

## Article

# The Effects of a Martial Arts-Based Intervention on Secondary School Students' Self-Efficacy: A Randomised Controlled Trial

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**Abstract:** Physical activities are generally accepted as promoting important psychological benefits. However, studies examining martial arts as a form of physical activity and mental health have exhibited many methodological limitations in the past. Additionally, recent philosophical discussion has debated whether martial arts training promotes psychological wellbeing or illness. Self-efficacy has an important relationship with mental health and may be an important mechanism underpinning the potential of martial arts training to promote mental health. This study examined the effect of martial arts training on the psychological construct of self-efficacy. A total of 283 secondary school students with a mean age of 12.76 ( $SD = 0.68$ ) years were recruited to complete a time-limited (10-session) martial arts intervention, which was examined using a randomised controlled trial. Univariate ANOVAs found that the intervention improved the experimental group's self-efficacy compared to the control group, which was sustained at follow-up. Regression analysis indicated that socio-educational status moderated this outcome. These findings support the martial arts-based intervention's potential to improve self-efficacy and promote wellbeing through physical activity. Martial arts training may be an efficacious psychosocial treatment that can be used as a complementary approach to promote mental health.

**Keywords:** mental health; martial arts; self-efficacy; psychological strengths; wellbeing



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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 [1]. 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 16% for males and 13% for females [2], which rises sharply in later adolescence, peaking at approximately 27% of people aged 18 to 19 years meeting the diagnostic criteria for a serious mental illness [3]. This presents a significant public health burden [4]. However, only 30% of Australian adolescents aged 13 to 17 years report using formal services for mental health problems [5].

Self-efficacy has an important relationship with mental health [6,7]. Lower self-efficacy is associated with higher levels of distress and mental health problems among students [7,8], while higher self-efficacy is associated with better mental health [9]. Although the relationship is not clearly understood, self-efficacy appears to predict physical activity among adolescents [10]. Given that physical activities are generally accepted as promoting mental health [11], activities that promote self-efficacy may have mental health benefits. Limited previous research has found that martial arts training improves both mental health [12] and self-efficacy [13–15]. This study aimed to examine the potential of martial arts training as a complementary psychosocial approach to improve adolescent self-efficacy.

## 1. Developing Self-Efficacy through Martial Arts Training: Philosophical and Psychological Considerations

Martial arts have been characterised as containing internal and external philosophies [16]. Internal philosophies are typically values-based and include sporting character, honour and responsibility, pacifism, nationalism and sacrifice, and civic responsibility [16]. Various external philosophies, religions, and ethical systems have also been applied to martial arts. For example, Zen and Taoism are linked with Aikido, Judo, Karate, and Kendo [17]. Notably, concepts associated with Zen and Taoism such as stillness and mindfulness are readily linked with modern notions of wellness [17]. From a philosophical perspective, it has been proposed that martial arts can promote a sense of mastery and accomplishment through providing opportunities for self-improvement [18]. This is an important observation given Bandura's [19] view that mastery experience has a significant influence on self-efficacy.

Self-efficacy is a component of social cognitive theory and refers to the extent to which an individual believes that they can perform a behaviour required to produce a particular outcome [19]. Limited previous research has found a positive association between higher self-efficacy and martial arts training. Bodin and Martinsen [13] conducted a randomised controlled trial of 12 clinically depressed participants who completed exercise sessions using martial arts and a stationary bike activity. The authors reported that martial arts activities increased participants' self-efficacy and positive affect, as well as reduced negative affect and anxiety, while noting no changes for the stationary bike activity. A controlled trial comparing a small group of geriatric participants ( $n = 12$ ) reported improved self-efficacy after training in a Chinese martial art [15]. Another study using a correlational design examined a group of 167 Iranian martial artists and reported greater self-confidence and self-efficacy compared to non-martial artists [14]. However, as with other research examining mental health and martial arts, these studies are significantly limited by a small sample size or weaker (i.e., correlational) research design.

Self-efficacy may be an important mechanism underpinning the potential of martial arts training to promote mental health. Several subfactors are conceptualised as contributing to self-efficacy: mastery experience, vicarious experience, social or verbal persuasion, and emotional arousal [20]. Mastery experience refers to judgments of competence based on previous attainment in a related task; vicarious experience refers to the observation of another person's attainment in a related task; social or verbal persuasion refers to feedback, judgments, and appraisals provided by significant others about engaging in the task; and emotional arousal describes the emotion or physical sensation one experiences while performing a particular task [21]. Bandura noted the differential effect of these subfactors and suggested that mastery experience may have the strongest impact on self-efficacy [19].

Martial arts training arguably utilises mastery experience, vicarious experience, social or verbal persuasion, and emotional arousal as core aspects of instruction. In particular, mastery is proposed as an important characteristic underpinning the potential effects of martial arts training. Traditional martial arts emphasise mastering techniques [22]. Technical practice refers to the basic elements of martial arts training [23], which includes stances, blocks, punching, and kicking. Developing mastery of these techniques is a significant aspect of the study's intervention and is proposed as a causal mechanism affecting the study's self-efficacy outcomes.

## 2. Martial Arts and Mental Health

How the term *martial arts* is defined and understood is complex, 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 a socially constructed behaviour based on physical activity, refers to the skills and practices that originated as methods of combat or self-defence [24], and incorporates a psychological health dimension [12,25,26].

