tsang et al., 2008; Vertonghen & Theeboom, 2010); (b) physical activity (Mammen & Faulkner, 2013; Taylor & Faulkner, 2005); and (c) complementary therapies (Deligiannidis & Freeman, 2016; Leventhal, 2013); is that the study designs typically lack academic rigor. Given this study used a randomised controlled trial with a large sample size, the study's results provide strong evidence for the efficacy of martial arts-based interventions to promote resilience and self-efficacy in adolescent populations. Consequently, the study's results suggest that martial arts-based interventions have the potential to function as an efficacious universal intervention program in school-based settings.

5.8 Are martial arts-based psychosocial interventions an efficacious strategy to improve adolescent mental health in school-based settings?

Whether martial arts-based interventions can be considered as an efficacious strategy to improve adolescent mental health in school-based settings can be determined by examining several factors. These include: (1) considering definitions of psychological therapy and

complementary and alternative therapies; (2) examining these definitions regarding the intervention delivered for the study; and (3) considering the mental health outcomes resulting from the intervention.

The term psychological therapy lacks an agreed definition (Prochaska & Norcross, 2007). Psychological therapy intends to “help people” (Ciarrochi & Bailey, 2008, p. 4) and refers to “the informed and intentional application of clinical methods ... from established psychological principles for the purpose of assisting people [to] modify their behaviours, cognitions, emotions and/or other personal characteristics” (Norcross, 1990, p. 218). While it has been suggested that martial arts training exhibits similarities to psychological therapy (Burke et al., 2007; Fuller, 1988; Weiser et al. 1995) and has specific parallels that develop self-understanding and self-actualisation (Burke et al., 2007), caution should to be exercised when comparing martial arts training to psychological therapy. Generally martial arts training does not incorporate informed and intentional application of psychological principles.

However, a distinction can be made between martial arts training and the martial arts-based intervention that was delivered for this study. The intervention was designed and delivered by a registered psychologist and the intervention content, including psychoeducation and martial arts training, incorporated informed and intentional application of psychological principles. In this context, martial arts-based interventions might be conceived as a psychological therapy. However, from a conceptual and practical perspective it may be more useful to conceive of martial arts training and martial arts-based interventions as a complementary approach to mental health.

Complementary treatments for mental health refer to a wide range of practices and treatments not traditionally associated with psychological therapy or other mental health treatments (Solomon & Adams, 2015). While numerous complementary treatments for mental health have been proposed (Simkin & Popper, 2014), research supporting their use is limited

(Deligiannidis & Freeman, 2016; Leventhal, 2013; Simkin & Popper, 2014; Solomon & Adams, 2015; van der Watt et al., 2008; Wahlstrom et al., 2008). Given that using martial arts training as a therapeutic approach to promote mental health is not a standard psychological treatment, martial arts training may be considered as a mental health treatment within a complementary approach. This study does not advocate using physical activities and martial arts-based interventions in place of conventional treatments for mental health.

As noted throughout the results and discussion, participants' mental health outcomes regarding psychological strengths clearly improved from participating in the martial arts-based intervention. This was evident when comparing the experimental and control group's post-intervention and examining the experimental group at baseline, post-intervention, and follow-up. Participants' resilience and self-efficacy improved from participating in the intervention. In this context, martial arts-based interventions can be considered as an efficacious psychosocial treatment for improving mental health in terms of wellbeing and psychological strengths. However, the study did not find positive effects for the intervention reducing the pathological symptoms of mental health.

Generally, the study's results support martial arts training as an efficacious strategy to improve adolescent mental health in school-based settings. Evidence from this study and previous research has found that martial arts training improves psychological strengths (Chen & Cheesman, 2013; Finkenberg, 1990; Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005; Milligan et al., 2015; Milligan et al., 2016; Reishchrei et al., 2014; Ryan et al., 2015; Trulson, 1986); while previous research has found that martial arts training improves symptoms associated with mental illness (Chou et al., 2004; Layton, 1990; Li et al., 2004; McGowan & Jordan, 1988; Milligan et al., 2015; Toskovic, 2001; Trulson, 1986). In this context, martial arts training can function as an efficacious psychosocial treatment within a complementary treatment framework (NSW Department of Health, 2015) and is an efficacious

strategy to improve adolescent mental health in school-based settings. However, a caveat should be considered prior to such an endorsement: an important element of complementary mental health therapies is that the individual delivering treatment is trained to deliver mental health interventions (Simkin & Popper, 2014). While presumably trained in martial arts, martial arts instructors are typically not trained to deliver mental health interventions. To be considered as a truly efficacious psychosocial treatment, martial arts training should explicitly and intentionally apply psychological and/or mental health treatment principles which should occur in consultation with trained mental health professionals.

5.9 Implications

The study has broad implications for promoting mental health generally and addressing mental health issues in the education system. Implications regarding future research directions arising from the study are also discussed.

5.9.1 *Mental health and martial arts*

The study provides additional evidence that martial arts training promotes psychological strengths. While the results did not support the hypothesis that martial arts training can decrease the symptoms associated with mental illness, this is not conclusive and further investigation should consider targeted population samples and varying study measures. The results regarding improved psychological strengths are promising and suggest that martial arts training can function as a complementary approach to mental health. This has the potential to be developed in many different directions.

The prevalence of mental health issues in Australian adolescents aged 12 to 17 years has been measured at 13% for females and 16% for males (Lawrence et al., 2015), and rises sharply

in later adolescence, peaking at approximately 27% of young people aged 18 to 19 years (Mission Australia, 2017). Australian youth report many barriers regarding seeking help including poor availability (Moore et al., 2019a) and accessibility of mental health treatment (Lawrence et al., 2015). Martial arts-based programs could be used as an engaging, preventative mental health approach and play a role in developing psychological strengths and supporting youth exhibiting mental health issues. Given the increasing prevalence of mental illness with age, a more preventative approach during earlier adolescence might be ideal prior to the peak onset age of those with mental health issues.

Broadly speaking, martial arts can be categorised as a physical activity-based approach to mental health. While research has consistently found a link between physical activity and mental health (Mammen & Faulkner, 2013; Rodriguez-Ayllon et al., 2019), the current study found that martial arts training produces better mental health outcomes regarding improving psychological strengths compared to other physical activities. Arguably, this results from various unique characteristics of traditional martial arts training, including an emphasis on personal development which incorporates psychological and philosophical components, skill mastery and intra-level comparisons, and social phenomena such as the development of an in-group identity. Given the estimated global cost of mental health issues (WHO, 2016) martial arts training should be recognised and used as an empirically supported, physically based approach to developing wellbeing and related psychological strengths.

5.9.2 *Education and martial arts*

Education systems spend significant resources on student mental health. The NSW DoE (2019) reported funding costs of more than \$200 million (AUD) for student wellbeing over the past three years. The costs associated with mental illness are projected to increase 240% from 2016 to 2030 (WHO, 2016), yet many individuals do not seek or receive care for mental health issues

(Corrigan, 2004; MHCNSW, 2014). The martial arts-based intervention used in the study appeared to effectively engage participants, functioning as a “hook” (Hartmann, 2003, p. 124) to deliver a psychosocial intervention. Given its group-based nature martial arts-based interventions may provide education systems with an engaging and cost-effective approach to promoting psychological strengths (noting that cost-benefit analysis regarding the intervention is required). In this context, it was especially encouraging that the mental health outcomes from the intervention were not adversely affected by demographic characteristics such as age, grade, or gender.

However, SES appeared to moderate the intervention effects. This is an important finding from the study and further research should consider to what extent this could be ameliorated. Education is significantly associated with perceived need for accessing mental health care (Villatoro et al., 2018). Given this, improving mental health literacy and attitudes to mental health care through psycho-education is arguably crucial. In this context, the school-based nature of this mental health intervention provides an opportunity to impact factors associated with SES. Although the intervention’s psycho-education did not appear to affect participants with a lower SES background as strongly as higher SES participants, it should be noted that this was not an aim of the study. The results highlight that this should be prioritised in future research.

5.9.3 *Future research directions*

The current study has a variety of implications for future research including sample considerations, methodological variations, developing a teacher professional learning program based on the study, and engaging with various non-government organisations to develop a collaborative platform to extend this research.

Future research should examine the intervention program's effects on different population samples to broaden the generalisability of the study. Given that the overall prevalence of mental illness increases from childhood into adolescence (Lawrence et al., 2015) and rises sharply during later adolescence (Mission Australia, 2017), earlier intervention should be examined by future research. For example, consideration should be given to implementing the intervention as a universal program with primary school students (ages 10-11 years). Further, the effect of martial arts training for older (adult) participants should also be considered. Future research should examine the efficacy of martial arts based interventions as a targeted secondary level intervention (Moon et al., 2017) for groups of children and adolescents diagnosed with mental health issues; as well as considering how to extend the intervention effects more effectively for youth with lower SES backgrounds. Broadening the study to international settings to examine the intervention's efficacy in different cultural milieus should also be considered.

Several methodological changes should be incorporated in future studies. Future research should utilise third party measures to corroborate self-report measures, use alternate measures of mental health pathology such as the Kessler 10 Psychological Distress Scale (Kessler et al., 2003), include a qualitative approach to investigate causal factors (i.e., theory of change), and vary the longitudinal parameters of the study by lengthening the intervention program (e.g., three, six, or 12 month interventions) and extending the follow-up period.

