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Well-being warriors: A randomized controlled trial examining the effects of martial arts training on secondary students' resilience

Brian Moore*[1], Stuart Woodcock[2] and Dean Dudley[3]

[1]Charles Sturt University, Bathurst, NSW, Australia
[2]Griffith University, Qld, Australia
[3]Macquarie University, NSW, Australia

Background. Mental health problems are a growing and significant issue in the Australian education system. Research has suggested that resilience can be learned and that schools can play an important role in developing resilient skills among youth; however, rigorous evaluation of interventions promoting resilience is limited.

Aims. As martial arts training has been found to have psychological benefits such as increased confidence and self-esteem, this study investigated whether a 10-week martial arts training programme was an efficacious sports-based mental health intervention that promoted resilience in secondary school students.

Sample. Two hundred and eighty-three secondary school students (age range 12–14 years) participated in the study.

Methods. The study examined the effects of martial arts training on participants' resilience by delivering a 10-week martial arts-based intervention in secondary school settings. The intervention was evaluated using quantitative methodology and an experimental research design using a randomized controlled trial which measured participant responses at baseline, post-intervention, and follow-up.

Results. The study found that the martial arts-based intervention had a significantly positive effect on developing students' resilience. This was especially apparent when the intervention and control group's mean resilience outcomes were compared. Resilience outcomes appeared to be stronger immediately following the intervention compared with 12-week follow-up.

Conclusions. Given the prevalence of mental illness among Australian youth, the current study provides robust evidence that students' resilience can be improved using martial arts-based interventions delivered in school settings.

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Mental health problems are a growing social and economic issue. The World Health Organization (WHO) has estimated the annual global cost of mental health problems in 2010 was $USD 2.5 trillion (WHO, 2016), and the annual cost of mental illness in Australia has been estimated at $AUD 60 billion (Australian Government, 2016). These costs are

*Corresponding should be addressed to Brian Moore, Faculty of Arts and Education, School of Teacher Education, Charles Sturt University, Panorama Avenue, Bathurst NSW 2795 Australia (e-mail: brmoore@csu.edu.au).

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projected to increase 240% by 2030 (WHO, 2016). The total prevalence of mental illness in Australian youth aged 4–17 years has been measured at 11.5% for females and 16.3% for males (Lawrence et al., 2015) and is a significant issue in the Australian education system. The New South Wales (NSW) Department of Education (DoE) has increased funding for student well-being by more than $AUD 200 million over the past 3 years (2019). As the former NSW Government's Mental Health Minister Tanya Davies stated, 'schools play a critical role in [providing] ... support to young people' (NSW DoE, 2019), but due to significant economic, structural, and social impediments schools need creative approaches to promote resilience to mental illness.

Models of mental health and resilience

The dominant model of mental health is 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). This model can be defined dichotomously as having a (1) pathological component (deficit model) which refers to the presence or absence of disease-based symptoms such as depression or anxiety; and (2) well-being component (strengths model) which refers to the presence or absence of beneficial mental health characteristics such as resilience. The deficit model is typically considered as the main mental health model (American Psychiatric Association, 2013), while considering mental health from a strengths perspective accords with current psychological trends (Moore & Woodcock, 2017). The dichotomy may also be conceptualized as a continuum (Antonovsky, 1987). This study was particularly interested in the strengths model and examined the well-being characteristics of resilience.

Resilience is a complex construct (Kaplan, 2006) that is often defined as the attainment of positive outcomes despite significant adversity, risk, or stress (Goldstein & Brooks, 2006). This complexity is evident in varying operational definitions of resilience including hardiness, optimism, competence, self-esteem, social skills, achievement, and absence of pathology in the face of adversity (Prince-Embury, 2007). Resilience is typically considered from the strengths-based perspective of mental health (Moore & Woodcock, 2017) and may be a beneficial way to promote mental health by identifying and reproducing the strengths of individuals and communities successfully dealing with adversity (Liebenberg & Ungar, 2009). Resilience can be conceptualized as a multilevel construct that includes (1) protective processes, (2) the interaction of protection and risks, and (3) as conceptual tools in predictive models (Elias, Parker, & Rosenblatt, 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 programmes (Moore & Woodcock, 2017).

This study has defined resilience as the capacity to cope with adversity, risk, or stress and achieve positive outcomes (Goldstein & Brooks, 2006). In addition to examining resilience as an overall construct, the study considered that it was important to examine several underlying features of resilience including (1) achievement and competence (i.e., individual capacities and resources), (2) social skills and family relationships (i.e., relationships with primary caregiver), and (3) broader environmental influences such as cultural background (i.e., contextual factors) (Prince-Embury, 2007; Ungar & Liebenberg, 2011; VicHealth, 2015).

School-based resilience programmes

According to Forbes and Fikretoglu (2018), resilience can be learned and schools have an important role in developing resilient youth. However, resilience research has generally focused on contextual factors such as parent and school relationships. For example, research has found that family factors such as warm relationships and positive home environments are associated with greater resilience (Bowes, Maughan, Caspi, Moffitt, & Arseneault, 2010) and that resilience is promoted by the positive role of a significant other (Gordon & Song, 1994) who individuals can disclose their experiences to (Rivers & Cowie, 2006). While few studies have focused on specific internal attributes or processes that develop resilient youth, specific resilience sub-factors including optimism and trust are suggested as having importance for the development of resilience programmes (Moore & Woodcock, 2017).

