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ORIGINAL PAPER

Acceptability and Effectiveness of an 8-week Mindfulness Program in Early- and Mid-adolescent School Students: a Randomised Controlled Trial

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Abstract

Objectives Mindfulness-based programmes (MBPs) show potential for universal prevention in schools, given that they target shared risk factors underpinning common mental health disorders. High-quality research in youth remains limited, but suggests that MBPs may be less effective in early- versus mid-adolescents.

Methods This randomised controlled trial tested the acceptability of an 8-week MBP in year 8 (M_{age} 13.7) and year 10 (M_{age} 15.5) students ($N = 434$; 48.2% female) and compared outcomes (mindfulness, depression, anxiety, eating disorder risk factors, wellbeing) to normal curricular controls.

Results Levels of acceptability were moderate and did not differ by age band. For younger students, there were no differences at post-intervention for mindfulness students compared to controls (Cohen's $d < .22$) but at 3-month follow-up, the mindfulness group were worse in wellbeing (Cohen's $d = -.25$; 95% CI $-.49, -.01$) and two aspects of mindfulness (Awareness of External Environment, $d = -.30; -.55, -.06$; Decentering and Nonreactivity, $d = -.39; -.63, -.15$). For older students, there were no significant differences between the intervention and control groups at post-intervention (Cohen's $d < .17$) or follow-up ($d < .22$).

Conclusions We suggest that the use of formal meditation in unscreened conscript early teens may be unwise. Further research is needed to identify acceptable and effective age appropriate modifications of MBPs for early- and mid-adolescents before they can be supported as universal interventions in schools. Suggestions are made for ongoing research in this area.

Trial Registration: Australian and New Zealand Clinical Trials Registry: ANZCTR 12,617,000,471,381

Keywords Adolescence · Mindfulness · Schools · Prevention · Universal

Three common and debilitating mental health conditions frequently emerge during adolescence: anxiety, depression and eating disorders (Fairweather-Schmidt & Wade, 2014, Teesson et al., 2014). One promising approach for prevention is mindfulness-based programmes (MBPs) that explicitly teach skills to counteract shared risk factors underpinning these mental disorders: emotional dysregulation (Aldao et al., 2010), rumination (McEvoy et al., 2013) and self-critical perfectionism (Egan et al., 2011). With their capacity to reach large numbers of youth, enthusiasm is therefore growing for widespread dissemination of mindfulness via universal prevention programmes in schools. There is accruing evidence for universal prevention programmes such that creating a small shift in risk factors or disease status has a larger population effect on wellbeing than targeting high-risk individuals (Cuijpers et al., 2008; Huppert, 2009).

However, the application of MBP as a prevention approach in youth remains nascent, with investigations rarely moving beyond early stage evaluations with low methodological rigour (Dunning et al., 2018; Shute, 2019; Tan, 2016; Volanen et al., 2020). While a series of meta-analyses (Kallapiran et al., 2015, $N = 11$ studies; Klingbeil et al., 2017, $N = 76$ studies; Maynard et al., 2017, $N = 35$ studies; Zenner et al., 2014; $N = 24$ studies; Zoogman et al., 2015, $N = 20$ studies) collectively support small to moderate benefits in youth across a range of outcomes such as psychological symptoms, externalising behaviour, social competence and measures of cognition, many of these analyses

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include early stage, small, unpublished, uncontrolled or non-randomised studies (Dunning et al., 2018). Only one meta-analysis has exclusively examined randomised controlled trials (RCTs; Dunning et al., 2018, $N = 33$ studies), reporting small to moderate positive effects on mindfulness, cognitive function, negative affect and negative behaviours (Cohen's $d = 0.16–0.47$). The studies, however, included at-risk and clinical populations together with general education settings, where effects can be expected to differ due to floor effects. Another meta-analysis examined MBPs exclusively in mainstream school settings (Carsley et al., 2018; $N = 24$ studies) but included non-randomised studies. Results showed small to moderate effects on mental health outcomes (Hedges' $g = 0.24$).

In the aforementioned analysis, interventions for older adolescents (15–18 years) had greater effects compared to middle childhood (6–10 years) with an absence of effects during early adolescence. The meta-analysis by Dunning et al. (2018) also reported an age effect, with larger effect sizes for older students on executive function, but larger effect sizes in younger students on negative behaviour. Also suggesting greater effectiveness for older than younger youth are the five investigations that have so far tested MBP approaches in large, universal, RCT designs with follow-up in mainstream secondary schools (Supplementary Table S1). Reasons for a differential age effect could include the following: (1) newly emergent conceptual thought processes that are not yet sufficiently advanced in young adolescents to benefit from adult-derived MBPs; (2) the dip in emotional regulation that occurs at this age with puberty (Cracco et al., 2017; Hagler et al., 2016; Zimmermann & Iwanski, 2014) lessening effectiveness and (3) lower stressors at this younger age that may reduce perceived relevance and therefore engagement.

It may also be that younger adolescents would benefit from increased classroom dosage rather than the brief "taster" format of the Dot be UK curriculum (Johnson et al., 2016, 2017a; Volanen et al., 2020). Reducing the intensity of adult MBPs (2.5 h per week, 30 min daily practice and day-long silent retreat) is appropriate and necessary in terms of adolescent developmental capacity (Tan, 2016). However, in the absence of dismantling research and developmental models of mindfulness, it is unknown which active ingredients should be retained in these diluted programmes (Felver et al., 2016). Thus, dose and content of at least some adolescent programmes may be insufficient.