While the results regarding mental health outcomes are promising, the intervention program is not currently sustainable in a school context. Future research should develop a professional learning program for teachers to facilitate similar programs which could be embedded within a physical education curriculum or welfare/pastoral care curriculum. Such programs would require piloting and ongoing measurement to ensure program efficacy.

Engaging with education, mental health, and martial arts non-government organisations to develop a collaborative platform to extend this research may function as an alternative or adjunct approach to developing a professional learning program for teachers. Linking these organisations to develop martial arts-based interventions may serve as an effective platform to deliver martial arts-based mental health interventions across education, mental health, and community contexts.

5.10 Limitations

Many of the limitations regarding previous studies examining the relationship between mental health and: (a) martial arts training; and (b) physical activity; have been addressed in the design and implementation of this study. Nonetheless, the following limitations regarding the sample, measures, intervention, and theoretical orientation used in this study should be noted.

The sample used in the study exhibits several limitations. As bias-coin randomisation was used to allocate participants to the intervention conditions, it is important to consider that allocation concealment is limited. The study examined participants aged 12 to 14 years, which limits the generalisability of results to the broader population. While sample self-selection effects are arguably less of an issue in this study compared with previous research due to the intervention using randomised selection processes and being delivered in secondary school settings, self-selection effects may still have affected participation in the intervention program. Related to this, the participation rate in the study was 21% which may be a source of selection bias. However, Morton et al. (2012) noted that studies reporting response rates of around 20% are able to yield accurate results, while Holbrook et al. (2007) reported that studies with response rates as low as 5% were often only slightly less accurate than studies with higher response rates. Although it is difficult to make direct comparisons to the current study as only 11.5% of school-based interventions report response rates (Blorn-Hoffman et al., 2009), it is

notable that the school-based martial arts intervention conducted by Zivin et al. (2001) reported a student response rate of 6%. As the current study's sample had a relatively even balance regarding biological sex and socio-economic status, and included culturally and linguistically diverse participants, it is proposed that the student response rate should not impact the study's external validity (Moore et al., 2021).

Several limitations were evident regarding the study's measures. Due to the delay in receiving ethics approval from NSW DoE, the opportunity to conduct follow-up measures for the control group was not possible. The lack of follow-up measures for the control group is a significant limitation regarding the analysis for some of the study's results. This has the potential to affect the internal validity for the within subjects' results, which only consider the experimental group. These specific results and related conclusions should be considered in this context. Minor problems were evident regarding the validity and reliability of the SDQ, which limited the study's ability to make conclusions regarding pathological mental health issues. Third party measures were not used in the study and the results rely upon self-reporting of mental health outcomes. A related issue is that the study's data were obtained from Likert scales which were treated as continuous variables. While continuous variables are useful for inferential statistics, they are complex and the real limits of intervals need to be considered (Gravetter & Wallnau, 2007).

The intervention incorporated a specific psychoeducation component which could be argued as a confounding factor regarding explanations of the intervention's effects. For example, there may have been a differential effect regarding the action of martial arts training versus the role of psychoeducation. However, while it is important to note this issue, the inclusion of group-based psychoeducation is consistent with the delivery of traditional martial arts training. Hence, it is argued that this issue is of minor significance and is not a confounding

factor in the study. It should also be noted that the study was not able to control for physical activities or sports participation outside the program.

Finally, from an epistemological perspective it should be noted that researcher bias is potentially an issue. The author has had extensive training as a martial artist. From a carnal-sociological perspective, however, possessing a relevant background results in deeper knowledge and understanding of the research, while also providing face validity in delivering the study's intervention. Further, in terms of scientific objectivity:

- (a) the dual role of researcher and martial arts practitioner was disclosed at the ethics approval stage, during recruitment of participants, and for reporting of results;
- (b) the study employed rigorous scientific methodology including using a randomised controlled trial, blinded assignment of participants to the experimental or control groups, and standardised assessment measures; and,
- (c) the research design, intervention implementation, and analysis of results was scrutinised by multiple parties, including higher degree research supervisors, ethics approval committees, clinical trial registration, and peer review of articles already published from the study.

While the issue of researcher bias can never be wholly eliminated, this study has taken significant steps to address this issue.

5.11 Conclusion

This study provides robust evidence that martial arts training improves wellbeing and mental health outcomes associated with psychological strengths. Mental health is a significant social problem and is a prevalent issue among Australian youth. Given the large economic costs associated with mental health (AGPC, 2020; WHO, 2016), it is crucial to establish efficacious and engaging programs to address mental health, both generally and specifically regarding

youth. Addressing mental health is extremely important from the perspective of United Nation's Sustainable Development Goals (2015), as the costs associated with mental health are projected to increase 240% between 2016-2030 (WHO, 2016).

Psychological research of the martial arts has been limited (Moore et al., 2019a) and while often reporting positive results the research base examining the psychological effects of martial arts training has significant methodological problems that limit the generalisability of findings (Tsang et al., 2008; Vertonghen & Theeboom, 2010). This study sought to address many of the limitations of previous studies and focused on whether martial arts training developed psychological strengths (i.e., resilience and self-efficacy), promoting mental health within the context of improving psychological well-being (WHO, 2018).

The study delivered a bespoke martial arts-based intervention that incorporated a psychoeducational component. The intervention was a 10-week program, which was delivered by a registered psychologist and trained martial artist, and completed by 243 participants. The intervention was assessed using a randomised controlled trial and used standardised psychometric measures to assess the intervention's mental health outcomes, which were analysed using quantitative procedures.

The study's results clearly show that martial arts-based interventions can improve wellbeing in terms of the psychological strengths of resilience and self-efficacy. Resilience was the strongest outcome at post-intervention, while self-efficacy was the strongest outcome at follow-up. However, mental health difficulties did not appear to improve from participating in the intervention, although this may be explained by sample and scale issues. Generally, demographic factors did not significantly affect the study's outcomes and it was especially encouraging that gender did not affect measured outcomes. However, SES appeared to moderate the effects of the intervention, which is likely to be associated with mental health literacy, attitudes towards mental health treatment, and intervention compliance. Intervention

fidelity appeared to be high which suggests the intervention successfully engaged participants. Overall, the results provide robust evidence that martial arts training improves wellbeing and mental health outcomes associated with psychological strengths.

The mental health of Australian adolescents is arguably in crisis (Australian Broadcasting Corporation, 2019; Special Broadcasting Service, 2018). However, many barriers impede access to mental health support resulting in large numbers of Australian adolescents assessed as having mental health problems not accessing mental health services (Lawrence et al., 2015). The current study found that martial arts-based interventions have the potential to promote adolescent wellbeing by using physical activity as “a hook” (Hartmann, 2003, p. 124) to deliver a psychosocial intervention in school-based settings. Martial arts training can improve psychological strengths such as resilience and self-efficacy, and when delivered in association with mental health professionals martial arts-based interventions are an efficacious psychosocial treatment that should be used as a complementary approach to promote mental health and wellbeing.

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APPENDIX A

Table A1. *Studies examining the effects of martial arts training on mental health*

Author	Design ^a	Sample	Study Description	Setting	Dose	Outcome	Outcome	Theory ^b
Year, Country					(wks)	Domain	Measure	
Bjorkqvist et al. (2001) Finland	CT	<i>n</i> = 319, mean age = 24.5 yrs (male), 23.3 yrs (female)	Convenience sample. MA ^c : karate, wrestling, boxing. Questionnaire post dose.	Sports club	104	Aggression	Attitudes to Violent Conflict Resolution Scale (Varhama, 1997)	x
Chou et al. (2004) China	RCT	<i>n</i> = 14, mean age = 72.6 yrs	Intervention. MA: tai-chi. Questionnaire pre & post dose.	Outpatient clinic	12	Internalising ^d , Wellbeing	Centre for Epidemiological Studies Depression Scale (Radloff, 1977)	x
Daniels et al. (1990) United Kingdom	CT	<i>n</i> = 90, mean age range = 19.9 yrs to 22.6 yrs	Convenience sample. MA: karate, ju-jitsu. Questionnaire post dose.	Sports club	Not stated	Aggression	Buss-Durkee Hostility Inventory (Buss & Durkee, 1957)	✓
Delva-Tauiliili (1995) United States	CT	<i>n</i> = 42, age range = 9 yrs to 12 yrs	Intervention. MA: aikido. Questionnaire pre & post dose.	School	2.5	Aggression, wellbeing	Teacher Self-control Rating Scale (Humphey, 1982)	x

Finkenberg (1990) United States	CT	$n = 100$, mean age = 22.61 yrs (intervention), 22.94 yrs (control)	Intervention. MA: taekwondo. Questionnaire pre & post dose.	College	18	Wellbeing	Tennessee Self-concept Scale (Roid & Fitts, 1989)	x
Layton (1990) United Kingdom	PP	$n = 93$, age range = 16 yrs to 53 yrs	Convenience sample. MA: karate. Questionnaire post dose.	Sports club	Not stated	Internalising	State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)	x
Li et al. (2004) United States	RCT	$n = 118$, mean age = 75.30 yrs (intervention), 75.45 yrs (control)	Intervention. MA: tai-chi. Questionnaire pre & post dose.	Community	24	Wellbeing	Centre for Epidemiological Studies Depression Scale (Radloff, 1977)	x
Milligan et al. (2016) Canada	CT	$n = 35$, mean age = 14.94 yrs	Intervention. MA: Integra MMA™. Questionnaire pre & post dose.	School	20	Wellbeing	MMA questionnaire (Milligan et. al., 2016)	√