School-based resilience programmes are limited within Australia (Massey, 2016) and often appear to be delivered within well-being frameworks. The NSW DoE Wellbeing Framework (2015) is based on themes of being connected, succeeding, and thriving. However, while such frameworks may provide schools with flexibility in promoting well-being characteristics such as resilience, they are not specific resilience-building programmes. School-based resilience programmes typically attempt to build internal coping skills (Martin & Marsh, 2008) or focus on risk versus protective factors in building resilience (McGrath, 2003). However, in an evaluation of 21 resilience interventions, few had been subjected to evaluation or controlled trials (Windle & Salisbury, 2010). Martial arts-based interventions may facilitate development of students' resilience through a specific programme of physical activities and psychoeducation.

Physical activity and mental health

The idea that physical activity promotes mental health is not new. 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).

There is a growing body of evidence that physical activity can have psychological benefits for youth (Dale, Vanderloo, Moore, & Faulkner, 2019; Rodriguez-Ayllon et al., 2019). This includes the positive impact of physical activities on mental health disorders such as anxiety (Lam, Mak, & Lee, 2016) and depression (Mammen & Faulkner, 2013; Rethorst, Greer, & Trivedi, 2016). Similarly, physical activities have been found to positively affect behaviours related to mental health by improving sleep (Youngstedt & Freelove-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).

Some evidence suggests physical activity improves resilience (Ho, Louie, Chow, Wong, & Ip, 2015; Ho et al., 2017). Ho et al., (2017) conducted a randomized controlled trial of 663 secondary students and reported that resilience improved following a physical activity-based intervention. However, while many types of physical activities might be used as a platform for improving mental health outcomes, martial arts training warrants

investigation as a physical activity medium. 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.

Martial arts-based psychosocial interventions

Martial arts training is often associated with promoting psychological benefits such as increased self-esteem and confidence (Daniels & Thornton, 1990), and several authors have suggested martial arts training exhibited similarities to psychological therapy (Burke, Al-Adawi, Lee, & Audette, 2007; Fuller, 1988; Weiser, Kutz, Jacobson, & Weiser, 1995) and may be a useful therapeutic approach (Woodward, 2009). Given its emphasis on respect, self-regulation, and health promotion, martial arts training may be an efficacious complement to psychological therapy where sport provides 'the hook' (Hartmann, 2003, p. 124) with which to deliver psychosocial interventions. Research investigating the psychological effects of martial arts training has often used a bipartite model distinguishing between traditional and modern martial arts (Donohue & Taylor, 1994). Traditional martial arts emphasize the non-aggressive aspects of martial arts including psychological and philosophical development, while modern martial arts emphasize competition and aggression (Twemlow et al., 2008). This study was interested in the traditional martial art's emphasis on health and personal development.

Previous research reported that martial arts training improved different factors associated with psychological strengths, although none examined resilience. A small body of research found that martial arts training improved self-concept (Finkenberg, 1990), self-confidence (Reishehrei, Reishehrei, & Soleimani, 2014), self-efficacy (Ryan, Shirley, Shamay, Karen, & Guo., X., 2015), self-esteem (Trulson, 1986), self-regulation (Milligan et al., 2016), and well-being (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005). However, generally this research exhibited significant methodological problems including conceptual 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 (Vertonghen & Theeboom, 2010).

Aims of the study

The current study investigated whether martial arts training was an efficacious sports-based mental health intervention that promoted resilience in secondary school students. Specifically, the study examined whether participation in a 10-week martial arts-based intervention improved resilience outcomes.

Method

Participants

The sample size required to detect changes in mental health-related outcomes resulting from martial arts training was determined using statistical power calculations. 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 $N = 234$ (intervention group: $n = 117$, control group: $n = 117$). As participant dropout rates of 20% are common in school-based randomized controlled

trials (Wood, White, & Thompson, 2004), the maximum proposed sample size of the study was $N = 293$ (intervention group: $n = 147$, control group: $n = 146$).

Two hundred and eighty-three ($N = 283$) participants from five secondary schools in an urban area of NSW, Australia, were recruited for the study. The mean age of participants was 12.76 ($SD = .68$) years. Sex, age, grade, and language characteristics were self-reported by participants. Socio-economic status (SES) was determined using data from the Australian My School website (Australian Curriculum, Assessment, & Reporting Authority, ACARA, 2018). Table 1 lists demographic information for participants at baseline and follow-up.

The student response rate was 21% (the response rate was calculated based on the numerator being the number of students consenting to participate and the denominator being the total number invited). As noted by Morton, Bandara, Robinson, and Carr (2012), studies with response rates of around 20% are able to yield accurate results, while Holbrook, Krosnick, and Pfent (2007) report that studies with response rates as low as 5% were often only marginally less accurate than studies with higher response rates. It is difficult to make direct comparison to the response rates of similar studies as only 11.5% of school-based interventions report response rates (Blorn-Hoffman et al., 2009), although it is notable that the school-based martial arts intervention conducted by Zivin et al. (2001) reported a student response rate of 6%. Given that the current study's sample contained a relatively even balance for biological sex, included culturally and linguistically diverse participants, and had a relatively even balance for socio-economic status; the student response rate should not impact the study's external validity. The study had a dropout rate of 14% at follow-up assessment.

Study design

The study was a 10-week secondary school-based intervention that was evaluated using a randomized controlled trial. Overall, the study was structured using quantitative

Table 1. Demographic characteristics of sample at baseline and follow-up

	Characteristic	Baseline		Follow-up	
		$N = 283$		$N = 243$	
		n	(%)	*n*	(%)
Sex	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	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-economic status, CALD = culturally and linguistically diverse.

methodology as this approach is effective for assessing intervention efficacy (Creswell, 2009). The other dominant methodological approach was an experimental research design using a randomized controlled trial. This design is highly replicable (Bryman, 2016) and produces results that are more generalizable to the broader population (Bordens & Abbott, 2008). Additionally, the design incorporated longitudinal design elements where the same group of participants were observed repeatedly so that intervention effects could be clearly measured (Field, 2013). Ethics approval was sought and obtained from the relevant ethics committees. The study was registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12618001405202), and the study protocol was also reviewed externally by school psychologists employed by the NSW DoE.