In order to test both increased dose and compare age bands, Johnson and Wade (2019) conducted a feasibility trial of a more intensive 8-week Belgian curriculum: Mindful Teens (Dewulf, 2013). With longer weekly lessons, more in-class meditation and inquiry, and frequent repetition of key practices, the intervention was delivered to early- (M_{age} 13.5) and mid-adolescents (M_{age} 15.5 years) by an experienced external facilitator. Compared to 10-min meditations (seated and lying body scan) in earlier studies testing the Dot be curriculum (Johnson et al., 2016, 2017a), meditations in the Mindful Teens feasibility study ranged in length from 20 (e.g. sitting with guided awareness of breath, sounds, thoughts and emotions, including short periods of silence) to 30 min (e.g. yoga, body scan). The longer lessons were difficult to accommodate within school timetables, but lesson content was rated as agreeable by students and developmentally appropriate by attending school staff, across both age bands. No adverse effects were reported. Results from this small pilot sample ($N = 90$) showed moderate reductions in depression and anxiety at 4-month follow-up (Supplementary Table S1). Although underpowered, moderation analysis suggested that the improvements were only in the older students.

The aim of the current study was to examine whether the promising effects of this more intensive 8-lesson mindfulness curriculum in a universal approach could be replicated in a larger adolescent sample. We hypothesised that (1) the programme would improve mindfulness together with a range of psychological outcomes (anxiety, depression, eating disorder risk, wellbeing) and (2) improvements, and acceptability of the programme, would be greater for mid- than early-adolescent students.

Method

Participants

Three Adelaide schools participated; two (school A, B) had participated in our pilot study but were not teaching mindfulness programmes; school C was approached to broaden our sample to include a public school. Schools were classified into socioeconomic (SES) bands using the Index of Community Socio-Educational Advantage (ICSEA) whereby 1000 represents the mean, with a *SD* of 100 (Australian Curriculum Assessment and Reporting Authority, 2012). Schools A (Private; ICSEA 1153) and C (Public; ICSEA 1125) were urban and classified as high SES (greater than one *SD* above the mean; Johnson et al., 2016), while school B (ICSEA 1063) was rural and classified as medium SES (within one *SD* above the mean). Power analysis showed that to detect a between group Cohen's *d* effect size of 0.30, with a power level of 0.80, 91 participants per group were required (Hedeker et al., 1999), which to account for our age moderation analyses required a total sample of 364.

Figure 1 shows the flow of participants ($N = 476$) through the study. Schools A and B provided three and two pairs of classes at each year level, respectively. School C provided one pair of year 8 classes but due to curricular pressure was unable to supply any year 10 classes. Mean age in the year