Reishehrei et al. (2014) Iran	CT	$n = 357$, mean age = 21.77 yrs	Convenience sample. MA: Not stated. Questionnaire post dose.	Sports club	Not stated	Wellbeing	Self-efficacy Scale (Bandura, 1977)	✓
Reynes et al. (2004) France	CT	$n = 99$, age range = 8 yrs to 10 yrs	Intervention. MA: judo, karate. Questionnaire pre & post dose.	Sports club	104	Aggression	Buss-Perry Aggression Questionnaire (Buss & Perry, 1992)	x
Skeleton et al. (1991) United States	PP	$n = 68$, age range = 6 yrs to 11 yrs	Convenience sample. MA: Taekwondo. Questionnaire post dose.	Sports club	Not stated	Aggression	Child Behaviour Checklist (Achenbach, 1981)	x
Vertonghen et al. (2014) Belgium, Korea	PP	$n = 477$, mean age = 14.0 yrs	Convenience sample. MA: aikido, judo, kick boxing, karate. Questionnaire post dose.	Sports club	Not stated	Aggression, internalising	Buss-Perry Aggression Questionnaire (Buss & Perry, 1992) Strengths and Difficulties Questionnaire (Goodman, 1997)	x
Twemlow et al. (2008)	CT	$n = 254$, age range = 8 yrs to 11 yrs	Intervention.	School	26	Aggression	Bully-Victim Questionnaire	x

United States			MA: Gentle Warrior Program.				(Dill, Vernberg, Fonagy, Twemlow & Gamm, 2004)	
			Questionnaire pre & post dose.					
Wargo et al. (2007)	PP	<i>n</i> = 39, mean age = 33.7 yrs (beginners), 38.3 yrs (experts)	Convenience sample. MA: karate, taekwondo. Questionnaire post dose.	Sports club	Not stated	Internalising	Minnesota Multiphasic Personality Inventory 2 nd Edition (Butcher, Dahlstrom, Graham, Tellegen, Kaemmer, 1989)	✓

Note. ^aCT = controlled trial, PP = pre-test/post-test, RCT = randomised controlled trial; ^bstudy included explicit theoretical orientation; ^cMA = martial art;

^dinternalising = internalising mental health

Table A2. *Methodological quality assessment items (Adapted from van Sluijs et al 2007)*

Item	Description
A	Key baseline characteristics are presented separately for treatment groups (age, and one relevant outcome (aggression, internalising mental health issues, or wellbeing) and for randomised controlled trials and controlled trials, positive if baseline outcomes were statistically tested and results of tests were provided.
B	Randomisation procedure clearly and explicitly described and adequately carried out (generation of allocation sequence, allocation concealment and implementation).
C	Validated measures of aggression, internalising mental health issues, and wellbeing (validation in same age group reported and/or cited).
D	Drop out reported and $\leq 20\%$ for < 6 -month follow-up or $\leq 30\%$ for ≥ 6 -month follow-up.
E	Blinded outcome variable assessments.
F	Aggression, internalising mental health issues, and wellbeing assessed a minimum of 6 months after pre-test.
G	Intention to treat analysis for martial arts training and outcomes related to mental health (i.e., aggression, internalising mental health issues, and wellbeing). Participants analysed in group they were originally allocated to, and participants not excluded from analyses because of non-compliance to treatment or because of some missing data.
H	Potential confounders accounted for in outcome analysis (e.g., baseline score, group/cluster, age).
I	Summary results for each group + treatment effect (difference between groups) + its precision (e.g., 95% confidence interval).
J	Power calculation reported, and the study was adequately powered to detect hypothesized relationships.

Table A3. *Methodological quality and risk of bias assessment*

Paper author/year	Assessment items											No. of criteria met
	A	B	C	D	E	F	G	H	I	J		
Randomised controlled trial												
Chou et al (2004)	✓	✓	✓	x	x	x	✓	✓	✓	x	6	
Li et al (2004)	✓	✓	✓	✓	x	✓	✓	✓	✓	x	8	
Controlled trial												
Bjorkqvist et al (2001)	✓	x	✓	x	x	x	✓	✓	✓	x	5	
Daniels et al (1990)	✓	x	✓	x	x	x	✓	✓	✓	x	5	
Delva-Tauiiili (1995)	✓	x	✓	x	x	x	✓	✓	x	x	4	
Finkenberg (1990)	✓	x	✓	x	x	x	✓	x	x	x	3	
Milligan et al (2016)	✓	x	✓	✓	x	x	✓	✓	✓	x	6	
Reishehrei et al (2014)	✓	x	✓	x	x	x	✓	x	✓	x	4	
Reynes et al (2004)	✓	x	✓	✓	x	✓	✓	x	✓	x	6	
Twemlow et al (2008)	✓	x	✓	x	x	✓	✓	✓	✓	x	6	
Pre-test/post-test												
Layton (1990)	✓	x	✓	x	x	x	✓	x	✓	x	4	
Skeleton et al (1991)	✓	x	✓	x	x	x	✓	✓	✓	x	5	
Vertonghen et al (2014)	✓	x	✓	x	x	x	✓	✓	✓	x	5	
Wargo et al (2007)	✓	x	✓	x	x	✓	✓	x	✓	x	5	

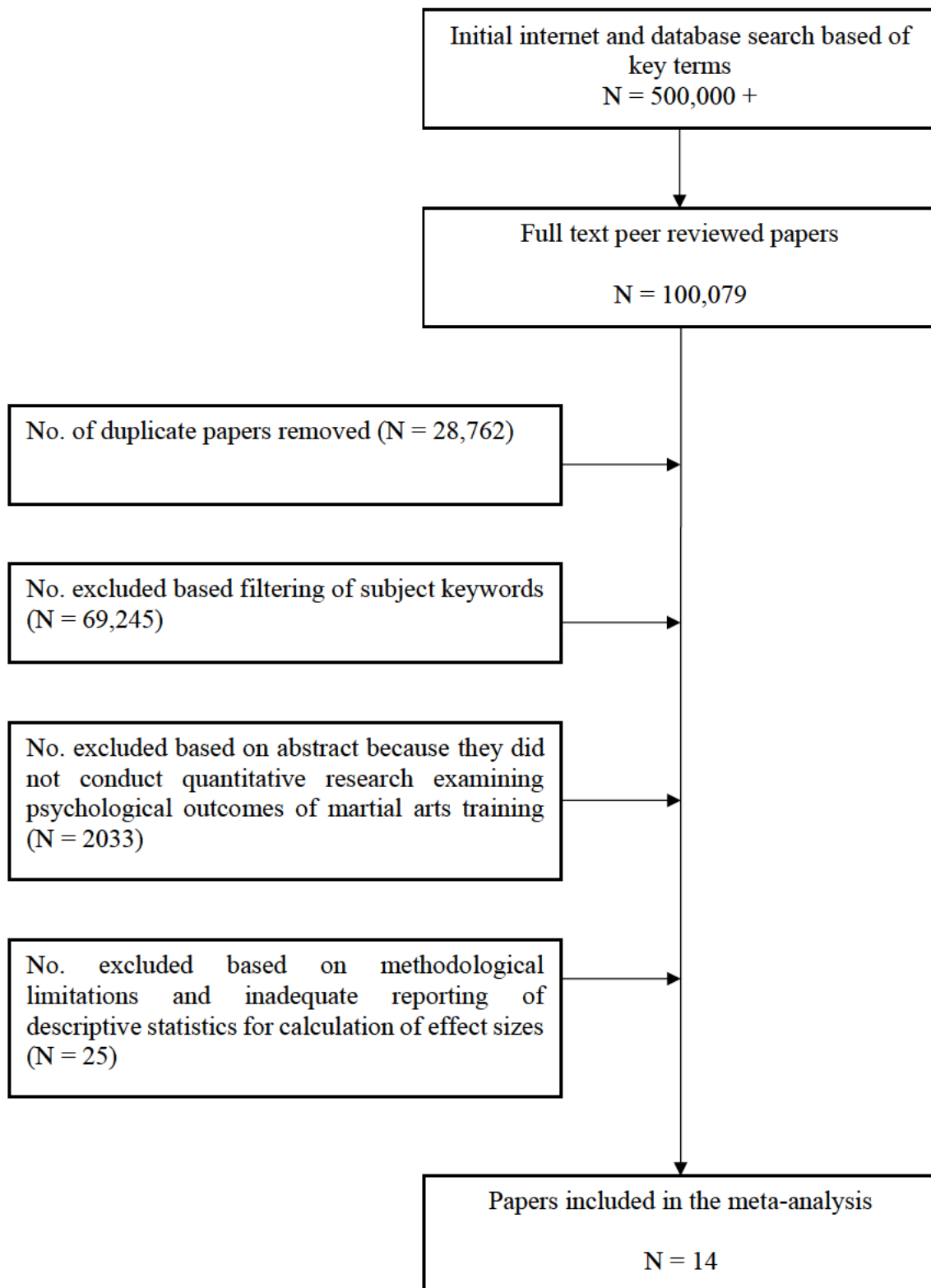
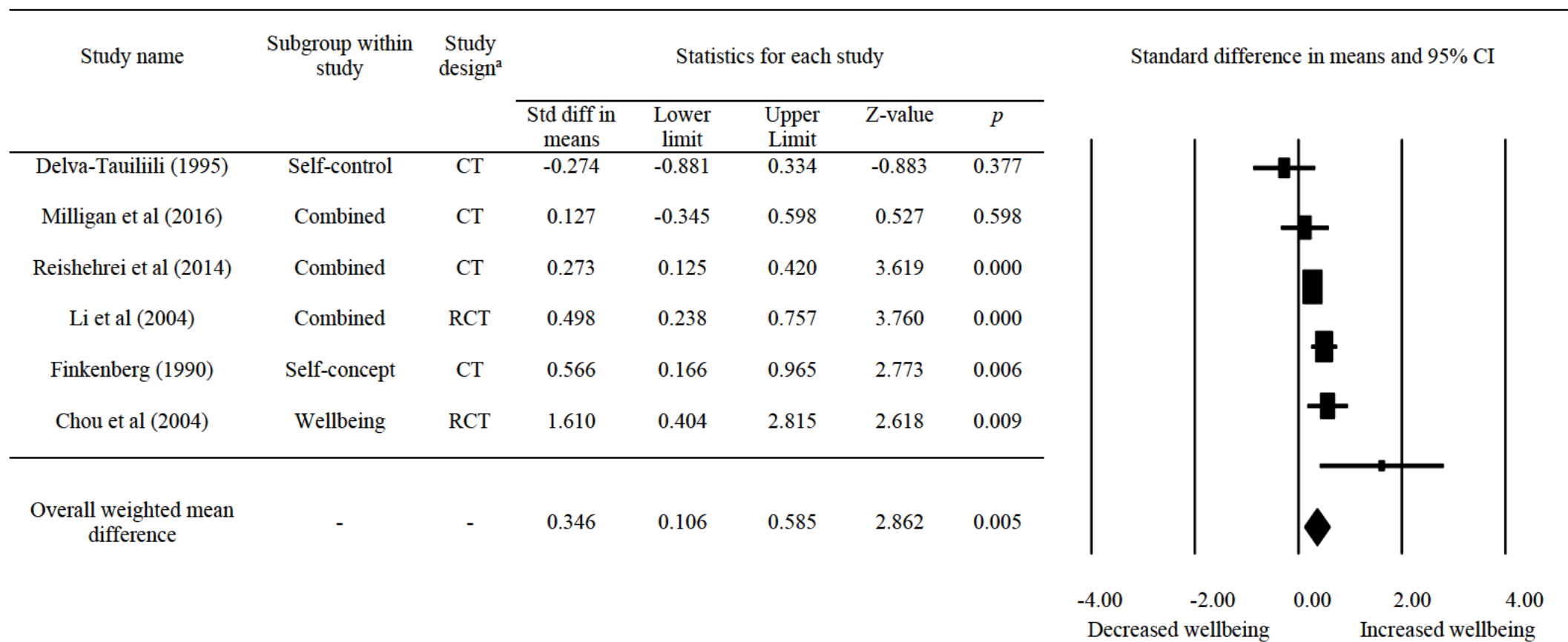
Figure A1. *Flowchart of study selection*