Popular perceptions of the martial arts vary dramatically [27]. One popular stereotype is that martial arts training improves mental health [12], while another refers to violent

depictions of the martial arts in the media [28] and is concerned that martial arts training increases aggressive behaviour. Notably, this dichotomy has been debated by philosophers in recent years especially in terms of whether martial arts training (a) promotes psychological wellness or illness, or (b) creates social benefit or harm [29]. Some of the philosophical critiques regarding martial arts have validity. For example, it appears that historical sources ignoring an explicit evidence base have been used to validate nationalistic narratives linking specific martial arts to national identity [30].

However, the philosophical positioning of martial arts as an inherently violent activity that is completely distinct from sport [31] arguably ignores the complexity of definitions and theoretical frameworks that can be applied to the martial arts [32]. According to the seminal work of Donohue and Taylor [16], there is no standard theoretical framework or classification of the martial arts. One approach that has been applied to the study of mental health outcomes arising from martial arts training is the bipartite model. The bipartite model is a classification system that may have evolved from the Japanese terms *jutsu* and *do*, which can be respectively translated as “art” and “way” (p. 29) [16]. In this context, the term martial arts can be applied to systems of combat and self-defence, while the term martial ways is associated with systems of combat but have a primary goal of psychological and personal development [33]. Research using the bipartite model distinguishes traditional martial arts training from modern martial arts training. Traditional martial arts typically emphasise the nonaggressive aspects of martial arts including psychological and philosophical components, while modern martial arts emphasise competition and aggression [34]. Given the wide variety of different martial arts systems, it is important to understand distinctions across these systems. For example, while krav maga may be characterised by aggressive behaviour [35], taekwondo is primarily a sport [36] that has limited potential to cause physical damage [30].

Few mental health professionals have considered using the martial arts to promote mental health and wellbeing [37], and the effect of martial arts on psychological and mental health outcomes has not been extensively examined. Martial arts training has been reported as improving various characteristics associated with mental health including anxiety, depression, self-concept, and self-esteem [27].

Some research has found that martial arts training reduced symptoms associated with anxiety. For example, training in tai-chi has been found to reduce anxiety in a geriatric population compared to a nontreatment condition [38]. Similar reductions have been associated with karate training [39], and a study examining populations exhibiting problematic behaviour profiles found significantly reduced anxiety following a 6 month taekwondo program [26]. However, while the study conducted by Li et al. [38] 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 [39] were based on a correlational design which precludes a casual understanding of whether martial arts training reduces anxiety.

Other research has found that 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 [40], training in tai-chi was found to reduce depression in a geriatric population compared to a nontreatment condition [41], and a study examining taekwondo found that participants exhibited improved mood immediately following martial arts training [42]. However, these studies also exhibited design limitations. For example, the results reported by McGowan and Jordan [40] were based on correlational data, while the results reported by Chou et al. [41] were obtained from a controlled trial of 14 participants using quantitative survey method.

Martial arts training has been reported as improving self-concept and self-esteem. 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 8 weeks [43]. In an earlier controlled trial, 34 adolescent males exhibiting problematic behaviour profiles reported increased self-esteem following a 6 month taekwondo program [26]. However,

given that both studies used quantitative survey methods, a lack of randomised design and small sample sizes significantly limit the external validity of these findings. Furthermore, Trulson's [26] study exhibited significant methodological concerns regarding deception and power dynamics.

According to Vertonghen and Theeboom [27], the studies reporting on the psychological outcomes from martial arts training mostly report positive effects, while few studies report negative effects (e.g., Endresen and Olweus [44]). Although this may reflect a genuine positive outcome, the issue of possible bias should be considered. This is especially pertinent given the research base considering the psychological impacts of martial arts has serious methodological issues limiting the validity and generalisability of reported findings [45]. These include conceptual and definitional issues, predominant use of cross-sectional designs, small sample size, reliance on self-report measures without third-party corroboration, self-selection effects, limited use of follow-up measures, not accounting for gender differences, and issues controlling for the role of the instructor [27,45].

### 3. Delivering a Martial Arts-Based Psychosocial Intervention in Schools

As noted, approximately one in seven Australian youths experience mental health disorders [1], but only 30% of Australian adolescents aged 13 to 17 years report using formal services for mental health problems [5]. Various barriers limit the impact of these services, including stigma [46], expense [47], poor mental health literacy [5], and service accessibility [48]. In this context, school-based mental health services have significant potential to alleviate these barriers as the school system provides a "natural and accessible" way to address the mental health issues of students (p. 32) [4].

Furthermore, physical activity could provide "a hook" (p. 124) [49] to attract young people to integrated physical activity-based psychosocial interventions [50] and may be a relatively simple and inexpensive way of improving mental health [51]. 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.

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. Martial arts training may achieve therapeutic goals through physical activity [52]. Previous studies reported that martial arts training improves mental health outcomes [43, 53–57]; however, as noted, this research had significant limitations. Traditional martial arts training is a unique form of physical activity that incorporates mechanisms that parallel mental health interventions [12,28,52,57]. These include emphasising personal and philosophical development, developing respect for others, and reinforcing appropriate behaviour [55]. Martial arts training has potential as a school-based approach to mental health service by providing universal and targeted mental health programs that develop psychological strengths such as self-efficacy.

The authors of this study previously published results reporting that martial arts training delivered in school settings promoted adolescents' resilience [58]. These results arose from the same intervention trial that the current self-efficacy study is based on. While self-efficacy and resilience are both related to mental health, they are discrete constructs. As noted, self-efficacy involves a person's belief in their capacity to produce a particular outcome. Compared with this, resilience is more complex to define [59]. Operational definitions of resilience include hardiness, optimism, competence, self-esteem, social skills, achievement, and absence of pathology in the face of adversity [60]. As such, this paper's examination of the impact of school-based martial arts training on self-efficacy is a novel contribution to the literature beyond previous work.