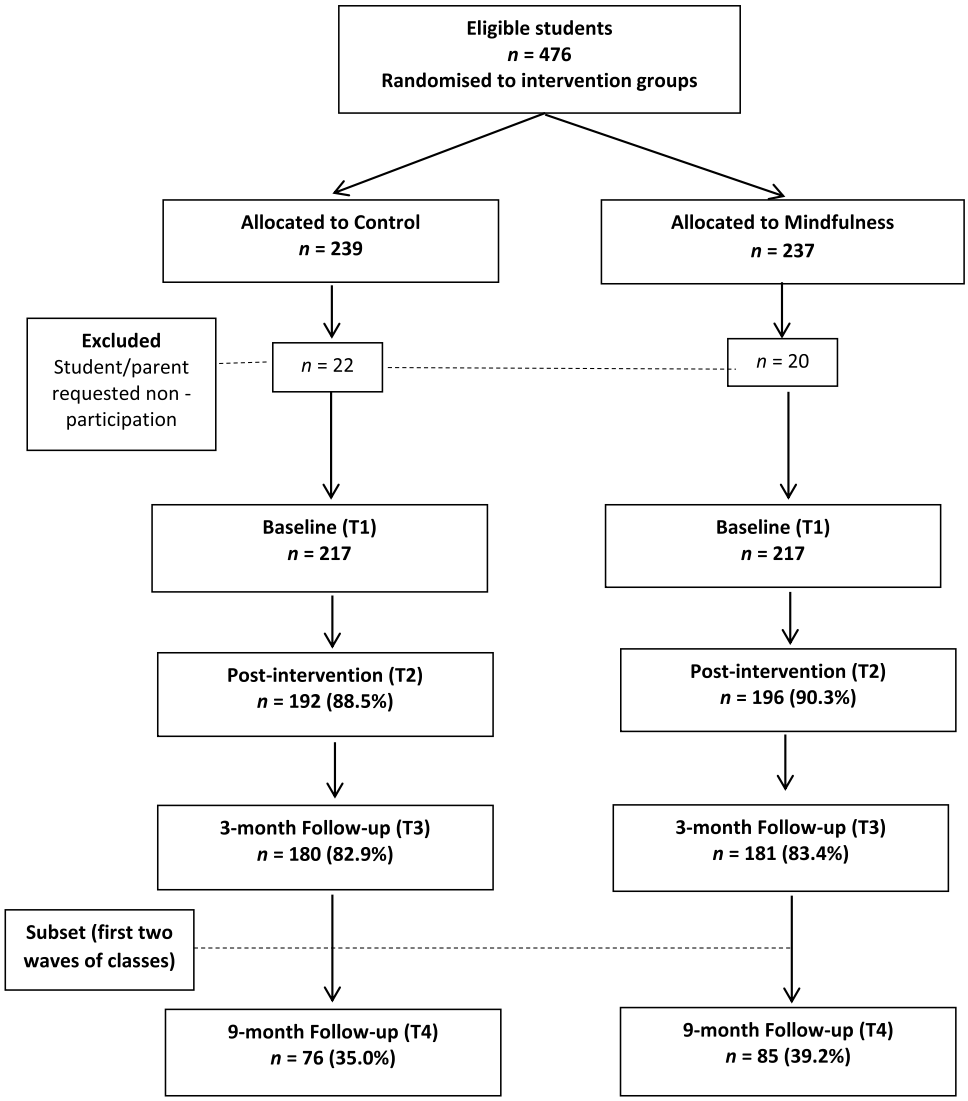

Fig. 1 Flow of participants through study

8 and 10 classes was 13.67 years (*SD* 0.42; 49.1% female) and 15.52 years (*SD* 0.37; 46.7% female), respectively. Levels of non-consent were greater in the medium SES school $N=24$ (17.1%) than the high SES schools $N=18$ (6.1%). A subset of students ($N=161$) from schools A and B who had taken part in the first two rounds of the intervention were available for 9-month follow-up data within the trial timeframe. For this subset, mean age in the year 8 classes was 13.61 years (*SD* 0.32; 48.5% female) and for year 10 students 15.50 years (*SD* 0.33; 46.7% female).

Procedure

A cluster (class-based) randomised controlled design was used, with assignment to mindfulness or control (usual curriculum) groups performed by the first author using the randomisation function in Excel. Outcome measures were administered on three occasions, 1–3 weeks pre-intervention (T1), 1–7 days post-intervention (T2) and at 3 months post-intervention (mean 12.3 weeks, range 9–17; T3). For a small subset available for 9-month follow-up (T4), mean time post-intervention was 41 weeks (range 39–43).

Research approval was granted by each school principal, the Department of Education (South Australia) and the Social and Behavioural Research Ethics Committee of Flinders University. A dual consent procedure was approved as follows: opt-out for parent and student on receipt of information pack and consent form, and student assent on the day of data collection. Testing was performed in a classroom setting with the teacher and principal researcher present. It was not possible for the students or the researcher to be blind to the allocated treatment group.

Intervention

The 8-week manualised programme Mindfulness Training for Teens (Dewulf, 2013) is designed for adolescents aged 13–18 years and was also used in the school study conducted by Raes et al. (2014) and our earlier feasibility trial (Johnson & Wade, 2019). The once-weekly curriculum is closely modelled on the adult programmes Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness-Based Cognitive Therapy (MBCT; Segal et al., 2013). Each session includes interactive introductions to mindfulness concepts, informal mindfulness practices (e.g. raisin exercise, 3-min STOP practice), guided seated or lying meditations and facilitator-guided group discussion of experiences. Given the longer formal meditations and more extensive inquiry compared to our earlier trials, a range of safety measures were included. These options were discussed in the first lesson and repeated before meditations: (1) tune out during meditations and take a rest; (2) raise hand and leave the room with the school counsellor who attended all sessions together with the class teacher; (3) see school counsellor following the session and (4) seek external support via parents, kids' helpline or general practitioner.

During the earlier feasibility trial (Johnson & Wade, 2019), lesson length was 90 min inclusive of a 10-min mid-lesson break (i.e. 80-min content time). School timetabling difficulties for the current trial necessitated further shortening of the lessons to 65–75 min. This was considered acceptable as small volunteer senior groups had been successfully conducted with shorter duration (75 min; no break), and this was also felt to reflect real world curricular constraints for dissemination of this programme at scale. Modifications for the current trial involved minor shortening across all sections of the lesson (formal meditations, discussions, introduction of concepts, home practice explanations). Mindfulness courses were conducted over four consecutive school terms in 2018–2019. The control groups undertook normal lessons (i.e. English, Christian Studies, Health/Physical Education or home class activities. The latter included peer mentoring, time to catch up on personal projects and planning for school or service activities). At the conclusion of the trial, control group students and their parents were offered a free evening mindfulness workshop at their school.

All mindfulness lessons were conducted by the first author (CJ), an adult mindfulness facilitator with over 15 years of personal practice and 4-years experience teaching mindfulness in secondary schools. Given that lesson delivery was by a single instructor (CJ) due to the constraints of a small research team, her fidelity and competence in teaching this curriculum were rigorously assessed during the feasibility and acceptability pilot (Johnson & Wade, 2019) as follows. The authors used a marking rubric based on the adult Mindfulness-Based Interventions Teaching Assessment Criteria (MBI-TAC; Crane et al., 2012) which assesses a combination of adherence and competence across six domains, modified slightly to reflect the classroom environment and assess age appropriate delivery (Supplementary Material). Audio recordings of all lessons were conducted with ethics approval; from this pool, lessons were randomly selected and reviewed by the programme developer (i.e. independent of the research team and blind to outcomes during this process), such that each of the eight lessons was reviewed once. For each lesson, a score out of six was given for each MBI-TAC domain, which were averaged into an overall score. Across the six domains, average lesson rating for this study's instructor was in the "proficient" band (5.2/6, range 4.7–5.5). A comment was given that meditations were sometimes shorter with less silence than in the original programme. The progression to a fully powered trial (albeit with a new sample) was considered an extension of the pilot, so fidelity was not assessed again for the current trial, given that the same presenter delivered all lessons.