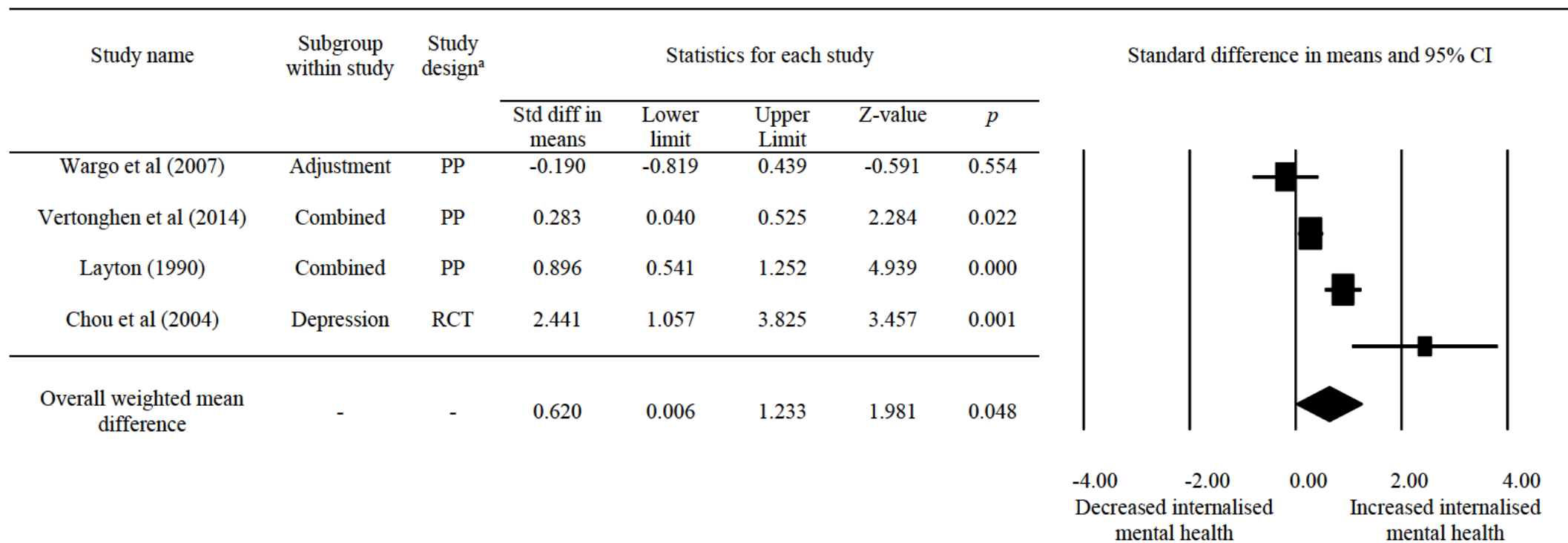
Table A4. Forest plot of effects of martial arts training on wellbeing



Note. $Q = 12.349$; $df = 5$; $p < 0.03$; $I^2 = 59.51\%$.

^aCT = controlled trial, RCT = randomised controlled trial.

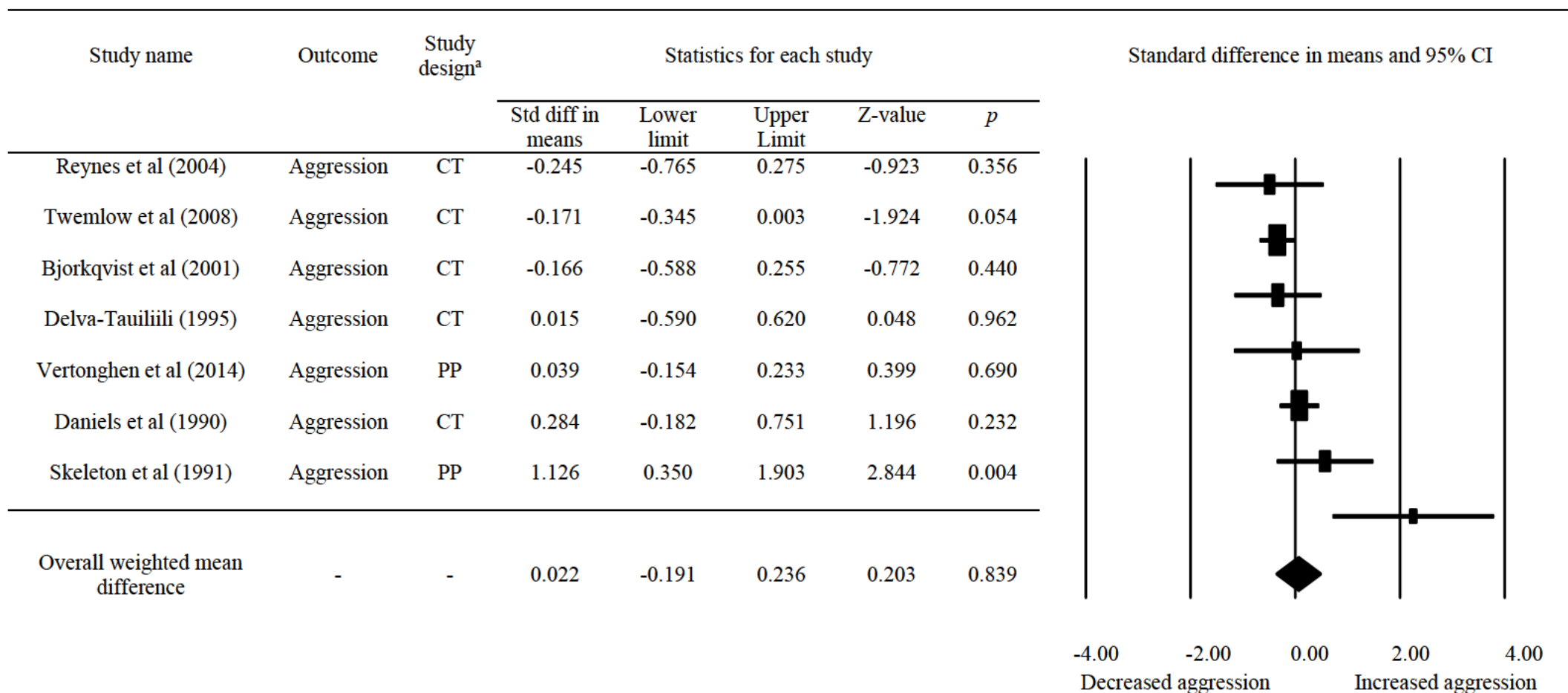
Table A5. Forest plot of effects of martial arts training on internalising mental health issues



Note. $Q = 19.793$; $df = 3$; $p < 0.001$; $I^2 = 84.84\%$.