### 4. Aims of the Study

This study investigated the extent to which martial arts-based psychosocial interventions are an efficacious strategy to improve adolescent self-efficacy in secondary school-

based settings. The study examined the following research questions: (1) To what extent does participation in a 10 week traditional martial arts-based intervention affect adolescents' self-efficacy at post-intervention and follow-up? (2) To what extent did demographic covariates affect adolescents' self-efficacy outcomes?

## 5. Methods

### 5.1. Participants

Participants ( $N = 283$ ) were recruited across five urban secondary schools in New South Wales, Australia, with ages ranging from 12 to 14 years ( $M = 12.76$ ,  $SD = 0.68$ ). Demographic information was self-reported including gender (male,  $n = 136$ ; female,  $n = 143$ ; nonbinary,  $n = 4^1$ ), age (12 years,  $n = 111$ ; 13 years,  $n = 133$ ; 14 years,  $n = 39$ ), grade (7,  $n = 192$ ; 8,  $n = 91$ ), and language (English,  $n = 251$ ; culturally and linguistically diverse,  $n = 32$ ). The Australian Curriculum, Assessment, and Reporting Authority (ACARA) [61] provides data regarding school students' socio-educational status (SES)<sup>2</sup>. Students were categorised as high SES ( $n = 155$ ) and low SES ( $n = 128$ ), which was determined by a natural break in the sample distribution.

Power calculations determined the sample size needed to detect changes in mental health related outcomes arising from martial arts training. These assumed pre-post-test expected effect size gains of  $d = 0.3$  based on 90% power with alpha levels set at  $p < 0.05$ . The minimum sample size required for completion was calculated as  $N = 234$ .

### 5.2. Study Design

The study examined a time-limited (10 sessions) martial arts-based intervention using a randomised controlled trial design. This experimental and quantitative methodology is suitable for evaluating intervention efficacy [62] and provides capacity to determine the cause of a given phenomenon [63]. The study design was reviewed and approved by a Human Research Ethics Committee. Additionally, the trial was recorded on the Australian and New Zealand Clinical Trials Registry (ACTRN12618001405202).

Criteria for inclusion included (a) grade 7 or 8 students, and (b) age between 12 to 14 years. Exclusion criteria included current martial arts practice. Consent forms and information sheets were distributed to all students who met the inclusion and exclusion criteria.

Bias-coin randomisation was used to allocate participants to the experimental or control conditions after pre-intervention assessment. The allocation was not concealed from participants given the inherent structure of the intervention. Bias-coin randomisation prevents bias and produces comparable groups when participants are allocated to an intervention's treatment conditions [64]. This was completed by an independent researcher who was not involved in the study, who was also blinded to participant identity. The experimental group then completed the intervention. Following this, post-intervention measures and a 12 week follow-up assessed the experimental and control conditions. The control was a waitlist group that received the same intervention following data collection.

The Consolidation Standards of Reporting Trials (CONSORT) guidelines informed the design, implementation, and reporting of this trial [65]; see Appendix A for CONSORT 2010 checklist. Caregivers and participants provided informed consent.

### 5.3. Intervention Program

The intervention included 10 sessions (approximately 60 min each) and was implemented weekly at participating schools onsite. The intervention was delivered by (a) a registered psychologist, and (b) a Second Dan (black belt) taekwondo instructor. A suitable indoor space was used to deliver intervention sessions. During the 10 week intervention, sessions occurred at the same time for each group. However, sessions were scheduled at different times throughout the day (i.e., morning and afternoon) to fit with logistical arrangements of participating schools. Each intervention session used a group format and included two parts, beginning with a psychoeducation component, and then moving to a

martial arts-based component. The basic program information and structure are reported in Table 1.

**Table 1.** Martial arts-based intervention structure.

Item	Activity	Time (Minutes)
A.	Salute	1
B.	Group discussion (psychoeducation)	10
C.	Warm up and stretching	10
D.	Martial arts technique practice	10
E.i <sup>1</sup>	Patterns practice	10
E.ii <sup>1</sup>	Modified sparring activity	10
F.	Breath-focused meditation	5
G.	Salute	1
Total time (minutes):		47 <sup>2</sup>

<sup>1</sup> E.i and E.ii occurred interchangeably during the program. <sup>2</sup> As the lesson length of secondary schools in New South Wales is generally 50–60 min, this timeframe is appropriate for the school timetable.

Group-based discussion of a quasi-psychoeducational nature frequently occurs at the beginning of martial arts training sessions. The primary distinction between this and the study's intervention program was that the study's psychoeducation component involved discussion that was led by a registered psychologist (i.e., psychoeducation information was evidence based). Topics included bullying, courage, goal-setting, optimism, resilience, respect, self-care, self-concept, self-esteem, and values. Minor differences were anticipated across intervention settings as group discussion is an open-ended process.

The intervention's martial arts element was adapted from taekwondo. Physical activities included warm up and stretching exercises, practice of traditional martial arts techniques, meditation, patterns practice, and sparring.

Warmup and stretching exercises are an important element of physical exercise as they reduce the risk of injury [66]. The intervention used nonspecific activities such as jogging and gradual warmup activities that mimicked subsequent activities in the intervention. Static stretching refers to slow and deliberate movement used to lengthen different muscles. Stretching activities included demonstration and guided practice of various stretches for large muscle groups including the hamstring, triceps, and quadriceps.