Measures

Course Acceptability

Students During the last mindfulness lesson, students were invited to undertake an anonymous pen and paper survey, rating the following questions on a 0–10 Likert scale with higher scores indicating greater satisfaction/likelihood: "*How would you rate the course in terms of being enjoyable/interesting?*", "*How much do you think you have learnt during the course?*", "*In the future, how likely are you to use any of the techniques you have learnt?*" and "*How would you rate the Instructor?*".

Staff During the last lesson, teachers and school counsellors rated these questions anonymously: "*How would you rate the course in terms of being enjoyable/interesting for students?*" and "*How much do you think students have learnt during the course?*".

Internal reliability for the following scales in the current study appears in Table 1.

Mindfulness

This construct was measured using the 25-item Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A; Johnson et al., 2017b) that contains 8 individual factors: Awareness of Internal Experiences (awareness of emotions, e.g. "when my mood changes, I notice it straight away"), Awareness of External Experiences (awareness of environment), Acting with Awareness (awareness of present

Table 1 Descriptive statistics for mindfulness and control groups ($N = 434$) at baseline, post-intervention and 3-month follow-up

	Cronbach α (item-total)		Control		Mindfulness	
			Mean	*SD*	Mean	*SD*
Mindfulness						
Aware INT	.72 (.52–.57)	T1	3.65	.71	3.61	.75
		T2	3.57	.71	3.50	.74
		T3	3.48	.80	3.48	.76
Aware EXT	.80 (.63–.67)	T1	3.52	.85	3.56	.91
		T2	3.41	.86	3.34	.93
		T3	3.35	.94	3.30	.95
Act Aware	.67 (.43–.53)	T1	2.90	.80	2.80	.88
		T2	2.96	.80	2.84	.86
		T3	3.01	.88	2.92	.83
Acc/NJ	.77 (.55–.64)	T1	2.83	.84	2.76	.85
		T2	2.86	.78	2.82	.81
		T3	2.82	.86	2.80	.78
Dec/NR	.77 (.58–.63)	T1	2.97	.81	2.98	.76
		T2	3.06	.75	2.97	.74
		T3	3.03	.84	2.89	.78
Openness	.66 (.38–.51)	T1	2.60	.69	2.55	.75
		T2	2.69	.66	2.56	.78
		T3	2.72	.83	2.65	.75
Relativity	.72 (.48–.51)	T1	3.69	.65	3.71	.74
		T2	3.67	.66	3.59	.75
		T3	3.55	.78	3.56	.77
Insight	.78 (.56–.68)	T1	2.81	.92	2.90	.91
		T2	2.89	.91	3.00	.93
		T3	2.79	1.01	2.91	.87
Depression	.90 (.56–.78)	T1	.86	.73	.79	.69
		T2	.78	.69	.72	.64
		T3	.84	.77	.79	.71
Anxiety	.92 (.63–.84)	T1	.89	.82	.90	.83
		T2	.88	.84	.90	.78
		T3	.88	.85	.92	.86
Wellbeing	.93 (.41–.82)	T1	3.35	.78	3.41	.76
		T2	3.38	.82	3.35	.75
		T3	3.33	.94	3.27	.78
Weight/shape concerns	.97 (.75–.91)	T1	1.82	1.82	1.88	1.88
		T2	1.91	1.85	2.01	1.96
		T3	1.84	1.95	1.89	1.87

Mindfulness, Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A): subscales are *Aware INT*, Awareness of Internal Experiences; *Aware EXT*, Awareness of External Experiences; *Act Aware*, Acting with Awareness; *Acc/NJ*, Accepting and Nonjudgemental Orientation; *Dec/NR*, Decentering and Nonreactivity; *Openness*, Openness to Experiences; *Relativity*, Relativity of Thoughts; *Insight*, Insightful Understanding. *Depression*, depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21). *Anxiety*, Generalised Anxiety Disorder Scale (GAD-7). *Wellbeing*, Warwick-Edinburgh Mental Wellbeing Scale. *Weight/shape concerns*, weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q)

moment as opposed to being caught up in thinking about past/future), Accepting and Nonjudgemental Orientation (self-kindness with mistakes and perceived weaknesses), Decentering and Nonreactivity (ability to step back from difficult thoughts and emotions and not react immediately), Openness to Experiences (willingness to expose oneself to pleasant/unpleasant thoughts, feelings and emotions), Relativity of Thoughts (recognition of thoughts as transient and

subjective) and Insightful Understanding (recognition that subjective interpretation of situation can create or compound difficulty). The scale has been validated for adolescents from age 13 and assesses the last 2 weeks. Items use a 5-point scale ranging from 1 "*never true*" to 5 "*always true*", with higher scores reflecting greater mindfulness.

Depression

The 7-item depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21; Lovibond & Lovibond, 1995) was used. It shows good fit in non-clinical adolescents (Szabo, 2010; Tully et al., 2009), and items include "*I couldn't seem to experience any positive feeling at all*". Each item is scored on a 4-point scale from 0 "*never*" to 3 "*almost always*", with higher scores reflecting greater depression over the past week.