Thirty-five secondary schools were invited to participate in the study. The school response rate was 49%. Schools that expressed interest in participating were contacted in random order (randomization was conducted by a researcher not directly involved with the study who was blinded to school identity). Additionally, randomization was based on cluster sampling using SES to determine the study's cohorts. While ensuring the SES criterion was met, the first five schools that consented were recruited into the study. SES was determined using the Index of Community Socio-educational Advantage (ICSEA) which was reported by 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. ICSEA data have been used as a proxy for SES in this study. Participants were recruited from schools with low (n = 1; ICSEA percentile = 11%), middle (n = 3; ICSEA percentile = 62%[1]), and high (n = 1; ICSEA percentile = 81%) SES, based on school ICSEA indices (ACARA, 2018).

Inclusion criteria for participation in the study included the following: (1) participants were currently enrolled in grades 7 or 8, and (2) participants' age ranged from 12 to 14 years. 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. All students who met these criteria were invited to participate in the study. Participant and caregiver information and consent forms were provided to students.

Researchers conducted baseline assessment at participating schools after the initial recruitment processes. Following baseline assessment participants were randomly assigned to the intervention or control group. Due to the nature of the intervention participants were not blinded to the allocation. Randomization of participants into intervention and control conditions was conducted using bias-coin randomization, which creates comparable groups and prevents bias in the allocation of participants to the study's treatment conditions (Berchialla, Gregori, & Baldi, 2019). Random assignment was completed by one of the researchers who was blinded to participant identity and not directly involved in the intervention delivery. Following random assignment, the intervention group received the intervention after which post-intervention measures assessed the intervention and control groups. A 12-week post-intervention (follow-up) assessment was also conducted. Figure 1 provides a flow chart of the study.

During the study design process, the researchers decided that the control group would receive the same intervention after administration of follow-up measures (i.e., waitlist intervention). This decision was based on ethical and pragmatic grounds. First, as the intervention programme was intended to improve mental health the researchers proposed it was ethically sounder for all participants to receive the intervention rather

[1] *Average ICSEA value for the three included schools.*

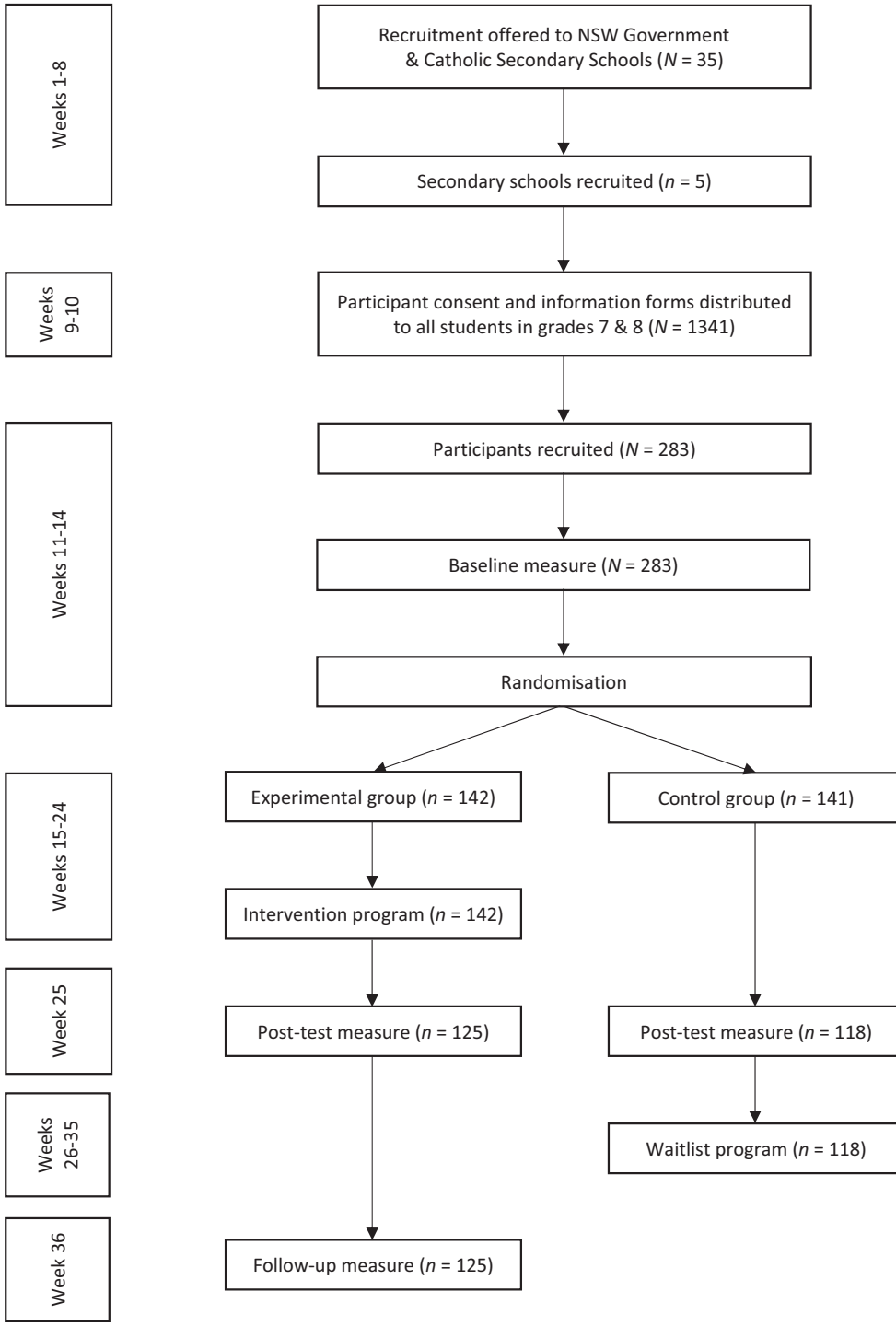

Figure 1. Flowchart of study.