Traditional taekwondo martial arts techniques that were taught and practiced during the program included stances, blocks, punching, and kicking techniques. It should be noted that the following descriptions are not definitive, and differences are likely to be found in practice (e.g., the World Taekwondo Federation as compared to the International Taekwondo Federation).

Stances refer to standing positions and are the most basic element of martial arts techniques. These included the following:

- Attention stance: Arms are straight and held firmly at one's side. Legs are straight and touching each other with toes pointing forwards;
- Ready stance: Arms are held in front of the body, with closed fists and elbows slightly bent, hands should be approximately 10 to 15 cm away from the stomach. Legs are straight with toes pointing forwards. Feet are shoulder width apart;
- Natural stance: Body orientation rotated 90° perpendicular (i.e., body side-on to imaginary attacker). Arms are held in front of the body with closed fists and elbows bent. Hands should be approximately 5 cm away from the chest. Legs are almost straight with knees slightly bent and toes pointing forwards. Feet are shoulder width apart;
- Front-forward stance: One leg is positioned in front and to the side of the other, in a wide/deep pose with hips facing forwards. The front leg is bent, and the other leg is straightened;
- Back stance: One foot is in front of the other. The front foot is pointed straight, and the back foot is pointed 90° perpendicular. Body weight is mostly placed on the back leg;

- Horse-riding stance: Legs are in a slight squat position, with feet apart facing forwards and knees bent;
- Relax stance: Arms are held behind the back. Legs are straight and touching each other with toes pointing forwards. Feet are shoulder width apart.

Blocks are defensive arm and hand movements used to deflect an attack. These included the following:

- Lower block: Used to deflect an attack to the torso. Starting near the opposite shoulder the leading hand moves down and across the body to deflect an attack with the forearm;
- Upper block: Used to defend against elevated (overhead) attacks to the head or shoulders. Starting near the waist, the arm is bent and raised above the head. The underside of the forearm deflects or absorbs the impact of the attack;
- Outside block: Used to deflect an attack to the torso or head. Starting near the opposite shoulder the leading hand moves across the body to deflect an attack with the forearm.

Punching and kicking techniques were based on traditional taekwondo martial arts practice and were completed in stationary or moving positions against imagined or physical objects (such as strike paddles or strike shields). Punching occurred from horse riding stance and participants were taught how to safely make a fist before practicing the technique (i.e., [a] hand in open palm; [b] curl fingers to make a fist; [c] curl thumb around bottom of fingers). Kicking occurred from a natural stance and included the following:

- Front kick: The knee is raised to the waist and the foot is quickly extended at the target (i.e., groin). The contact point is the instep of the attacking foot;
- Roundhouse kick: The knee is raised, the hip turns, the non-kicking foot is used as a pivot, and the kick is extended horizontally at the target. The contact point is the instep of attacking foot (ball/heel of foot can also be used);
- Push kick: The knee is raised to the waist, the toes are pulled back, and the foot is quickly extended at the target. The contact point is the ball/heel of attacking foot. The is intended to push an attacker away.

A simple definition refers to meditation as the practice of focusing attention [33]. In martial arts, this often involves focusing on breathing, bodily sensations, or on a word or phrase, which can occur while stationary, or while practising patterns which is often referred to as a moving meditation [67]. The intervention program incorporated meditation as a stationary breath-focusing exercise.

Patterns practice and a modified sparring activity were included in the intervention program and occurred on an alternating basis across sessions. A pattern is a choreographed sequence of movements consisting of combinations of blocks, punches, and kicks, performed as though defending against imaginary opponents. A modified sparring activity based on the 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 program.

The final intervention session concluded the program with a formal martial arts grading, where participants were awarded a yellow belt<sup>3</sup> according to the demonstration of martial arts techniques (i.e., stances, blocks, punching, and kicking) and the pattern learnt during the program. While desirable for participants to attend all 10 sessions, a satisfactory intervention dose was based on participation level and whether participants performed well [68]. The intervention dose was presumed adequate in this study if participants completed a yellow-belt taekwondo grading upon completion of the intervention<sup>4</sup>.

#### 5.4. Measures

The intervention program's effect on self-efficacy was evaluated using the Self-Efficacy Questionnaire for Children (SEQC) [69]. The SEQC is a 24-item instrument that examines different elements of children's and adolescents' self-efficacy. The questionnaire provides a measure of overall self-efficacy and three subscales: academic self-efficacy, social self-

efficacy, and emotional self-efficacy. Each subscale 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 ( $SD = 1.82$ ) [70]. The SEQC scale has been evaluated as having satisfactory internal consistency ( $\alpha > 0.70$ ) [71]. Items are scored on a five-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 include the following: (1) How well can you work in harmony with your classmates? (2) How well do you succeed in not worrying about things that might happen? See Appendix A for a complete copy of the SEQC.

### 5.5. Data Collection

Data were collected at three timepoints during the study period: pre-intervention, post-intervention, and follow-up (12-week). Pre-intervention measures were administered by withdrawing participants from their usual classes in small groups. Post-intervention and follow-up outcome measures were administered to the groups in which participants completed the intervention. Participants were provided with an explanation of rating scales and instructions regarding how to complete the scale. Additionally, participants were informed that they could discontinue the assessment at any point and that the assessment was confidential. Upon completion, the surveys were collected and placed in a lockable container to maintain participant confidentiality.

### 5.6. Data Analysis

Statistical Package for the Social Sciences version 25 (IBM SPSS, 2017) was used to conduct data analysis. Alpha levels for the study were set at  $p < 0.05$ .