^aCT = controlled trial, PP = pre-test/post-test.

Table A6. Forest plot of effects of martial arts training in reducing aggression



Note. $Q = 14.322$; $df = 6$; $p = 0.03$; $I^2 = 58.12\%$.

^aCT = controlled trial, PP = pre-test/post-test.

APPENDIX B

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-Chancellor

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MACQUARIE
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<http://www.research.mq.edu.au>

CRICOS Provider No 00002J

14 December 2017

Dear Dr Woodcock,

Reference No: 5201700901

Title: *"Wellbeing Warriors: Mental Health and the Martial Arts"*

Thank you for submitting the above application for ethical and scientific review. Your application was considered by the Macquarie University Human Research Ethics Committee (HREC (Human Sciences & Humanities)).

I am pleased to advise that ethical and scientific approval has been granted for this project to be conducted by:

- Macquarie University

This research meets the requirements set out in the *National Statement on Ethical Conduct in Human Research* (2007 – Updated May 2015) (the *National Statement*).

Standard Conditions of Approval:

1. Continuing compliance with the requirements of the *National Statement*, which is available at the following website:

<http://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research>

2. This approval is valid for five (5) years, subject to the submission of annual reports. Please submit your reports on the anniversary of the approval for this protocol.

3. All adverse events, including events which might affect the continued ethical and scientific acceptability of the project, must be reported to the HREC within 72 hours.

4. Proposed changes to the protocol and associated documents must be submitted to the Committee for approval before implementation.

It is the responsibility of the Chief investigator to retain a copy of all documentation related to this project and to forward a copy of this approval letter to all personnel listed on the project.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email ethics.secretariat@mq.edu.au

The HREC (Human Sciences and Humanities) Terms of Reference and Standard Operating Procedures are available from the Research Office website at:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics

The HREC (Human Sciences and Humanities) wishes you every success in your research.

Yours sincerely

Dr Karolyn White

Director, Research Ethics & Integrity,

Chair, Human Research Ethics Committee (Human Sciences and Humanities)

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research* (2007) and the *CPMP/ICH Note for Guidance on Good Clinical Practice*.

Details of this approval are as follows:

Approval Date: 5 December 2017

The following documentation has been reviewed and approved by the HREC (Human Sciences & Humanities):

Documents reviewed	Version no.	Date
Macquarie University Ethics Application Form		Received 23/08/2017
Response addressing the issues raised by the HREC		Received 25/10/2017, 21/11/2017, 29/11/2017
Participant Information and Consent Forms:	1	29/11/2017
✦ Screening Assessment		
✦ Group 1		
✦ Group 2		
Questionnaires:	1	23/08/2017
✦ Screening Test		
✦ Pre-test Questionnaire		
✦ Post-test Questionnaire		
✦ Follow-up Questionnaire		

***If the document has no version date listed one will be created for you. Please ensure the footer of these documents are updated to include this version date to ensure ongoing version control.**

Mr Brian Moore
Balaclava Road
Macquarie University NSW 2109

DOC18/257488
SERAP 2017541

Dear Mr Moore

I refer to your application to conduct a research project in NSW government schools entitled *Wellbeing warriors: Mental health and the martial arts*. I am pleased to inform you that your application has been approved.

You may contact principals of the nominated schools to seek their participation. **You should include a copy of this letter with the documents you send to principals.**

This approval will remain valid until 07-Dec-2018.

The following researchers or research assistants have fulfilled the Working with Children screening requirements to interact with or observe children for the purposes of this research for the period indicated:

Researcher name	WWCC	WWCC expires
Brian Moore	WWC1182862E	02-Dec-2021

I draw your attention to the following requirements for all researchers in NSW government schools:

- The privacy of participants is to be protected as per the NSW Privacy and Personal Information Protection Act 1998.
- School principals have the right to withdraw the school from the study at any time. The approval of the principal for the specific method of gathering information must also be sought.
- The privacy of the school and the students is to be protected.
- The participation of teachers and students must be voluntary and must be at the school's convenience.
- Any proposal to publish the outcomes of the study should be discussed with the research approvals officer before publication proceeds.
- All conditions attached to the approval must be complied with.

When your study is completed please email your report to: serap@det.nsw.edu.au You may also be asked to present on the findings of your research.

I wish you every success with your research.

Yours sincerely

Elsa Lat
**R/Director, School Policy and
Information Management** 6 April 2018



**School Policy and Information Management
NSW Department of Education**

Level 1, 1 Oxford Street, Darlinghurst NSW 2010 – Locked Bag 53, Darlinghurst NSW 1300

Telephone: 02 9244 5060 – Email: serap@det.nsw.edu.au



Brian Moore

Macquarie University
Faculty of Human Sciences
Balaclava Rd
Macquarie University NSW 2109
M: 0427 095 993
E: brian.moore1@students.mq.edu.au

28th March, 2018

Dear Brian,

Thank you for your Application to Conduct Research entitled: *Wellbeing Warriors: Mental health and the martial arts*, with schools under the auspices of Catholic Education, Diocese of Parramatta (CEDP).

This research has been approved.

This letter approves you and/or your research team to approach the principals of identified schools in the Parramatta Diocese.

Please note the following points in relation to the research request:

1. This approval letter must accompany any approach by your team to a school principal
2. It is the school principal who will provide final permission for research to be carried out in the school
3. Confidentiality needs to be observed in reporting and must comply with the requirements of the Commonwealth Privacy Amendment (Private Sector) Act 2000.
4. Feedback should be provided to schools and a copy of the findings of the research forwarded to the email address shown below.

I look forward to the results of this study and wish you the best over the coming months. If you would like to discuss any aspect of this research in our diocese, please do not hesitate to contact me on [REDACTED]

Yours sincerely,

Mr Patrick Barrett

Manager of Programs (Special Purpose)



Abstract

Society views the relationship between the martial arts and mental health in divergent terms, with perspectives ranging from martial arts practice promoting well-being, to increasing aggression and hostility. The relationship has received little academic attention, and the existing research seems contradictory and inconclusive, largely due to methodological limitations. The proposed research aims to develop the understanding of this relationship by examining up to 300 adolescents participating in a 10-week Taekwondo based therapeutic program, conceptualised within the framework of the salutogenic health model and social cognitive theory. Intervention outcomes will be examined using a quantitative study design, incorporating experimental and longitudinal parameters.

Ethics Approval

Human Research Ethics Committee (Macquarie University)

Approval Date: Valid to 14/12/2022

Reference: HREC 5201700901

Schools

- All Diocesan schools

Working With Children Check

Surname	Moore
First Name	Brian
WWC number	WWC1182862E
Expiry	12/2/2021



MACQUARIE
University

Brian Moore <brian.moore1@students.mq

info@actr.org.au

To:

Dear Brian Moore,

Re: Wellbeing warriors: Examining the effects of martial art training on mental health outcomes for secondary school students

Thank you for submitting the above trial for inclusion in the Australian New Zealand Clinical Trials Registry (ANZCTR).

Your trial has now been successfully registered and allocated the ACTRN:

ACTRN12618001405202

Web address of your trial: <http://www.ANZCTR.org.au/ACTRN12618001405202.aspx>

Date submitted: 18/08/2018 4:44:48 PM

Date registered: 21/08/2018 9:14:14 AM

Registered by: Brian Moore

Principal Investigator: Brian Moore

****Please note that as your trial was registered after the first participant was enrolled, it does not fulfil the criteria for prospective registration and will therefore be marked as being Retrospectively Registered on our website.****

If you have already obtained Ethics approval for your trial, please send a copy of at least one Ethics Committee approval letter to info@actr.org.au or by fax to (+61 2) 9565 1863, attention to ANZCTR.

Note that updates should be made to the registration record as soon as any trial information changes or new information becomes available. Updates can be made at any time and the quality and accuracy of the information provided is the responsibility of the trial's primary sponsor or their representative (the registrant). For instructions on how to update please see

<http://www.anzctr.org.au/Support/HowToUpdate.aspx>.

Please also note that the original data lodged at the time of trial registration and the tracked history of any changes made as updates will remain publicly available on the ANZCTR website.

The ANZCTR is recognised as an ICMJE acceptable registry

(<http://www.icmje.org/faq.pdf>) and a Primary Registry in the WHO registry network

(<http://www.who.int/ictp/network/primary/en/index.html>).

If you have any enquiries please send a message to info@actr.org.au or telephone +61 2 9562 5333.

Kind regards,

ANZCTR Staff

T: +61 2 9562 5333

F: +61 2 9565 1863

E: info@actr.org.au

W: www.ANZCTR.org.au



APPENDIX C



Department of Educational Studies
Faculty of Human Sciences
MACQUARIE UNIVERSITY NSW 2109

Phone: +61 (02) 9850 4298

Fax: +61 (02) 9850 8677

March 19, 2019

Dear <Principal>,

We would like to invite your school to participate in an exciting mental health promotion research study during 2018. The study aims to improve resilience and self-efficacy through participation in a school based martial arts therapeutic program. The research study is part of the requirements to complete a Doctor of Philosophy (PhD), and is being run by Mr Brian Moore, who is a registered psychologist, black belt taekwondo instructor, and PhD candidate at Macquarie University. The study is being supervised by Dr Stuart Woodcock and Dr Dean Dudley.