than the control group receiving a placebo, alternate, or no intervention. Consequently, the research design proposed to deliver the intervention to the experimental and control groups while maintaining a valid and reliable study. Second, it was pragmatic to provide the intervention programme to the control group as this arguably provided a greater incentive for schools to participate in the programme and this was used to promote the programme during school recruitment. The study design originally planned to administer follow-up measures 6 month post-intervention. However, this was modified due to administrative delays receiving approval from the NSW DoE to conduct the study. Consequently, the control group received the intervention before follow-up measures were obtained.

The design, conduct, and reporting of this study adhered to the Consolidation Standards of Reporting Trials (CONSORT) guidelines for a randomized controlled trial (Schulz, Altman, & Moher, 2010). Participants and caregivers provided written informed consent.

Intervention programme

The intervention was delivered by a (1) registered psychologist with minimum 6 years of experience as a school psychologist and (2) 2nd Dan/level black-belt taekwondo instructor with minimum 5 years of experience. The intervention included 10 × 50 60-minute sessions, once per week for 10 weeks and was delivered onsite at participating schools using a group format. The sessions were delivered in an appropriate indoor space. Table 2 provides information regarding the basic intervention programme structure.

Each intervention session commenced with a psychoeducation component, which involved facilitator guided group discussion. While group-based discussion is common at the start of martial arts programmes, the study's intervention programme incorporated an explicit psychoeducation component. Topics included respect, goal-setting, self-concept and self-esteem, courage, resilience, bullying and peer pressure, self-care and caring for others, values, and optimism and hope. Although this was a discrete component of the programme, ongoing reference to the ideas discussed during psychoeducation occurred within and across sessions. 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.

Table 2. Well-being warriors: Basic intervention programme structure

Item	Activity	Time (minutes)
1.	Salutation	1
2.	Psychoeducation	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]

Note. [1]5(a). or 5(b). will occur interchangeably during the programme.; [2]Most secondary schools in NSW have lessons between 50 and 60 min; hence, 47 min fits within the school timetable.

The martial arts-based component of the intervention included the following physical activities adapted from taekwondo:

1. Warm-up exercises – Warm-up activities are an important element of any physical exercise as they minimize risk of injury (Woods, Bishop, & Jones, 2007). Active warm-up activities were used including non-specific activities such as jogging and gradual warm-up activities that mimicked subsequent activities in the intervention (Woods et al., 2007). The latter used large muscle groups and gradually increased in intensity;
2. Stretching exercises – Stretching activities are also an important element of physical exercise as they minimize risk of injury (Woods et al., 2007). 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 demonstration and guided practice of various stretches including hamstring, triceps, and quad muscle groups;
3. Traditional martial arts practice – techniques that were taught and practised during the programme included stances, blocks, punching, and kicking:
    a. *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.
    b. *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.
    c. *Punching*[2] was based on traditional martial arts practice. Punching occurred from horse riding stance. Note: 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 important that fingers were not held over thumb).
    d. *Kicking*[2] 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).
4. Meditation – based on breath focusing exercise.

Additionally, after technical practice the following traditional martial arts activities were alternated during the programme:

5. Patterns practice – a pattern is a choreographed sequence of movements consisting of combinations of blocks, punches, and kicks, performed as though defending against imaginary opponents; or
6. Sparring – an activity based on the tai-chi sticking hands exercise was included as an alternative to traditional martial arts sparring. It should be noted that aggressive physical contact was not part of the intervention programme.

The final intervention session concluded the programme with a formal martial arts grading where participants were awarded a yellow belt based upon demonstration of martial arts techniques (stances, blocks, punching, and kicking) and the pattern learnt

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

during the programme. 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 successfully completed the formal grading and were awarded a yellow belt.

Measures

Evaluation of the resilience outcomes for the intervention programme was conducted using the Child and Youth Resilience Measure (CYRM, Ungar & Liebenberg, 2011). The CYRM is a 28-item instrument that measures various aspects of resilience. The primary outcome measured by the CYRM was mean total resilience. Additionally, the CYRM measured the following secondary outcomes: individual capacities and resources, relationships with primary caregivers, and contextual factors. The individual capacities and resources sub-scale have 11 items, the relationships with primary caregivers sub-scale have seven items, and the contextual factors sub-scale have 10 items. The sub-scales are added to compute a total resilience scale. The self-report version of the scale was used which has good internal consistency (Sanders, Munford, Thimasarn-Anwar, & Liebenberg, 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 the following: (1) I have people I look up to and (2) I feel supported by my friends.

Data collection

Data were collected pre-intervention (baseline), post-intervention, and 12-week post-intervention (follow-up). During data collection, participants were withdrawn from regular classes in small groups (baseline), or the groups in which they completed the programme (post-intervention and follow-up). This enabled the researchers to explain and provide assistance while participants completed the questionnaire. Participants were reminded that their answers were confidential and that they could discontinue the questionnaire at any point. Upon completion, participants placed the questionnaire into a locked box to ensure confidentiality.

Data analysis

Statistical analysis was conducted using Statistical Package for the Social Sciences version 25 (IBM SPSS Statistics, 2017), and alpha levels were set at $p < 0.05$.