Factor analysis and Cronbach's alpha were used to establish the validity and reliability of the study's outcome measure. Factor analysis was used to combine measurement data into subscale variables. The internal consistency (Cronbach's alpha) of each variable was then determined. Scale variables were created by adding included items for pre-intervention, post-intervention, and 3 month follow-up timepoints. Univariate and repeated-measures analysis of variance (ANOVA) was employed to evaluate participants' self-efficacy outcomes. The program's impact upon self-efficacy outcomes was examined by evaluating the adjusted mean differences (i.e., actual differences) between treatment conditions, and comparing the effect size with those reported in earlier studies [72]. Regression analyses were employed to examine the moderating effect of the sample's demographic characteristics on self-efficacy outcomes. Analyses were based on the intention-to-treat principle.

## 6. Results

### 6.1. Instrument Validity and Reliability

Exploratory factor analysis was used to examine whether individual scale items validly represented overall self-efficacy and the sublevel 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 to makes sense of the data. Nonorthogonal rotation was also used; however, this process did not improve the outcome.

The SEQC converged across three factors during factor analysis: academic self-efficacy, social self-efficacy, and emotional self-efficacy. For academic self-efficacy, item 1 did not converge across timepoints and was discarded. The revised subscale exhibited satisfactory internal consistency across timepoints ( $\alpha = 0.84, 0.84, \text{ and } 0.84$ , respectively). Two items (items 8 and 23) did not converge across timepoints for social self-efficacy and were dis-

carded from the scale, while an additional item (item 18) converged and was included. The revised social self-efficacy subscale exhibited satisfactory internal consistency across timepoints ( $\alpha = 0.76, 0.81,$  and  $0.80,$  respectively). For emotional self-efficacy, item 18 did not converge across timepoints and was discarded. The revised subscale exhibited satisfactory internal consistency across time-points ( $\alpha = 0.81, 0.85,$  and  $0.84,$  respectively). The SEQC self-efficacy scale (total self-efficacy) exhibited satisfactory internal consistency across pre-intervention, post-intervention, and follow-up measures ( $\alpha = 0.89, 0.91,$  and  $0.90,$  respectively).

### 6.2. Self-Efficacy: Comparison of the Intervention and Control Conditions

Univariate ANOVAs evaluated the effects on self-efficacy from participating in the intervention. This facilitated a comparison of self-efficacy effects between the treatment conditions for pre-intervention and post-intervention timepoints. Univariate ANOVAs examining the adjusted mean intervention difference found the intervention improved the experimental group's self-efficacy and related subfactors compared with the control group. A summary of descriptive statistics for self-efficacy factors is reported in Table 2. Overall, martial arts training improved the experimental group's total self-efficacy. Analysis of the adjusted mean difference indicated that the intervention improved the experimental group's self-efficacy compared to the control group,  $F(1, 238) = 28.23, p < 0.001, \eta_p^2 = 0.11.$

**Table 2.** SEQC descriptive statistics for experimental and control conditions: (a) pre-intervention and post-intervention timepoints; (b) adjusted intervention difference.

Self-Efficacy Scale	Condition	Pre-Intervention		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	0.75	2.77	0.68	0.22	0.80	0.34 *	0.08	0.18, 0.50
	Control	2.45	0.78	2.40	0.72	−0.07	0.79			
Social	Experimental	2.60	0.76	2.87	0.65	0.27	0.66	0.33 *	0.08	0.17, 0.48
	Control	2.80	0.59	2.62	0.69	−0.19	0.77			
Emotion	Experimental	2.21	0.80	2.63	0.71	0.41	0.88	0.42 *	0.09	0.25, 0.60
	Control	2.34	0.73	2.26	0.79	−0.09	0.83			
Total self-efficacy	Experimental	2.44	0.61	2.74	0.52	0.30	0.62	0.36 *	0.07	0.23, 0.49
	Control	2.54	0.52	2.42	0.59	−0.12	0.66			

Note. *Mdif* = mean difference. Significance used Bonferroni adjustments for multiple comparisons. \* The mean difference was significant at 0.05.

This effect was also found for related subfactors. Compared with the control condition, the intervention condition had a significant effect on the intervention conditions: (a) academic self-efficacy,  $F(1, 238) = 17.67, p < 0.001, \eta_p^2 = 0.07;$  (b) social self-efficacy,  $F(1, 238) = 17.61, p < 0.001, \eta_p^2 = 0.07;$  and (c) emotional self-efficacy,  $F(1, 238) = 21.93, p < 0.001, \eta_p^2 = 0.08.$

### 6.3. Intervention Groups' Self-Efficacy at Pre-Intervention, Post-Intervention, and Follow-Up

Repeated-measures ANOVA found that the intervention improved the experimental group's self-efficacy and related subfactors at follow-up. A summary of descriptive statistics for self-efficacy factors is reported in Table 3.

Total self-efficacy: The assumption of sphericity was violated,  $\chi^2(2) = 11.77, p < 0.01;$  consequently, degrees of freedom were corrected using Hyunh–Feldt estimates of sphericity ( $\epsilon = 0.93$ ). The findings demonstrated that the study's intervention exhibited a significant impact on participants' total self-efficacy,  $F(1.86, 228.52) = 18.21, p < 0.001, \eta_p^2 = 0.13.$  Contrasts showed a significant pre-post-intervention effect,  $F(1, 123) = 29.00, p < 0.001, \eta_p^2 = 0.19,$  while the post-intervention to follow-up effect was not significant,  $F(1, 123) = 1.09, p > 0.05, \eta_p^2 = 0.009.$

**Table 3.** SEQC descriptive statistics for the experimental condition at pre-intervention, post-intervention, and follow-up timepoint: (a) means and standard deviations; (b) pairwise mean differences and confidence intervals.