The study intends to recruit up to fifty students aged 11-14 years (Year 7/8 students in 2018) to participate in the program during Term 3 and Term 4, 2018. A random selection strategy will be used to recruit participants. All students in the target age range will be invited to participate in the study. Participants will then be randomly selected from students who consent to the invitation. All students who consent to the invitation will be notified regarding their participation, or if they were not recruited into the study.

Participants will engage in a 10-week school based martial arts therapeutic program during Term 3 or Term 4, 2018. Sessions will occur at school once per week for approximately 45-60 minutes. It is

envisaged the program will take place in the school gym/hall, or another suitable location on school premises. Each session will include:

- (a) physical activities based on a beginner taekwondo curriculum (including warm up exercises and stretching, technique practice, patterns practice, ***no contact sparring*** and meditation), and
- (b) psychological-education delivered as group discussion across a range of topics (respect, identity, values, goal-setting, authority & rules, optimism & hope, self-esteem, negative self-talk, resilience, self-care, caring for others, courage, aggression, peer pressure, responsibility).

Research information/data will be collected three times during the research study: June 2018, September 2018 and December 2018. On each occasion this will involve the participant being withdrawn from class to complete a questionnaire. This should take approximately 30 minutes and is planned to minimise disruption to learning by varying the subject the participant is withdrawn from. All information provided by the participant will be kept confidential except as required by law. A roll will be kept monitoring student attendance, and the school will be immediately notified following program sessions if students have not attended.

As research has found martial arts training is low risk compared to other sports and that most martial arts injuries are minor, anticipated physical risks are low. Further, the NSW Department of Education Martial Arts Policy and Guidelines has been consulted regarding inclusion of specific safety strategies to minimise risk including no physical contact or contact sparring, appropriate stretching, progressive skill development, and ensuring ice and first aid kits are available. While the researchers have developed protocols addressing physical and psychological risk, we will organise to meet with you to define local procedures to follow if concerns arise.

It is anticipated that results of the study will be distributed through: (a) thesis publication in online databases, (b) publication in peer reviewed journals, and (c) presentation of results at conferences. A summary of the study's results will also be provided to the school. The results will not identify individual participants or participating schools, and all information provided by participants will be confidential.

Please note that participation in the study is voluntary and that the participant has the right to discontinue participation at any time during the study.

If you are interested in your school participating in the study or have any questions please direct these to Mr Brian Moore, who can be contacted through: (a) phone [REDACTED] or (b) writing to the below email address. We will contact you approximately 1-2 weeks after receipt of this letter to follow up regarding your interest.

We look forward to working with you in this exciting opportunity to promote mental health.

Warm regards

Mr Brian Moore
Macquarie University

[REDACTED]

Dr Stuart Woodcock
Macquarie University
stuart.woodcock@mq.edu.au

Dr Dean Dudley
Macquarie University
dean.dudley@mq.edu.au

Kids Helpline

- Phone: 1800 55 1800
- Web: kidshelpline.com.au
- Email: counsellor@kidshelpline.com.au



Department of Educational Studies
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MACQUARIE UNIVERSITY NSW 2109

Phone: +61 (02) 9850 4298

Fax: +61 (02) 9850 8677

Dear parent/caregivers,

<School> is participating in an exciting mental health promotion research study during 2018. The study aims to improve resilience and self-efficacy through participation in a school based martial arts therapeutic program. The research study is part of the requirements to complete a Doctor of Philosophy (PhD), and is being run by Mr Brian Moore, who is a registered psychologist, black belt taekwondo instructor, and PhD candidate at Macquarie University. The study is being supervised by Dr Stuart Woodcock and Dr Dean Dudley.

We are currently recruiting students aged 12-14 years (Year 7/8 students in 2018) for the program, and we would like to invite your child to participate.

There is no financial cost for participation, however numbers in the program are limited. Students will be randomly selected to participate in the study from the list of students who consent to this invitation. Please note that participation in the research program is voluntary and that students may discontinue participation in the study at any time.

Participants will engage in a 10-week school based martial arts therapeutic program during Term 3 or Term 4, 2018. Sessions will occur at school once per week for approximately 45-60 minutes. The program will take place in the St Columba's Catholic College gym/hall. Each session will include:

- (a) physical activities based on a beginner taekwondo curriculum (including warm up exercises and stretching, technique practice, patterns practice, ***no contact sparring*** and meditation), and
- (b) psychological-education delivered as group discussion across a range of topics (respect, identity, values, goal-setting, authority & rules, optimism & hope, self-esteem, negative self-talk, resilience, self-care, caring for others, courage, aggression, peer pressure, responsibility).

Research information/data will be collected three times during research study: June 2018, September 2018 and December 2018. On each occasion this will involve your child being withdrawn from class to complete a questionnaire. This should take approximately 30 minutes and is planned to minimise disruption to learning by varying the subject your child is withdrawn from. All information provided by your child will be kept confidential except as required by law. A roll will be kept to monitor student attendance, and the school will be immediately notified following program sessions if students have not attended.

As research has found martial arts training is low risk compared to other sports and that most martial arts injuries are minor, anticipated physical risks are low. Further, the NSW Department of Education Martial Arts Policy and Guidelines has been consulted regarding inclusion of specific safety strategies to minimise risk including no physical contact or contact sparring, appropriate stretching, progressive skill development, and ensuring ice and first aid kits are available. The researchers have met with the school and confirmed risk management procedures if concerns arise.

It is anticipated that results of the study will be distributed through: (a) thesis publication in online databases, (b) publication in peer reviewed journals, and (c) presentation of results at conferences. A summary of the study's results will also be provided to the school. The results will not identify individual participants or participating schools, and all information provided by participants will be confidential.

If you and your child consent to participate in the study please complete the following form. If you have any questions please direct these to Mr Brian Moore, who can be contacted through: (a) phone [REDACTED] (b) writing to the below email address, or (c) via the school.

We look forward to working with you and your child in this exciting opportunity to promote mental health.

Mr Brian Moore
Macquarie University

[REDACTED]

Dr Stuart Woodcock
Macquarie University
 stuart.woodcock@mq.edu.au

Dr Dean Dudley
Macquarie University
 dean.dudley@mq.edu.au

- Web: kidshelpline.com.au
- Email: counsellor@kidshelpline.com.au



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stuart.woodcock@mq.edu.au

Consent Form - Wellbeing Warriors: Mental Health and the Martial Arts

Students name (please print):

Parent/caregiver consent

I consent to <Participant name> participating in the Wellbeing Warriors: Mental Health and the Martial Arts study.

Parent/caregiver's name

Signature

Date

Participant consent

I consent participating in the Wellbeing Warriors: Mental Health and the Martial Arts study.

Participant's name

Signature

Date



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Wellbeing Warriors: Mental Health and the Martial Arts

Dear < Participant name> and parent/caregiver,

< Participant name> has been selected to participate in the Wellbeing Warriors martial arts therapeutic program, during Term 3, 2018.

Sessions will occur at school once per week for approximately 45-60 minutes. The program will take place in the <School name> high school gym/hall. Each session will include:

- (a) physical activities based on a beginner taekwondo curriculum (including warm up exercises and stretching, technique practice, patterns practice, ***no contact sparring*** and meditation), and
- (b) psychological-education delivered as group discussion across a range of topics (respect, identity, values, goal-setting, authority & rules, optimism & hope, self-esteem, negative self-talk, resilience, self-care, caring for others, courage, aggression, peer pressure, responsibility).

Research information/data will be collected three times during research study: April, 2018, July, 2018 and October, 2018. On each occasion this will involve <Participant name> being withdrawn from class to complete a questionnaire. This should take approximately 30 minutes and is planned to minimise disruption to learning by varying the subject <Participant name> is withdrawn from. All information provided by <Participant name> will be kept confidential except as required by law.

Please note that participation in the research program is voluntary and that participants have the right to discontinue participation in the study at any time.

If you have any questions please direct these to Mr Brian Moore, who can be contacted through: (a) phone [REDACTED]

[REDACTED] (b) writing to the below email address, or (c) via the school.

We look forward to working with <Participant name> in this exciting opportunity to promote mental health.

Mr Brian Moore
Macquarie University

[REDACTED]

Dr Stuart Woodcock
Macquarie University
stuart.woodcock@mq.edu.au

Dr Dean Dudley
Macquarie University
dean.dudley@mq.edu.au

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Fax: +61 (02) 9850 8677

Email: stuart.woodcock@mq.edu.au

Wellbeing Warriors: Mental Health and the Martial Arts

Dear < Participant name> and parent/caregiver,

< Participant name> has been selected to participate in the Wellbeing Warriors martial arts therapeutic program, during Term 4, 2018.

Sessions will occur at school once per week for approximately 45-60 minutes. The program will take place in the <School name> high school gym/hall. Each session will include:

- (a) physical activities based on a beginner taekwondo curriculum (including warm up exercises and stretching, technique practice, patterns practice, ***no contact sparring*** and meditation), and
- (b) psychological-education delivered as group discussion across a range of topics (respect, identity, values, goal-setting, authority & rules, optimism & hope, self-esteem, negative self-talk, resilience, self-care, caring for others, courage, aggression, peer pressure, responsibility).

Research information/data will be collected three times during research study: April, 2018, July, 2018 and October, 2018. On each occasion this will involve <Participant name> being withdrawn from class to complete a questionnaire. This should take approximately 30 minutes and is planned to minimise disruption to learning by varying the subject <Participant name> is withdrawn from. All information provided by <Participant name> will be kept confidential except as required by law.