The collected psychometric test data were consolidated into sub-scale variables using factor analysis and the internal consistency of each variable was examined to determine reliability. Items to be included in the scale variables were added to create composite scores for baseline, post-intervention, and follow-up data. Multivariate analysis of variance (MANOVA) and repeated-measures analysis of variance (ANOVA) were used to examine participants' responses. The programme's effect on resilience outcomes was evaluated by examining mean differences between the intervention and control groups, and comparing observed effect sizes to effect sizes reported by previous research (Pogrow, 2019; Thompson, 2007). Regression was used to provide a more detailed analysis of the relationship between the demographic characteristics of the sample and the study's resilience outcomes. Analysis was based on the principle of intention to treat.

Table 3. Internal consistency for CYRM across baseline, post-intervention, and follow-up measures

Sub-scale	Condition	Alpha	No. items
Individual	Baseline	.83	12
	Post-test	.87	12
	Follow-up	.85	12
Relation	Baseline	.80	6
	Post-test	.81	6
	Follow-up	.75	6
Context	Baseline	.73	6
	Post-test	.74	6
	Follow-up	.73	6
Total	Baseline	.89	28
	Post-test	.91	28
	Follow-up	.89	28

Results

Factor analysis

During factor analysis, the CYRM converged in three factors. Table 3 reports baseline, post-intervention, and follow-up internal consistency for the CYRM. For the individual capacities and resources sub-scale 12 factors converged across baseline, post-intervention, and follow-up measures. Items 8 and 25 did not converge during factor analysis and were discarded from the sub-scale. Additionally, items 16, 19, and 28 converged during factor analysis and were included in the sub-scale. Internal consistency for the sub-scale was good (e.g., >.70). 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. Internal consistency for the sub-scale was good. For the contextual factors, sub-scale items 1, 3, 16, 19, and 28 did not converge across baseline, post-intervention, and follow-up measures and were discarded from the sub-scale. Additionally, item 26 converged during factor analysis and was included in the sub-scale. Internal consistency for the sub-scale was good. Internal consistency for the CYRM total resilience scale was good across baseline, post-intervention, and follow-up measures.

Comparison of intervention and control group's resilience

MANOVAs were used to examine the effects of participation in the 10-week martial arts-based intervention and facilitated comparison of these effects between the intervention and control groups across baseline and post-intervention conditions. The intervention improved levels of the overall resilience and resilience sub-factors. Means and standard deviations are summarized in Table 4, and mean differences and confidence intervals are reported in Table 5.

Individual capacities and resources: Using Pillai's trace, the intervention condition had a significant effect on participants' individual capacities and resources, $V = .10$, $F(2, 239) = 13.02$, $p = .000$, $\eta_p^2 = .10$[3]. Separate univariate ANOVAs revealed no significant difference between the intervention and control groups at baseline, $F(1, 240) = 3.52$,

[3] *Cohen* d *effect sizes have also been calculated and are available in Appendix 1.*

Table 4. Means and standard deviations for intervention and control groups across CYRM baseline and post-intervention conditions

		Baseline		Post-intervention	
Scale	Condition	*M*	*SD*	*M*	*SD*
Individual	Intervention	2.88	.65	3.04	.56
	Control	3.03	.59	2.73	.70
Relations	Intervention	3.12	.70	3.18	.65
	Control	3.05	.73	2.73	.78
Context	Intervention	2.50	.76	2.62	.72
	Control	2.38	.77	2.18	.71
Total Resilience	Intervention	2.89	.52	3.01	.44
	Control	2.90	.56	2.62	.61

Table 5. Mean differences and confidence intervals comparing intervention to control groups across CYRM baseline and post-intervention conditions

				95% CI	
Scale	Condition	Mean difference	*SE*	Lower	Upper
Individual	Baseline	−.15	.08	−.31	.01
	Post-intervention	.31*	.08	.15	.47
Relations	Baseline	.07	.09	−.11	.25
	Post-intervention	.44*	.09	.26	.62
Context	Baseline	.12	.10	−.08	.31
	Post-intervention	.43*	.09	.25	.62
Total Resilience	Baseline	−.01	.07	−.15	.12
	Post-intervention	.39*	.07	.25	.52

Note. Significance has used Bonferroni adjustment for multiple comparisons.
*The mean difference is significant at the .05 level.

$p = .06$, $\eta_p^2 = .01$; however, there was a significant difference in favour of the intervention group post-intervention, $F(1, 240) = 14.97$, $p = .000$, $\eta_p^2 = .06$.

Relationship with primary caregiver: Using Pillai's trace, the intervention condition had a significant effect on participants' relationship with primary caregiver, $V = .09$, $F(2, 239) = 11.81$, $p = .000$, $\eta_p^2 = .09$. Separate univariate ANOVAs revealed no significant difference between the intervention and control groups at baseline, $F(1, 240) = .61$, $p = .44$, $\eta_p^2 = .003$; however, there was a significant difference in favour of the intervention group post-intervention, $F(1, 240) = 23.17$, $p = .000$, $\eta_p^2 = .09$.

Contextual factors: Using Pillai's trace, the intervention condition had a significant effect on participants' contextual factors, $V = .09$, $F(2, 239) = 11.98$, $p = .000$, $\eta_p^2 = .09$. Separate univariate ANOVAs revealed no significant difference between the intervention and control groups at baseline, $F(1, 240) = 1.39$, $p = .24$, $\eta_p^2 = .006$; however, there was a significant difference in favour of the intervention group post-intervention, $F(1, 240) = 22.03$, $p = .000$, $\eta_p^2 = .08$.

Total resilience: Using Pillai's trace, the intervention condition had a significant effect on participants' total resilience, $V = .13$, $F(2, 239) = 18.48$, $p = .000$, $\eta_p^2 = .13$. Separate

univariate ANOVAs revealed no significant difference between the intervention and control groups at baseline, $F(1, 240) = .04$, $p = .84$, $\eta_p^2 = .000$; however, there was a significant difference in favour of the intervention group post-intervention, $F(1, 240) = 31.96$, $p = .000$, $\eta_p^2 = .12$.