Self-Efficacy Scale	Intervention Timepoints					
	Pre M (SD)	Post M (SD)	Follow M (SD)	Pre-Post Mdif (SE) [CI]	Pre-Follow Mdif (SE) [CI]	Post-Follow Mdif (SE) [CI]
Academic	2.56 (0.75)	2.77 (0.68)	2.86 (0.70)	0.20 * (0.08) [0.02, 0.39]	0.30 * (0.09) [0.07, 0.53]	0.10 (0.09) [−0.11, 0.31]
Social	2.60 (0.76)	2.87 (0.65)	2.92 (0.67)	0.27 * (0.06) [0.12, 0.42]	0.32 * (0.09) [0.10, 0.55]	0.05 (0.08) [−0.15, 0.26]
Emotion	2.21 (0.80)	2.63 (0.71)	2.66 (0.73)	0.42 * (0.08) [0.23, 0.61]	0.45 * (0.09) [0.22, 0.67]	0.03 (0.09) [−0.18, 0.24]
Total self-efficacy	2.44 (0.61)	2.74 (0.52)	2.81 (0.55)	0.30 * (0.06) [0.17, 0.44]	0.37 * (0.07) [0.19, 0.55]	0.07 (0.07) [−0.09, 0.23]

Note. Pre = pre-intervention. Post = post-intervention. Follow = follow-up. Mdif = mean difference. Significance used Bonferroni adjustments for multiple comparisons. \* The mean difference is significant at 0.05.

Academic self-efficacy: Mauchly’s test indicated that the assumption of sphericity had been violated,  $\chi^2(2) = 7.66, p < 0.05$ ; therefore, degrees of freedom were corrected using Hyunh–Feldt estimates of sphericity ( $\epsilon = 0.96$ ). The results demonstrated that the intervention exhibited a significant effect on participants’ academic self-efficacy for the experimental condition,  $F(1.91, 235.38) = 6.39, p < 0.01, \eta_p^2 = 0.05$ . Contrasts found a significant effect for pre-post-intervention,  $F(1, 123) = 7.28, p < 0.01, \eta_p^2 = 0.06$ , while the post-intervention to follow-up effect was not significant,  $F(1, 123) = 1.24, p > 0.05, \eta_p^2 = 0.01$ .

Social self-efficacy: The assumption of sphericity was violated,  $\chi^2(2) = 26.98, p < 0.001$ ; degrees of freedom were corrected using Hyunh–Feldt estimates of sphericity ( $\epsilon = 0.85$ ). The findings showed that the intervention significantly affected participants’ social self-efficacy,  $F(1.69, 207.76) = 9.33, p < 0.001, \eta_p^2 = 0.07$ . Contrasts indicated a significant pre-post-intervention effect,  $F(1, 123) = 19.47, p < 0.001, \eta_p^2 = 0.14$ ; while the post-intervention to follow-up effect was not significant,  $F(1, 123) = 0.40, p > 0.05, \eta_p^2 = 0.003$ .

Emotional self-efficacy: The assumption of sphericity was satisfied,  $\chi^2(2) = 4.80, p > 0.05$ . The results indicated that the experimental condition had a significant effect on participants’ emotional self-efficacy,  $F(2, 246) = 16.48, p < 0.001, \eta_p^2 = 0.07$ . Contrasts exhibited a significant effect for pre-intervention to post-intervention,  $F(1, 123) = 27.69, p < 0.001, \eta_p^2 = 0.19$ , while the post-intervention to follow-up effect was not significant,  $F(1, 123) = 0.11, p > 0.05, \eta_p^2 = 0.001$ .

#### 6.4. The Moderating Effect of Demographic Characteristics on Self-Efficacy

Regression analyses examined how the intervention’s impact on self-efficacy was moderated by the study’s demographic characteristics. Analysis examined post-intervention outcomes. A consistent pattern of predictors emerged across the regression models for the SEQC. In models 1, 2, and 3 for each regression, only the intervention condition significantly predicted the self-efficacy outcome. However, in model 4 for three of four regressions, the outcome was moderated by the intervention condition and SES.

Gender, age, grade, and language did not predict self-efficacy outcomes. However, SES predicted outcomes for: (a) social self-efficacy,  $F(6, 233) = 4.15, p < 0.01, R^2 = 0.07$ , statistically adding to the prediction for social self-efficacy,  $B = 0.25, p < 0.001$ ; (b) emotional self-efficacy,  $F(6, 233) = 4.02, p < 0.01, R^2 = 0.07$ , statistically adding to the prediction for emotional self-efficacy,  $B = 0.19, p < 0.01$ ; and (c) total self-efficacy,  $F(6, 233) = 5.53, p < 0.001, R^2 = 0.10$ , statistically adding to the prediction for total self-efficacy,  $B = 0.23, p < 0.001$ . See Appendix C for summaries of self-efficacy regression models.

## 7. Discussion

This study's findings indicate that the school-based martial arts intervention improved students' self-efficacy. The intervention had a positive effect on the experimental group's self-efficacy compared with the control group. Interestingly, the effect for the experimental group's reported self-efficacy was stronger at follow-up compared to post-intervention.