Please note that participation in the research program is voluntary and that participants have the right to discontinue participation in the study at any time.

If you have any questions please direct these to Mr Brian Moore, who can be contacted through: (a) phone [REDACTED] (b) writing to the below email address, or (c) via the school.

We look forward to working with <Participant name> in this exciting opportunity to promote mental health.

Mr Brian Moore

Macquarie University

[REDACTED]

Dr Stuart Woodcock

Macquarie University

stuart.woodcock@mq.edu.au

Dr Dean Dudley

Macquarie University

dean.dudley@mq.edu.au

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Phone: +61 (02) 9850 4298
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Email: stuart.woodcock@mq.edu.au

Wellbeing Warriors: Mental Health and the Martial Arts

Dear <student's name> and parent/caregiver,

Unfortunately, we are unable to offer <student's name> a place in the Wellbeing Warriors martial arts therapeutic program during 2018.

As we indicated previously, students were randomly selected to participate and the number of students able to participate was limited.

If you have any questions please direct these to Mr Brian Moore, who can be contacted through: (a) phone [REDACTED]

[REDACTED] (b) writing to the below email address, or (c) via the school.

We wish you well in the future.

Mr Brian Moore
Macquarie University

[REDACTED]

Dr Stuart Woodcock
Macquarie University
stuart.woodcock@mq.edu.au

Dr Dean Dudley
Macquarie University
dean.dudley@mq.edu.au

Kids Helpline

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- Email: counsellor@kidshelpline.com.au

APPENDIX D

WELLBEING WARRIORS – QUESTIONNAIRE⁹

The following surveys asks a variety of questions about various aspects of your life.

All your answers will be anonymous and confidential.

How old are you (please circle):

12

13

14

What is your biological sex (please circle):

Male

Female

Other

What is the main language that you speak at home?

What is the total number of minutes of vigorous exercise you participate in each day?

What do you think is the recommended daily amount of exercise?

⁹ Baseline coversheet.

WELLBEING WARRIORS – QUESTIONNAIRE¹⁰

The following surveys asks a variety of questions about various aspects of your life.

All your answers will be anonymous and confidential.

How old are you (please circle): 12 13 14

What is your biological sex (please circle): Male Female Other

What is the main language that you speak at home?

What is the total number of minutes of vigorous exercise
you participate in each day?

What do you think is the recommended daily amount of
exercise?

Would you like to continue practising martial arts after
completing the program (please circle):

Yes

No

¹⁰ Post-test coversheet.

WELLBEING WARRIORS – QUESTIONNAIRE¹¹

The following surveys asks a variety of questions about various aspects of your life.

All your answers will be anonymous and confidential.

How old are you (please circle): 12 13 14

What is your biological sex (please circle): Male Female Other

What is the main language that you speak at home?

What is the total number of minutes of vigorous exercise you participate in each day?

What do you think is the recommended daily amount of exercise?

Have you taken up a martial art since completing the program (please circle):

Yes No

If yes, what type (please write):

¹¹ Follow-up coversheet.

CHILD AND YOUTH RESILIENCE MEASURE (CYRM)

To what extent do the sentences below describe you? Circle one answer for each statement.

	Not at all	A little	Somewhat	Quite a bit	A lot
1. I have people I look up to	0	1	2	3	4
2. I cooperate with people around me	0	1	2	3	4
3. Getting an education is important to me	0	1	2	3	4
4. I know how to behave in different social situations	0	1	2	3	4
5. My parent(s)/caregiver(s) watch me closely	0	1	2	3	4
6. My parent(s)/caregiver(s) know a lot about me	0	1	2	3	4
7. If I am hungry, there is enough to eat	0	1	2	3	4
8. I try to finish what I start	0	1	2	3	4
9. Spiritual beliefs are a source of strength for me	0	1	2	3	4
10. I am proud of my ethnic background	0	1	2	3	4
11. People think that I am fun to be with	0	1	2	3	4

12. I talk to my family/caregiver(s) about how I feel	0	1	2	3	4
13. I am able to solve problems without harming myself or others (for example by using drugs and/or being violent)	0	1	2	3	4
14. I feel supported by my friends	0	1	2	3	4
15. I know where to go in my community to get help	0	1	2	3	4
16. I feel I belong at my school	0	1	2	3	4
17. My family stands by me during difficult times	0	1	2	3	4
18. My friends stand by me during difficult times	0	1	2	3	4
19. I am treated fairly in my community	0	1	2	3	4
20. I have opportunities to show others that I am becoming an adult and can act responsibly	0	1	2	3	4
21. I am aware of my own strengths	0	1	2	3	4
22. I participate in organized religious activities	0	1	2	3	4
23. I think it is important to serve my community	0	1	2	3	4
24. I feel safe when I am with my family/caregiver(s)	0	1	2	3	4

25. I have opportunities to develop skills that will be useful later in life (like job skills and skills to care for others)	0	1	2	3	4
26. I enjoy my family's/caregiver's cultural and family traditions	0	1	2	3	4
27. I enjoy my community's traditions	0	1	2	3	4
28. I am proud to be a citizen of _____ (insert country)	0	1	2	3	4

SELF-EFFICACY QUESTIONNAIRE FOR CHILDREN (SEQC)

To what extent do the sentences below describe you? Circle one answer for each statement.

	Not at all	A little	Somewhat	Quite a bit	A lot
1. How well can you get teachers to help you when you get stuck on schoolwork?	0	1	2	3	4
2. How well can you express your opinions when other classmates disagree with you?	0	1	2	3	4
3. How well do you succeed in cheering yourself up when an unpleasant event has happened?	0	1	2	3	4
4. How well can you study when there are other interesting things to do?	0	1	2	3	4
5. How well do you succeed in becoming calm again when you are very scared?	0	1	2	3	4
6. How well can you become friends with other children?	0	1	2	3	4
7. How well can you study a chapter for a test?	0	1	2	3	4
8. How well can you have a chat with an unfamiliar person?	0	1	2	3	4
9. How well can you prevent to become nervous?	0	1	2	3	4
10. How well do you succeed in finishing all your homework every day?	0	1	2	3	4
11. How well can you work in harmony with your classmates?	0	1	2	3	4

12. How well can you control your feelings?	0	1	2	3	4
13. How well can you pay attention during every class?	0	1	2	3	4
14. How well can you tell other children that they are doing something that you don't like?	0	1	2	3	4
15. How well can you give yourself a pep-talk when you feel low?	0	1	2	3	4
16. How well do you succeed in understanding all subjects in school?	0	1	2	3	4
17. How well can you tell a funny event to a group of children?	0	1	2	3	4
18. How well can you tell a friend that you don't feel well?	0	1	2	3	4
19. How well do you succeed in satisfying your parents with your schoolwork?	0	1	2	3	4
20. How well do you succeed in staying friends with other children?	0	1	2	3	4
21. How well do you succeed in suppressing unpleasant thoughts?	0	1	2	3	4
22. How well do you succeed in passing a test?	0	1	2	3	4
23. How well do you succeed in preventing quarrels with other children?	0	1	2	3	4
24. How well do you succeed in not worrying about things that might happen?	0	1	2	3	4

STRENGTHS AND DIFFICULTIES QUESTIONNAIRE (SDQ)

For each item please circle the one answer (not true, a little true, somewhat true, mostly true, and certainly true) that is most right for you during the last six months.

	Not True	Somewhat True	Certainly True
1. I try to be nice to other people. I care about their feelings	0	1	2
2. I am restless, I cannot stay still for long	0	1	2
3. I get a lot of headaches, stomach-aches or sickness	0	1	2
4. I usually share with others, for example CD's, games, food	0	1	2
5. I get very angry and often lose my temper	0	1	2
6. I would rather be alone than with people of my age	0	1	2
7. I usually do as I am told	0	1	2
8. I worry a lot	0	1	2
9. I am helpful if someone is hurt, upset or feeling ill	0	1	2
10. I am constantly fidgeting or squirming	0	1	2
11. I have one good friend or more	0	1	2

12. I fight a lot. I can make other people do what I want	0	1	2
13. I am often unhappy, depressed or tearful	0	1	2
14. Other people my age generally like me	0	1	2
15. I am easily distracted, I find it difficult to concentrate	0	1	2
16. I am nervous in new situations. I easily lose confidence	0	1	2
17. I am kind to younger children	0	1	2
18. I am often accused of lying or cheating	0	1	2
19. Other children or young people pick on me or bully me	0	1	2
20. I often volunteer to help others (parents, teachers, children)	0	1	2
21. I think before I do things	0	1	2
22. I take things that are not mine from home, school or elsewhere	0	1	2
23. I get along better with adults than with people my own age	0	1	2
24. I have many fears, I am easily scared	0	1	2
25. I finish the work I'm doing. My attention is good	0	1	2

APPENDIX E

Table E.1. *Regression model for CRYM individual capacities and resources*

	Individual capacities and resources							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.73*	[2.62, 2.85]	2.76*	[2.61, 2.91]	2.70*	[2.53, 2.88]	2.54*	[2.23, 2.85]
Condition	.24*	[.15, .47]	.23*	[.14, .46]	.24*	[.15, .47]	.25*	[.16, .48]
Gender			-.04	[-.20, .11]	-.05	[-.21, .10]	-.03	[-.19, .12]
Grade					.02	[-.20, .24]	-.02	[-.24, .19]
Age					.07	[-.12, .29]	.02	[-.18, .23]
Language							.01	[-.27, .32]
SES							.25*	[.15, .49]
<i>R</i> ²	.06		.06		.06		.10 [†]	
<i>F</i>	14.08		7.21		3.96		5.31	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p*<.001.