Anxiety

This was measured using the 7-item Generalised Anxiety Disorder Scale (GAD-7) which demonstrated good psychometric properties during its development and validation (Spitzer et al., 2006) and is recommended for use from age 12 (Quittner et al., 2014). Items include "*How often have you been bothered by feeling nervous, anxious, or on edge?*". Items are scored on a 4-point scale from 0 "*not at all*" to 3 "*nearly every day*", with higher scores reflecting greater anxiety over the past fortnight.

Weight and Shape Concerns

The weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) were used, which correlate well with the interview format which itself has excellent psychometric properties (Berg et al., 2012). This measure has been used in early adolescent research previously (Wilksch & Wade, 2009). These 12 items (e.g. "*How dissatisfied have you felt about your weight?*") use a 7-point rating scale ranging from 0 "*not at all*" to 6 "*markedly*". Questions relate to the last 28 days and higher scores indicate greater concerns.

Wellbeing

This was measured with the 14-item Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS), validated in both university and community adult populations (Tennant et al., 2007) and used in adolescent samples (Kuyken et al., 2013). It surveys the last 2 weeks (e.g. "*I've been feeling optimistic about the future*"). Items are rated on a 5-point scale ("*none of the time*" to "*all of the time*"); higher scores signify higher wellbeing.

Data Analyses

All analyses were undertaken using IBM Statistical Package for the Social Sciences, version 23. Data were assessed for normality, and logistic regression analyses conducted for the post-intervention, 3- and 9-month follow-up data to test if any baseline characteristics predicted absence. Logistic regression analyses were also used to check baseline differences between treatment groups. Repeated measures analyses were conducted using Linear Mixed Modelling (LMM), enabling inclusion of cases with missing data via maximum likelihood estimation. Baseline measures were entered as covariates to reduce the impact of variation of baseline scores on between-group effect sizes. This analysis tested the effect of the intervention on mindfulness and other psychological outcomes (Hypothesis 1); year level was then entered into LMM as a moderator to test Hypothesis 2. Acceptability levels for the intervention were compared between the mid- and early-adolescents using independent *t*-tests, also for Hypothesis 2. For group comparisons, we report the effect size, Cohen's *d*, with suggested interpretation as small ($d = 0.2$), medium ($d = 0.5$) and large ($d = 0.8$; Cohen, 1988).

Results

Course Acceptability

At school A, two year 10 students stepped out of lessons with the counsellor, who reported external issues as responsible for the concerns, and five year 8 students asked to withdraw due to perceived religious concerns (i.e. meditation and yoga being contrary to their Christian beliefs) but chose to continue after discussion with their class teacher. One year 10 student at school B asked to withdraw due to disinterest but continued after discussion with the class teacher. At school C, three year 8 students spoke to the counsellor or their class teacher. One was bored and two were experiencing anxiety unrelated to the course. The former student was encouraged by their home class teacher to persist, and the latter two students chose to continue alongside pre-existing external counselling.

Anonymous feedback forms were obtained from students at the final session ($N = 228$). Mean instructor rating was 8.01 (median = 8; range 4–10). Mean ratings of the course were as follows: enjoyment and interest 5.61 (median = 6; range 0–10), amount learnt 5.98 (median = 6; range 0–10) and likelihood of using mindfulness practices in the future 5.30 (median = 5; range 0–10). These ratings did not differ between year 8 and year 10 students ($p > 0.10$).

Counsellors and class teachers also provided anonymous feedback ($N = 11$), with the following mean ratings:

perceived student enjoyment and interest 8.36 (median 9, range 6–10) and perceived amount learnt by students 8.12 (median 8, range 5–10). Three staff suggested that the lesson length, concepts and sitting still were challenging for year 8 s and one noted that year 10 groups conducted in term 1 appeared more self-conscious during meditation practices and less engaged in class discussions, perhaps due to lack of familiarity with classmates at the start of the school year.

Quantitative Results

Data for mindfulness (Openness to Experiences facet), depression, anxiety and weight/shape concerns were positively skewed; square root transformations attained acceptable normality (Supplementary Table S2), following recommendations by Tabachnick and Fiddell (2013, pp. 82). Three mindfulness facets were negatively skewed and required reflect/square root transformations. There were no differences at baseline between groups randomised to treatment and control arms (Supplementary Table S3). Comparable percentages of students in the control and intervention groups were missing at each time point (Fig. 1). Presence at T2, T3 and T4 data collection was not predicted by gender or year level, nor baseline levels of depression, anxiety, wellbeing or weight/shape concerns (Supplementary Table S4). One aspect of mindfulness (Awareness of External Experiences) predicted missingness at T2 (3-month follow-up) such that those who were higher in this facet were more likely to be absent (odds ratio 0.38, 95% CI 0.15, 0.93).

For the combined age groups, descriptive statistics for the mindfulness intervention and the control groups at post-intervention and 3-month follow-up are shown in Table 1. Table 2 presents effect sizes from the mixed model analysis after adjusting for baseline scores. There were no differences between the mindfulness and control groups on any outcome measure at post-intervention, and effect sizes were small (Cohen's $d < 0.17$). At 3-month follow-up, one of eight facets of mindfulness (Decentering and Nonreactivity) was lower (worse) in the mindfulness group ($d = -0.20$; 95% CI $-0.39, -0.01$) but there were no between-group differences in other psychological outcome variables ($d < 0.13$).