### 7.1. Self-Efficacy Outcomes

Following intervention, the experimental group's levels of self-efficacy significantly improved compared to the control group. This was evident across effect sizes and mean differences. Similarly, the experimental group exhibited statistically significant improvements for self-efficacy across all timepoints when follow-up data for the experimental group were considered. For both analyses, the largest observed post-intervention effect size was reported for total self-efficacy, while the largest post-intervention adjusted mean difference was found for emotional self-efficacy. Examination of mean differences for total self-efficacy and related subscales indicated all the self-efficacy outcomes improved across post-intervention and follow-up timepoints. Stronger improvements were found when examining pre-intervention to follow-up mean differences, which was evident across the self-efficacy scales. This indicates that the intervention's impact on self-efficacy did not diminish post-intervention and exhibited a stronger impact at follow-up. While positive, the reasons for the larger impact at follow-up are unclear and should be examined in future research. Although direct comparisons with previous research are not possible due to limitations regarding how self-efficacy was reported in these studies, the present findings support previous results that martial arts training has a positive effect on self-efficacy outcomes [13–15].

Different elements of the sources of self-efficacy [20,21] 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 [19] view that mastery experience has a significant influence on self-efficacy and supports the philosophical perspective that martial arts can promote a sense of mastery and accomplishment through providing self-improvement opportunities [18]. 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 and relates to stillness and mindfulness concepts associated with Zen and Taoism [17].

Further, it is important to note that the intervention effects for self-efficacy are 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 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.

### 7.2. The Effect of Demographic Characteristics on Self-Efficacy

Most of the variance in the models across the self-efficacy scales was explained by the intervention condition. For total self-efficacy, social self-efficacy, and emotional self-efficacy, 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.

The impact of demographic characteristics on mental health and psychological outcomes resulting from martial arts training has not received significant attention in previous studies. This study's findings support limited prior research reporting that gender does not predict significant self-efficacy differences [73]. This suggests that martial arts training may have psychological benefits irrespective of gender.

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 [74] and more positive attitudes towards mental health treatment [75]. 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 that health varies by SES, which may be explained by people with lower SES having higher frequencies of negative health behaviours and difficulties accessing healthcare [76]. 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.

### 7.3. Limitations

Some limitations regarding the study should be noted. The study examined participants aged 12 to 14 years, which limits the generalisability of results to the broader population. Although participants were randomised, self-selection effects may still have affected participation in the intervention program. While this was arguably less of an issue in this study compared with previous research due to randomisation, it should be noted that participant interest may have been a motivating factor that could have impacted commitment to the intervention, potentially increasing psychosocial benefits. Lastly, the intervention comprised several components that arguably reflect traditional martial arts practice (i.e., psychoeducation, specific martial arts techniques, and meditation). From one perspective, the psychoeducation and meditation components of the program may be viewed as confounding factors regarding explanations of the intervention's effects (i.e., there may have been a differential effect regarding martial arts technical training versus the role of psychoeducation and/or meditation). However, while it is important to consider this, the study aimed to examine the effect of traditional martial arts on self-efficacy. As noted, traditional martial arts typically include psychoeducation and meditation components in addition to more specific martial arts techniques. In this context, it is argued that this is not a confounder of the study's self-efficacy outcomes.

## 8. Implications for Practice and Future Directions

Generally, this study exhibited positive findings regarding the martial arts-based intervention improving self-efficacy. According to various authors, a major limitation of research examining the relationship between mental health and (a) martial arts training [27,45], (b) physical activity [50,77], and (c) complementary therapies [78,79] is that the study designs typically lack academic rigor. Given that 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 self-efficacy in adolescent populations.

While the results regarding self-efficacy outcomes are promising, the intervention program is not currently sustainable in a school context. Future research should develop a professional development program for teachers to facilitate similar programs. This could be

embedded within a physical education or welfare/pastoral care curriculum. Such programs would require piloting and ongoing measurement to ensure program efficacy.

Further research is needed to expand these results. It is important to isolate aspects of the intervention (i.e., psychoeducation, specific martial arts techniques, and meditation) to establish if there is a differential effect for these components. Additionally, future research should examine the intervention program's self-efficacy effects on different population samples to broaden the generalisability of the study. For example, consideration should be given to implementing the intervention as a universal program with primary school students and the effect of martial arts training for older (adult) participants should also be considered.

## 9. Conclusions

This study reports additional empirical evidence that martial arts-based training fosters self-efficacy. This is an important result given that self-efficacy is predictive of mental health, and that martial arts can be considered as a physical activity-based approach to mental health. It is especially encouraging that the study's positive outcomes for self-efficacy were maintained at follow-up, and that demographic covariates exhibited little impact on this result. The study supports school-based martial arts interventions as having the potential to promote adolescent self-efficacy through physical activity. When delivered in association with mental health professionals, martial arts-based interventions are an efficacious psychosocial treatment that can be used as a complementary approach to promote characteristics associated with mental health such as self-efficacy.

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**Data Availability Statement:** Data is available upon reasonable request to the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A. CONSORT 2010 Checklist

CONSORT 2010 checklist of information to include when reporting a randomised trial \*.