Table E.2. *Regression model for CRYM relationship with primary caregiver*

	Relationship with primary caregiver							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.74**	[2.61, 2.87]	2.70**	[2.54, 2.87]	2.66**	[2.46, 2.86]	2.57**	[2.21, 2.92]
Condition	.29**	[.25, .61]	.29**	[.25, .62]	.30**	[.26, .63]	.31**	[.27, .63]
Gender			.05	[-.11, .24]	.04	[-.12, .24]	.06	[-.09, .27]
Grade					.02	[-.22, .28]	-.01	[-.26, .23]
Age					.04	[-.17, .30]	.002	[-.23, .24]
Language							-.02	[-.40, .29]
SES							.21*	[.12, .50]
<i>R</i> ²	.08		.09		.09		.11 [†]	
<i>F</i>	21.59		11.06		5.69		5.65	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .01. ** *p* < .001.

Table E.3. *Regression model for CRYM contextual factors*

	Contextual factors							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.19**	[2.06, 2.32]	2.18**	[2.02, 2.35]	2.17**	[1.96, 2.37]	2.50**	[2.14, 2.86]
Condition	.29**	[.24, .61]	.29**	[.24, .61]	.29**	[.24, .61]	.29**	[.25, .62]
Gender			.01	[-.17, .19]	.02	[-.16, .20]	.04	[-.12, .24]
Grade					-.08	[-.37, .13]	-.07	[-.37, .14]
Age					.06	[-.15, .33]	.05	[-.17, .31]
Language							-.15*	[-.75, -.06]
SES							.03	[-.15, .24]
<i>R</i> ²	.08		.08		.09		.08 [†]	
<i>F</i>	21.00		10.46		5.44		4.56	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .05. ** *p* < .001.

Table E.4. *Regression model for CRYM total resilience*

	Total Resilience							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.63**	[2.53, 2.72]	2.63**	[2.50, 2.75]	2.58**	[2.43, 2.73]	2.56**	[2.29, 2.82]
Condition	.34**	[.24, .51]	.34**	[.24, .51]	.34**	[.25, .52]	.35**	[.26, .53]
Gender			-.001	[-.13, .13]	-.003	[-.14, .13]	.02	[-.11, .16]
Grade					-.01	[-.20, .17]	-.04	[-.23, .14]
Age					.07	[-.09, .26]	.03	[-.14, .21]
Language							-.04	[-.35, .16]
SES							.21*	[.10, .38]
<i>R</i> ²	.12		.12		.12		.14 [†]	
<i>F</i>	30.34		15.11		7.82		7.29	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .01. ** *p* < .001.

Table E.5. *Regression model for SEQC academic self-efficacy*

	Academic self-efficacy							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.41*	[2.28, 2.54]	2.41*	[2.25, 2.57]	2.42*	[2.22, 2.62]	2.31*	[1.96, 2.66]
Condition	.24*	[.17, .52]	.24*	[.17, .52]	.24*	[.16, .52]	.24*	[.17, .53]
Gender			.00	[-.17, .17]	.00	[-.17, .18]	.01	[-.16, .19]
Grade					.00	[-.24, .24]	-.02	[-.27, .22]
Age					-.01	[-.25, .21]	-.04	[-.28, .18]
Language							.01	[-.30, .37]
SES							.13	[-.00, .38]
R^2	.06		.06		.06		.08	
F	14.79		7.37		3.66		3.13	

Note. Linear regression models. $n=240$. B =standardised beta. CI=confidence interval for B . SES=socio-educational status.

* $p < .001$.

Table E.6. *Regression model for SEQC social self-efficacy*

	Social self-efficacy							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.62**	[2.50, 2.74]	2.67**	[2.51, 2.82]	2.62**	[2.44, 2.81]	2.45**	[2.13, 2.78]
Condition	.18*	[.07, .41]	.17*	[.06, .40]	.18*	[.07, .41]	.18*	[.08, .42]
Gender			-.07	[-.25, .08]	-.07	[-.25, .08]	-.05	[-.23, .10]
Grade					-.03	[-.27, .19]	-.06	[-.32, .14]
Age					.07	[-.12, .32]	.03	[-.18, .25]
Language							.01	[-.29, .34]
SES							.25**	[.16, .51]
R^2	.03		.04		.04		.07 [†]	
F	7.73		4.42		2.40		4.15	

Note. Linear regression models. $n=240$. B =standardised beta. CI =confidence interval for B . SES =socio-educational status. $^{\dagger}R^2$ is adjusted.

* $p < .01$. ** $p < .001$.

Table E.7. *Regression model for SEQC emotional self-efficacy*

	Emotional self-efficacy							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.26**	[2.12, 2.39]	2.32**	[2.15, 2.49]	2.32**	[2.11, 2.53]	2.32**	[1.94, 2.69]
Condition	.24**	[.18, .56]	.23**	[.17, .55]	.23**	[.16, .55]	.24**	[.18, .56]
Gender			-.07	[-.29, .08]	-.07	[-.29, .08]	-.05	[-.26, .12]
Grade					-.02	[-.29, .23]	-.04	[-.33, .19]
Age					.01	[-.23, .26]	-.03	[-.29, .20]
Language							-.05	[-.50, .22]
SES							.19*	[.09, .49]
<i>R</i> ²	.06		.06		.06		.07 [†]	
<i>F</i>	14.44		7.88		3.92		4.02	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .01. ** *p* < .001.

Table E.8. *Regression model for SEQC total self-efficacy*

	Total Self-efficacy							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	2.43*	[2.33, 2.53]	2.46*	[2.33, 2.59]	2.45*	[2.29, 2.60]	2.35*	[2.08, 2.63]
Condition	.27*	[.17, .45]	.27*	[.16, .45]	.27*	[.16, .45]	.27*	[.17, .46]
Gender			-.05	[-.19, .08]	-.05	[-.19, .09]	-.03	[-.17, .11]
Grade					-.03	[-.23, .16]	-.06	[-.26, .12]
Age					.04	[-.14, .22]	-.01	[-.19, .17]
Language							-.01	[-.29, .24]
SES							.23*	[.12, .42]
R^2	.07		.08		.08		.10 [†]	
<i>F</i>	18.69		9.64		4.84		5.53	

Note. Linear regression models. $n=240$. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†] R^2 is adjusted.

* $p < .001$.

Table E.9 Regression model for SDQ emotional difficulties

	Emotional difficulties							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	.73**	[.64, .82]	.67**	[.56, .79]	.60**	[.47, .74]	.55**	[.31, .79]
Condition	-.06	[-.19, .06]	-.05	[-.18, .07]	-.04	[-.16, .09]	-.05	[-.17, .08]
Gender			.11	[-.02, .22]	.09	[-.04, .20]	.06	[-.06, .18]
Grade					.09	[-.08, .26]	.10	[-.06, .27]
Age					.08	[-.08, .24]	.12	[-.04, .28]
Language							.08	[-.10, .37]
SES							-.17*	[-.29, -.03]
<i>R</i> ²	.004		.02		.04		.04 [†]	
<i>F</i>	.93		1.79		2.27		2.62	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .05. ** *p* < .001.

Table E.10. *Regression model for SDQ behavioural difficulties*

	Behaviour Difficulties							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	.63**	[.55, .70]	.65**	[.57, .76]	.65**	[.54, .77]	.63**	[.43, .84]
Condition	.10	[-.02, .19]	.10	[-.03, .18]	.10	[-.03, .19]	.09	[-.03, .18]
Gender			-.09	[-.17, .03]	-.08	[-.16, .04]	-.09	[-.17, .04]
Grade					-.08	[-.21, .07]	-.07	[-.21, .08]
Age					.07	[-.08, .19]	.09	[-.06, .21]
Language							.04	[-.14, .25]
SES							-.08	[-.18, .05]
R^2	.01		.02		.02		.003 [†]	
F	2.51		2.15		1.34		1.13	

Note. Linear regression models. $n=240$. B =standardised beta. CI=confidence interval for B . SES=socio-educational status. [†] R^2 is adjusted.

* $p < .001$.

Table E.11. *Regression model for SDQ total difficulties*

	Total difficulties							
	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95% CI
Constant	.78**	[.73, .82]	.78**	[.72, .83]	.76**	[.69, .83]	.75**	[.63, .87]
Condition	.08	[-.02, .10]	.08	[-.02, .10]	.09	[-.02, .11]	.08	[-.02, .10]
Gender			-.01	[-.06, .06]	-.01	[-.07, .06]	-.04	[-.08, .04]
Grade					-.002	[-.09, .08]	.02	[-.08, .10]
Age					.07	[-.05, .11]	.11	[-.03, .13]
Language							.06	[-.07, .17]
SES							-.18*	[-.15, -.02]
<i>R</i> ²	.01		.01		.02		.02 [†]	
<i>F</i>	1.60		.81		.68		1.61	

Note. Linear regression models. *n*=240. *B*=standardised beta. CI=confidence interval for *B*. SES=socio-educational status. [†]*R*² is adjusted.

* *p* < .01. ** *p* < .001.