Intervention groups' resilience at baseline, post-intervention, and follow-up

Repeated-measures ANOVA was used to examine the effects of participation in the 10-week martial arts-based intervention and facilitated analysis of these effects for the intervention group across baseline, post-intervention, and follow-up conditions. For this analysis, baseline data for the intervention group have been used as the control and serve as a basis for comparison. The intervention improved levels of the overall resilience and resilience sub-factors. Means and standard deviations are summarized in Table 6, and mean differences and confidence intervals are reported in Table 7.

Individual capacities and resources: Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 14.61$, $p = .001$; therefore, degrees of freedom were corrected using Huynh–Feldt estimates of sphericity ($\varepsilon = .91$). The results showed that martial arts training had a significant effect on participants' individual capacities and resources, $F(1.82, 224.13) = 9.51$, $p = .000$, $\eta_p^2 = .07$. Contrasts revealed a significant baseline–post-intervention effect, $F(1, 123) = 8.53$, $p = .004$, $\eta_p^2 = .07$, and a non-significant post-intervention follow-up effect $F(1, 123) = 3.56$, $p = .06$, $\eta_p^2 = .03$.

Relationship with primary caregiver: Mauchly's test indicated that the assumption of sphericity was satisfied, $\chi^2(2) = 2.47$, $p = .29$. The results showed that martial arts training did not have a significant effect on participants' relationship with primary caregiver, $F(2, 246) = 1.21$, $p = .30$, $\eta_p^2 = .01$. Contrasts revealed a non-significant baseline–post-intervention effect, $F(1, 123) = 0.59$, $p = .45$, $\eta_p^2 = .005$, and a non-significant post-intervention follow-up effect $F(1, 123) = 0.65$, $p = .42$, $\eta_p^2 = .005$.

Contextual factors: Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 16.67$, $p = .000$; therefore, degrees of freedom were corrected using Huynh–Feldt estimates of sphericity ($\varepsilon = .90$). The results showed that martial arts training had a significant effect on participants' contextual factors, $F(1.80, 221.10) = 5.86$, $p = .005$, $\eta_p^2 = .05$. Contrasts revealed a non-significant baseline–post-intervention effect, $F(1, 123) = 3.11$, $p = .08$, $\eta_p^2 = .03$, and a non-significant post-intervention–follow-up effect, $F(1, 123) = 3.21$, $p = .08$, $\eta_p^2 = .03$.

Total resilience: Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 14.35$, $p = .001$; therefore, degrees of freedom were corrected using

Table 6. Means and standard deviations for the intervention group across CYRM baseline, post-intervention, and follow-up conditions

	Baseline		Post-intervention		Follow-up	
Scale	*M*	*SD*	*M*	*SD*	*M*	*SD*
Individual	2.88	.65	3.04	.56	3.17	.57
Relations	3.12	.70	3.18	.65	3.24	.61
Context	2.50	.77	2.62	.72	2.78	.74
Total resilience	2.89	.52	3.01	.44	3.12	.48

Table 7. Mean differences and confidence intervals for the intervention group across CYRM baseline, post-intervention, and follow-up conditions

Scale	Condition		Mean difference	*SE*	95% CI[a] Lower	Upper
Individual	Post	Base	.16*	.05	.03	.29
	FU	Base	.28*	.07	.11	.46
	FU	Post	.13	.07	−.04	.29
Relations	Post	Base	.06	.07	−.12	.23
	FU	Base	.12	.08	−.07	.31
	FU	Post	.07	.08	−.13	.26
Context	Post	Base	.12	.07	−.04	.28
	FU	Base	.28*	.09	.07	.49
	FU	Post	.16	.09	−.06	.39
Total Resilience	Post	Base	.12*	.05	.01	.23
	FU	Base	.23*	.06	.09	.38
	FU	Post	.11	.06	−.03	.25

Note. Base = baseline, Post = post-intervention, FU = follow-up.
[a]Confidence intervals used Bonferroni adjustment for multiple comparisons.; *The mean difference is significant at the .05 level.

Huynh–Feldt estimates of sphericity (ε = .91). The results showed that martial arts training had a significant effect on participants' total resilience, $F(1.83, 224.52) = 9.25$, $p = .000$, $\eta_p^2 = .07$. Contrasts revealed a significant baseline–post-intervention effect, $F(1, 123) = 7.34$, $p = .008$, $\eta_p^2 = .06$, and a non-significant post-intervention follow-up effect, $F(1, 123) = 3.92$, $p = .05$, $\eta_p^2 = .03$.

The effect of demographic co-variates on resilience outcomes

Regression analysis was used to examine the effect of demographic co-variates on resilience outcomes arising from participation in the 10-week martial arts-based intervention. This was examined using post-intervention data. A pattern of regression predictors was observed across the regression models for resilience. 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 (1) SES; or (2) 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 (1) individual capacities and resources, $F(6, 233) = 5.31$, $p < .001$, $R^2 = .10$, adding statistically to the prediction for this sub-scale, $B = .25$, $p < .001$; (2) 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 (3) 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 summarizing the regression models for resilience are reported in Appendix 2.

Discussion

The study found that the martial arts-based intervention had a positive effect on developing students' resilience. This was especially apparent when the intervention and control group's mean resilience outcomes were compared. Resilience outcomes appeared to be stronger immediately following the intervention compared to 12-week follow-up.