Age (year 8 versus year 10) was investigated as a moderator (Table 3). Year 8 students who had undertaken the mindfulness course showed no improvement at post-intervention compared to control ($d < 0.22$). At 3-month follow-up, those who received the mindfulness intervention were worse in two aspects of mindfulness (Awareness of External Environment, $d = -0.30$; 95% CI $-0.55, -0.06$; Decentering and Nonreactivity, $d = -0.39$; 95% CI $-0.63, -0.15$) and in wellbeing ($d = -0.25$; 95% CI $-0.49, -0.01$) compared to control. There were no significant differences in outcomes for the older students (year 10) who had undertaken the mindfulness course compared to control at either time point ($d < 0.22$).

Table 2 Mixed model analyses with between-group effect sizes and 95% confidence intervals ($N = 434$)

Outcome measures	Between-group ES (95% CI)	
	Post-intervention (T2)	3-month follow-up (T3)
Mindfulness facets		
Aware INT	−.07 (−.26, .12)	0 (−.19, .19)
Aware EXT	−.10 (−.29, .08)	−.16 (−.35, .03)
Act Aware	.09 (−.10, .27)	−.01 (−.20, .17)
Acc/NJ	.03 (−.16, .22)	−.06 (−.25, .13)
Dec/NR	.14 (−.05, .33)	**−.20 (−.39, −.01)**
Openness	.17 (−.02, .36)	.06 (−.12, .25)
Relativity	−.15 (−.33, .04)	.02 (−.17, .21)
Insight	.07 (−.27, .12)	−.05 (−.23, .14)
Depression	0 (−.19, .19)	−.04 (−.23, .15)
Anxiety	−.13 (−.31, .06)	−.09 (−.27, .10)
Weight/shape concerns	−.04 (−.23, .15)	−.02 (−.21, .17)
Wellbeing	.16 (−.02, .35)	.13 (−.06, .32)

ES, effect size (Cohen's *d*); significant findings in bold text; *Mindfulness*, Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A); where abbreviated: *Aware INT*, Awareness of Internal Experiences; *Aware EXT*, Awareness of External Experiences; *Act Aware*, Acting with Awareness; *Acc/NJ*, Accepting and Nonjudgemental Orientation; *Dec/NR*, Decentering and Nonreactivity; *Openness*, Openness to Experiences; *Relativity*, Relativity of Thoughts; *Insight*, Insightful Understanding. *Depression*, depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21). *Anxiety*, Generalised Anxiety Disorder Scale (GAD-7). *Wellbeing*, Warwick-Edinburgh Mental Wellbeing Scale. *Weight/shape concerns*, weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q)

Amount of home practice outside of sessions was examined as a potential moderator for all outcomes but no significant results emerged, nor did amount of home practice vary by age group. These analyses are available from the first author upon request.

Extended Follow-up

For the groups involved in the first two rounds of the intervention ($N = 161$), we were able to collect 9-month follow-up data. Descriptive statistics for this subsample of participants appear in Table 4. Analysis of repeated measures (Table 5) showed all significant differences favoured the control group over the students who received the mindfulness intervention. At 3-month follow-up, Decentering and Nonreactivity was worse (Cohen's $d = -0.43$; 95% CI $-0.74, -0.12$) as was wellbeing ($d = -0.41; -0.72, -0.09$). Wellbeing was also worse at 9-month follow-up ($d = -0.40; -0.70, -0.08$) as were weight/shape concerns ($d = -0.35; -0.67, -0.04$).

Table 3 Mixed model analyses: estimated marginal means for moderator (age) by treatment group (2) by time (2)