Section/Topic	Item No	Checklist Item	Reported on Page No
<b>Title and abstract</b>			
	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	-
<b>Introduction</b>			
Background and objectives	2a	Scientific background and explanation of rationale	2–6
	2b	Specific objectives or hypotheses	6
<b>Methods</b>			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	7
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	n/a
Participants	4a	Eligibility criteria for participants	7–8
	4b	Settings and locations where the data were collected	6
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	8–9, Appendix A and Section B
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	9–10
	6b	Any changes to trial outcomes after the trial commenced, with reasons	n/a
Sample size	7a	How sample size was determined	7
	7b	When applicable, explanation of any interim analyses and stopping guidelines	n/a
<b>Randomisation:</b>			
Sequence generation	8a	Method used to generate the random allocation sequence	8
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	8
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	8
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	8

Section/Topic	Item No	Checklist Item	Reported on Page No
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	n/a
	11b	If relevant, description of the similarity of interventions	n/a
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	10–11
Statistical methods	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	10–11
<b>Results</b>			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	6
	13b	For each group, losses and exclusions after randomisation, together with reasons	27
Recruitment	14a	Dates defining the periods of recruitment and follow-up	-
	14b	Why the trial ended or was stopped	-
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	27
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	27
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	12–14
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	n/a
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	14, Appendix A and Section B
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	n/a
<b>Discussion</b>			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	18–19
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	18–19
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	15–18

Section/Topic	Item No	Checklist Item	Reported on Page No
<b>Other information</b>			
Registration	23	Registration number and name of trial registry	7
Protocol	24	Where the full trial protocol can be accessed, if available	8–9, Appendix A and Section B
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	-

\* We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, noninferiority and equivalence trials, nonpharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming; for those and for up-to-date references relevant to this checklist, see [www.consort-statement.org](http://www.consort-statement.org).

### B. 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 do not 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 do not 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

### C. Regression Models for SEQC

**Table 1.** Regression model for SEQC academic self-efficacy.

	Academic Self-Efficacy							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	B	95% CI	B	95% CI	B	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	0.24 *	[0.17, 0.52]	0.24 *	[0.17, 0.52]	0.24 *	[0.16, 0.52]	0.24 *	[0.17, 0.53]
Gender			0.00	[−0.17, 0.17]	0.00	[−0.17, 0.18]	0.01	[−0.16, 0.19]
Grade					0.00	[−0.24, 0.24]	−0.02	[−0.27, 0.22]
Age					−0.01	[−0.25, 0.21]	−0.04	[−0.28, 0.18]
Language							0.01	[−0.30, 0.37]
SES							0.13	[−0.00, 0.38]
R <sup>2</sup>	0.06		0.06		0.06		0.08	
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. \*  $p < 0.001$ .

**Table 2.** Regression model for SEQC social self-efficacy.

	Social Self-Efficacy							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	B	95% CI	B	95% CI	B	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	0.18 *	[0.07, 0.41]	0.17 *	[0.06, 0.40]	0.18 *	[0.07, 0.41]	0.18 *	[0.08, 0.42]
Gender			−0.07	[−0.25, 0.08]	−0.07	[−0.25, 0.08]	−0.05	[−0.23, 0.10]
Grade					−0.03	[−0.27, 0.19]	−0.06	[−0.32, 0.14]
Age					0.07	[−0.12, 0.32]	0.03	[−0.18, 0.25]
Language							0.01	[−0.29, 0.34]
SES							0.25 **	[0.16, 0.51]
R <sup>2</sup>	0.03		0.04		0.04		0.07 †	
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. †  $R^2$  is adjusted. \*  $p < 0.01$ , \*\*  $p < 0.001$ .

**Table 3.** Regression model for SEQC emotional self-efficacy.

	Emotional self-efficacy							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	B	95% CI	B	95% CI	B	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	0.24 **	[0.18, 0.56]	0.23 **	[0.17, 0.55]	0.23 **	[0.16, 0.55]	0.24 **	[0.18, 0.56]
Gender			−0.07	[−0.29, 0.08]	−0.07	[−0.29, 0.08]	−0.05	[−0.26, 0.12]
Grade					−0.02	[−0.29, 0.23]	−0.04	[−0.33, 0.19]
Age					0.01	[−0.23, 0.26]	−0.03	[−0.29, 0.20]
Language							−0.05	[−0.50, 0.22]
SES							0.19 *	[0.09, 0.49]
R <sup>2</sup>	0.06		0.06		0.06		0.07 †	
F	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. \*  $p < 0.01$ , \*\*  $p < 0.001$ .

**Table 4.** Regression model for SEQC total self-efficacy.

	Total Self-Efficacy							
	Model 1		Model 2		Model 3		Model 4	
	B	95% CI	B	95% CI	B	95% CI	B	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	0.27 *	[0.17, 0.45]	0.27 *	[0.16, 0.45]	0.27 *	[0.16, 0.45]	0.27 *	[0.17, 0.46]
Gender			−0.05	[−0.19, 0.08]	−0.005	[−0.19, 0.09]	−0.03	[−0.17, 0.11]
Grade					−0.03	[−0.23, 0.16]	−0.06	[−0.26, 0.12]
Age					0.04	[−0.14, 0.22]	−0.01	[−0.19, 0.17]
Language							−0.01	[−0.29, 0.24]
SES							0.23 *	[0.12, 0.42]
R <sup>2</sup>		0.07		0.08		0.08		0.10 <sup>†</sup>
F		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. <sup>†</sup> R<sup>2</sup> is adjusted. \*  $p < 0.001$ .

## Notes

- Given that nonbinary gender comprised 1% of the sample, this aspect of gender was excluded from analysis.
- This was based on ACARA's Index of Community Socio-Educational Advantage (ICSEA), which includes information about parental education and occupation, and the socio-economic background of the school location. An ICSEA score of 900 or lower corresponds with low SES, 1000 indicates average SES, and 1100 or higher indicates high SES.
- The belt colour grading system represents levels of achievement in a martial art. A yellow belt is one level above white belt (beginner level).
- It should be noted that 100% of the participants assigned to the intervention group achieved the yellow belt criterion.

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