Resilience outcomes: Intervention compared to control group

The intervention group's reported levels of the overall resilience and resilience sub-factors significantly improved post-intervention compared to the control group. The largest observed effect sizes were reported for total resilience. Further, significant post-intervention difference in means was found comparing the intervention group and control group for total resilience and the resilience sub-scales. The largest mean difference post-intervention was observed for the relationship with primary caregiver sub-scale.

Previous research of the effect martial arts training on psychological strengths has not specifically considered resilience outcomes. However, broadly the results are consistent with previous research finding that martial arts training was associated with improving psychological strengths (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005; Milligan et al., 2016; Trulson, 1986). Compared to meta-analytic data reporting the overall weighted mean difference for martial arts training and well-being (Moore, Dudley, & Woodcock, 2020), the current intervention reported greater post-intervention differences in mean for relationship with primary caregiver, contextual factors, and total resilience, while individual capacities and resources were slightly poorer. The results indicate that the martial arts-based training programme used for the intervention positively affected participants' resilience outcomes.

Resilience outcomes: Intervention group across baseline, post-intervention, and follow-up

The intervention group exhibited several statistically significant changes across baseline, post-intervention, and follow-up measures. Total resilience had a significant post-intervention effect and was the strongest resilience outcome. The individual capacities and resources sub-scale were significant at post-intervention, but not significant at follow-up. Neither the post-intervention or follow-up condition was statistically significant for the relationship with primary caregiver sub-scale or contextual factors sub-scale.

Examination of the differences in means for total resilience and resilience sub-scales indicates that all the resilience scales improved at post-intervention and follow-up. The strongest improvements were observed when comparing baseline to follow-up differences in means, which were observed for the individual capacities and resources sub-scale, contextual factors sub-scale, and total resilience scale. The individual capacities and resources sub-scale and total resilience scale also exhibited significant improvements when comparing baseline to post-intervention differences in means.

Broadly, these results are consistent with previous research finding that martial arts training improved psychological strengths (Jansen & Dahmen-Zimmer, 2012; Matsumoto & Konno, 2005; Milligan et al., 2016; Trulson, 1986). Compared to meta-analytic data reporting the overall weighted mean difference for martial arts training and well-being (Moore et al., 2020), the differences in total resilience and resilience sub-scale means for the intervention group at post-intervention and follow-up were generally smaller, although only slightly for the strongest observed improvements when comparing baseline to follow-up differences in means.

Resilience outcomes: The effect of demographic co-variates

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 co-variates. However, socio-educational status broadly and consistently affected the mental health outcomes from the intervention, where higher SES appeared to be related to better mental health outcomes, while language background predicted responses to the contextual factors resilience sub-scale. While the effect of demographic co-variates on mental health outcomes resulting from martial arts training has received little attention in previous research, these results support previous research finding no significant differences between genders (Vertonghen, Theeboom, & Pieter, 2014).

Explanation of intervention effects

Martial arts training clearly improved the intervention group's reported levels of resilience. However, the quantitative design of the study only allows for speculation regarding the causal mechanisms associated with the intervention effects. Resilience is a complex construct and there are many elements in the intervention programme incorporated from resilience literature that could result in improving resilience outcomes. These include changing negative scripts, establishing realistic goals, encouraging participants to learn from mistakes, and encouraging problem solving and self-discipline (Brooks, 2006). Additionally, the development of an in-group identity (Kurzban & Leary, 2001) and group superordinate goals (Sherif et al., 1961) may have strengthened the intervention effect as participants in the intervention programme functioned as a distinct group within school-based settings.

Additionally, it is notable that resilience was measured as having a stronger intervention effect when the intervention group was compared to the control group, which contrasted with the intervention group's resilience outcomes that incorporated follow-up measures. This suggests the intervention effect regarding resilience was stronger post-intervention. However, the reported baseline to follow-up mean differences from the repeated-measures analysis suggests the intervention effect for resilience was maintained at follow-up which is a positive result. Further, 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 carers is often focused on in resilience literature (Bowes et al., 2010; Gordon & Song, 1994); however, this was the weakest intervention effect in the study. This may 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 programme's focus on skill development

which is consistent with research regarding the importance of mastery in resilience development (Prince-Embury, 2007).

While language background predicted responses to the contextual factors resilience sub-scale, 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 programme 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 resilience 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, Bartels, Cardenas, Dhaliwal, & Alegría, 2012) and more positive attitudes towards mental health treatment (Villatoro, Mays, Ponce, & Aneshensel, 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 programme 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 programme 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.

Practical significance of findings

The study's results are generally positive regarding martial arts training improving overall resilience and related sub-factors. However, interpreting the results based upon the social science convention of reporting effect sizes and standardized thresholds may lead to questions regarding the practical significance of the findings. Two related issues should be considered regarding this.

First, while the study has followed social science convention and reported effect sizes, it is important to note that large effect sizes do not necessarily correlate with clinical or practical importance (Bordens & Abbott, 2008). For example, school-based universal prevention programmes frequently report small effect sizes, and these small effects can yield large impacts (Prentice & Miller, 1992) that produce meaningful improvements at the population level (Werner-Siedler, Perry, Calear, Newby, & Christensen, 2017). This highlights the importance of context when interpreting results, rather than focusing on standardized thresholds.

Second, while the use and reporting of effect sizes have become a standard in the social sciences, relying on effect size to determine the effectiveness and practical significance of interventions may be problematic and misleading (Field, 2013; Pogrow, 2019; Wasserstein, Schirm, & Lazar, 2019). While the use of thresholds to evaluate effect size has been proposed (e.g., Richardson, 2011) and is commonly employed in the social sciences, this approach has similar limitations to the use of thresholds regarding statistical significance. An alternative and potentially more meaningful approach is to compare a study's observed effect sizes to the effect sizes reported by previous research (Pogrow, 2019; Thompson, 2007).