Outcome measures	Baseline covariate value	Post-intervention						3-month follow-up					
		Year 8			Year 10			Year 8			Year 10		
		M (*SE*)		Between-group ES (95%CI)	*M* (*SE*)		Between-group ES (95%CI)	*M* (*SE*)		Between-group ES (95%CI)	*M* (*SE*)		Between-group ES (95%CI)
		MF (*N* = 131)	C (*N* = 136)		MF (*N* = 86)	C (*N* = 81)		MF	C		MF	C	
Mindfulness facets													
Aw INT*	1.52	1.55 (.02)	1.53 (.02)	.09 (−.15, .33)	1.57 (.02)	1.58 (.02)	−.06 (−.36, .25)	1.59 (.02)	1.57 (.02)	.09 (−.15, .33)	1.54 (.03)	1.57 (.03)	−.11 (−.41, .19)
Aw EXT*	1.54	1.61 (.02)	1.58 (.02)	.13 (−.11, .37)	1.59 (.02)	1.58 (.03)	.04 (−.26, .35)	1.66 (.02)	1.59 (.02)	**−.30 (−.55, −.06)**	1.59 (.03)	1.60 (.03)	−.04 (−.34, .27)
ActAW	2.84	2.91 (.06)	2.99 (.06)	−.12 (−.36, .12)	2.76 (.08)	2.78 (.08)	−.03 (−.33, .28)	3.05 (.06)	3.04 (.06)	.01 (−.23, .25)	2.87 (.08)	2.85 (.08)	.03 (−.28, .33)
ANJ	2.80	2.84 (.06)	2.85 (.06)	−.01 (−.25, .23)	2.77 (.07)	2.82 (.07)	−.08 (−.38, .23)	2.81 (.06)	2.80 (.06)	.01 (−.23, .25)	2.84 (.08)	2.74 (.08)	.14 (−.17, .44)
DNR	2.99	2.99 (.06)	3.13 (.06)	−.20 (−.44, .04)	2.93 (.07)	2.95 (.07)	−.03 (−.33, .27)	2.81 (.06)	3.08 (.06)	**−.39 (−.63, −.15)**	2.97 (.08)	2.91 (.08)	.08 (−.22, .39)
Open	1.58	1.57 (.02)	1.62 (.02)	−.22 (−.46, .02)	1.60 (.02)	1.61 (.02)	−.06 (−.36, .25)	1.64 (.02)	1.64 (.02)	0 (−.24, .24)	1.58 (.03)	1.62 (.03)	−.15 (−.45, .16)
Rel*	1.50	1.54 (.02)	1.49 (.02)	.22 (−.02, .46)	1.54 (.02)	1.54 (.02)	0 (−.30, .30)	1.55 (.02)	1.53 (.02)	.09 (−.15, .33)	1.53 (.03)	1.57 (.03)	−.15 (−.45, .16)
Insight	2.88	3.00 (.07)	3.01 (.07)	−.01 (−.25, .23)	2.93 (.09)	2.77 (.09)	.20 (−.11, .50)	2.88 (.07)	2.81 (.07)	.09 (−.15, .33)	2.85 (.09)	2.85 (.09)	0 (−.30, .30)
Depression	.80	.75 (.03)	.75 (.03)	0 (−.24, .24)	.78 (.04)	.78 (.04)	0 (−.30, .30)	.76 (.04)	.69 (.03)	.17 (−.07, .41)	.81 (.04)	.89 (.04)	−.22 (−.52, .08)
Anxiety	.81	.81 (.03)	.74 (.03)	.20 (−.04, .44)	.84 (.04)	.86 (.04)	−.06 (−.36, .25)	.79 (.04)	.72 (.03)	.17 (−.07, .41)	.83 (.04)	.87 (.04)	−.11 (−.41, .19)
Weight/shape concerns	1.14	1.21 (.04)	1.15 (.04)	.13 (−.11, .37)	1.10 (.05)	1.15 (.05)	−.11 (−.41, .19)	1.14 (.05)	1.06 (.05)	.14 (−.10, .38)	1.04 (.06)	1.14 (.06)	−.002 (−.31, .31)
Wellbeing	3.39	3.35 (.05)	3.44 (.05)	−.16 (−.40, .08)	3.23 (.07)	3.34 (.07)	−.17 (−.48, .13)	3.24 (.07)	3.43 (.06)	**−.25 (−.49, −.01)**	3.29 (.08)	3.22 (.08)	.10 (−.21, .40)

ES, effect size (Cohen's *d*); significant findings in bold text; *Mindfulness*, Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A); where abbreviated: *Aw INT*, Awareness of Internal Experiences; *Aw EXT*, Awareness of External Experiences; *ActAW*, Acting with Awareness; *ANJ*, Accepting and Nonjudgemental Orientation; *DNR*, Decentering and Nonreactivity; *Open*, Openness to Experiences; *Rel*, Relativity of Thoughts; *Insight*, Insightful Understanding. *Depression*, depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21). *Anxiety*, Generalised Anxiety Disorder Scale (GAD-7). *Wellbeing*, Warwick-Edinburgh Mental Wellbeing Scale. *Weight/shape concerns*, weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q). *These variables underwent reflection transformations prior to analysis so a lower mean score reflects improvement

Table 4 Descriptive statistics for subset of mindfulness and control groups ($N = 161$) at baseline, post-intervention, 3- and 9-month follow-up

		Control		Mindfulness	
		Mean	*SD*	Mean	*SD*
Mindfulness					
Aware INT	T1	3.64	.78	3.59	.71
	T2	3.51	.75	3.50	.72
	T3	3.55	.70	3.47	.68
	T4	3.39	.73	3.44	.66
Aware EXT	T1	3.51	.82	3.60	.90
	T2	3.26	.90	3.38	.92
	T3	3.38	.88	3.31	.99
	T4	3.28	.89	3.35	.86
Act Aware	T1	2.78	.84	2.72	.95
	T2	3.04	.87	2.86	.91
	T3	3.10	.92	2.97	.83
	T4	3.10	.88	2.98	.93
Acc/NJ	T1	2.82	.84	2.71	.82
	T2	2.83	.78	2.74	.76
	T3	2.84	.85	2.74	.75
	T4	2.70	.86	2.65	.81
Dec/NR	T1	3.06	.87	2.98	.75
	T2	3.11	.81	2.94	.71
	T3	3.17	.79	2.87	.73
	T4	3.01	.81	2.86	.78
Openness	T1	2.60	.71	2.53	.76
	T2	2.70	.70	2.58	.78
	T3	2.75	.77	2.59	.76
	T4	2.81	.75	2.68	.73
Relativity	T1	3.80	.62	3.74	.73
	T2	3.76	.66	3.58	.75
	T3	3.69	.70	3.57	.80
	T4	3.61	.78	3.42	.80
Insight	T1	2.89	.93	2.93	.87
	T2	2.89	.91	3.01	.93
	T3	2.74	1.03	2.92	.89
	T4	2.69	.89	2.77	.95
Depression	T1	.85	.69	.77	.65
	T2	.80	.74	.69	.66
	T3	.80	.75	.83	.77
	T4	.81	.75	.94	.79
Anxiety	T1	.86	.78	.94	.86
	T2	.89	.87	.95	.84
	T3	.86	.86	1.03	.94
	T4	.92	.83	1.09	.88
Wellbeing	T1	3.36	.73	3.43	.70
	T2	3.28	.88	3.25	.75
	T3	3.41	.83	3.19	.76
	T4	3.38	.77	3.16	.79
Weight/shape concerns	T1	1.94	1.86	1.91	1.92
	T2	2.07	1.98	2.02	1.98
	T3	1.86	1.87	1.93	1.96
	T4	1.82	1.94	2.13	2.02