Limitations and future research

While the study addressed many of the limitations evident in previous research, the study was limited by several issues. As the study's age range is restricted, the results may not generalize to the broader population. Future research should examine a broader population sample. The study did not obtain third party corroboration of self-report measures. Third-party measures should be considered for future research. As the study did not include a qualitative component, the causal mechanisms underlying the resilience outcomes are unclear. Future research should include a qualitative research component to explore this. Lack of participant blinding may have overestimated the programme's treatment effect. This should be considered during the design of future research. Psychoeducation and martial arts training were presented as part of a single intervention programme; hence, it was not possible to separate their effects. However, it is arguable that combined psychoeducation and martial arts training is consistent with the practice of many traditional martial arts; hence, this issue may only have superficial significance. Finally, in its current format the sustainability of the intervention is questionable. Future research should develop a teacher professional learning programme based on the study's intervention programme to create a sustainable school-based resilience programme.

Implications for practice

Given the prevalence of mental illness in Australian youth, martial arts-based programmes could be used as an engaging preventative mental health approach across education systems. While research has suggested that resilience can be learned, school-based resilience programmes are limited within Australia. The current study provides robust evidence that students' resilience can be improved using martial arts-based interventions delivered in school settings. This provides an opportunity for school psychologists to develop similar bespoke programmes, which could either be delivered personally or collaboratively within the education system. This potentially raises the school-based profile of the school psychologist and can facilitate engagement with clients who might avoid conventional *therapy*.

Conclusion

Mental health is a significant social and economic problem, and given the prevalence of mental illness among Australian youth is a serious issue for the Australian education system. The study provides robust evidence that martial arts training promotes resilience and is an effective approach for developing positive youth mental health. This is important as efficacious resilience-building programmes can help address the crisis of mental illness within the education system and broader community.

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Author contributions

Brian Moore (Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Writing – original draft; Writing – review & editing) Stuart Woodcock

(Supervision; Writing – review & editing) Dean Dudley (Supervision; Writing – review & editing).

Conflict of interest

All authors declare no conflict of interest.

Data availability statement

The datasets used and analysed during the current study will be available from the corresponding author on reasonable request.

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Appendix 1: Effect size conversion: Partial eta squared (η_p^2) to Cohen's *d*

During peer review of this manuscript, reviewers requested the addition of Cohen's *d* effect size to supplement partial eta squared (η_p^2). It should be noted that the calculation of Cohen's *d* occurred post hoc, using a discrete effect size calculator (https://www.psychometrica.de/effect_size.html).

Table A1. Comparison of intervention and control group's resilience: Effect size conversion

Scale/sub-scale	Condition	η_p^2	*d*
Individual capacities and resources	Total	.10	.47
	Baseline	.01	.24
	Post-intervention	.06	.50
Relationship with primary caregiver	Total	.09	.44
	Baseline	.003	.10
	Post-intervention	.09	.62
Contextual factors	Total	.09	.45
	Baseline	.006	.15
	Post-intervention	.08	.61
Total resilience	Total	.13	.55
	Baseline	.000	.03
	Post-intervention	.12	.73

Table A2. Intervention groups' resilience at baseline, post-intervention, and follow-up: Effect size conversion

Scale/sub-scale	Condition	η_p^2	*d*
Individual capacities and resources	Total	.07	.49
	Baseline to Post-	.07	.37
	Post to Follow-up	.03	.24
Relationship with primary caregiver	Total	.01	.19
	Baseline to Post-	.005	.14
	Post to Follow-up	.005	.10
Contextual factors	Total	.05	.39
	Baseline to Post-	.03	.22
	Post to Follow-up	.03	.23
Total resilience	Total	.07	.48
	Baseline to Post-	.06	.34
	Post to Follow-up	.03	.25

Note. Post- = Post-intervention.

Appendix 2: Resilience regression models

Table B1. Regression model for CRYM individual capacities and resources

	Individual capacities and resources							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	*B*	95% CI	*B*	95% CI	*B*	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]
R^2	.06		.06		.06		.10†	
F	14.08		7.21		3.96		5.31	

Note. Linear regression models. $n = 240$.
B = standardized beta; CI = confidence interval for *B*; SES = socio-educational status.
*$p < .001$.; †R^2 is adjusted.

Table B2. Regression model for CRYM relationship with primary caregiver

	Relationship with primary caregiver							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	*B*	95% CI	*B*	95% CI	*B*	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]
R^2	.08		.09		.09		.11†	
F	21.59		11.06		5.69		5.65	

Note. Linear regression models. $n = 240$.
B = standardized beta; CI = confidence interval for *B*; SES = socio-educational status.
*$p < .01$.; **$p < .001$.; $^{\dagger}R^2$ is adjusted.

Table B3. Regression model for CRYM contextual factors

	Contextual factors							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	*B*	95% CI	*B*	95% CI	*B*	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]
R^2	.08		.08		.09		.08†	
F	21.00		10.46		5.44		4.56	

Note. Linear regression models. $n = 240$.
B = standardized beta; CI = confidence interval for *B*; SES = socio-educational status.
*$p < .05$.; **$p < .001$.; $^{\dagger}R^2$ is adjusted.

Table B4. Regression model for CRYM total resilience

	Total Resilience							
	Model 1		Model 2		Model 3 Model 3		Model 4	
	B	95% CI	*B*	95% CI	*B*	95% CI	*B*	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]
R^2	.12		.12		.12		.14†	
F	30.34		15.11		7.82		7.29	

Note. Linear regression models. $n = 240$.
B = standardized beta; CI = confidence interval for *B*; SES = socio-educational status.
*$p < .01$.; **$p < .001$.; $^{\dagger}R^2$ is adjusted.