Mindfulness, Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A); where abbreviated: *Aware INT*, Awareness of Internal Experiences; *Aware EXT*, Awareness of External Experiences; *Act Aware*, Acting with Awareness; *Acc/NJ*, Accepting and Nonjudgemental Orientation; *Dec/NR*, Decentering and Nonreactivity; *Openness*, Openness to Experiences; *Relativity*, Relativity of Thoughts; *Insight*, Insightful Understanding. *Depression*, Depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21). *Anxiety*, Generalised Anxiety Disorder Scale (GAD-7). *Wellbeing*, Warwick-Edinburgh Mental Wellbeing Scale. *Weight/shape concerns*, weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q)

Moderation by age group was not investigated due to the small sample size.

Discussion

This study aimed to replicate the promising improvements and acceptability ratings from a smaller feasibility study (Johnson & Wade, 2019) testing a more intensive 8-week mindfulness programme that had suggested greater improvements in mid versus early adolescence. Across our whole sample, there were no differences between the intervention and control groups with the exception of one aspect of mindfulness (Decentering and Nonreactivity), which was worse at 3-month follow-up in the mindfulness group compared to controls. With age as a moderator, the younger students (M_{age} 13.7 years) who received mindfulness lessons were worse in wellbeing and two aspects of mindfulness (Awareness of External Environment, Decentering and Nonreactivity) compared to controls at 3-month follow-up; effects were small. There were no significant differences between the intervention and control groups in the older students (M_{age} 15.5 years) at either post-intervention or 3-month follow-up. There were no differences between younger and older students on course acceptability. For a small subsample (combined age groups) with 9-month follow-up, deterioration in the mindfulness group was noted for weight and shape concerns and wellbeing compared to controls.

Our prediction that a more intensive 8-lesson curriculum would improve outcomes in adolescents compared to lower "dosage" programmes (Johnson et al., 2016, 2017a) was not supported: neither curriculum yielded benefits across

Table 5 Mixed model analyses with between-group effect sizes for subset with 9-month follow-up data ($N = 161$)

Outcome measures	Between-group ES (95% CI)		
	Post-intervention (T2)	3-month follow-up (T3)	9-month follow-up (T4)
Mindfulness facets			
Aware INT	0 (−.31, .31)	−.06 (−.37, .25)	.11 (−.20, .42)
Aware EXT	.13 (−.18, .44)	−.19 (−.50, .12)	.04 (−.27, .35)
ACT Aware	.16 (−.15, .47)	.15 (−.16, .46)	.12 (−.19, .43)
ANJ	.06 (−.25, .37)	.09 (−.22, .40)	−.02 (−.32, .29)
DNR	.21 (−.10, .52)	**−.43 (−.74, −.12)**	.17 (−.14, .48)
Openness	.09 (−.22, .40)	.18 (−.13, .49)	.13 (−.18, .44)
Relativity	−.28 (−.59, .03)	−.11 (−.42, .20)	−.19 (−.50, .12)
Insight	−.09 (−.40, .22)	−.19 (−.50, .12)	−.08 (−.39, .23)
Depression	0 (−.31, .31)	−.06 (−.37, .25)	.11 (−.20, .42)
Anxiety	−.06 (−.37, .25)	−.18 (−.49, .13)	−.25 (−.56, .06)
Weight/shape concerns	0 (−.31, .31)	−.13 (−.44, .18)	**−.35 (−.67, −.04)**
Wellbeing	.18 (−.13, .49)	**−.41 (−.72, −.09)**	**−.40 (−.70, −.08)**

ES, effect size (Cohen's *d*); significant findings in bold text; *Mindfulness*, Comprehensive Inventory of Mindfulness Experiences—Adolescents (CHIME-A); where abbreviated: *Aware INT*, Awareness of Internal Experiences; *Aware EXT*, Awareness of External Experiences; *Act Aware*, Acting with Awareness; *ANJ*, Accepting and Nonjudgemental Orientation; *DNR*, Decentering and Nonreactivity; *Openness*, Openness to Experiences; *Relativity*, Relativity of Thoughts; *Insight*, Insightful Understanding. *Depression*, depression subscale of the Depression, Anxiety and Stress Scale—Short Form (DASS-21). *Anxiety*, Generalised Anxiety Disorder Scale (GAD-7). *Wellbeing*, Warwick-Edinburgh Mental Wellbeing Scale. *Weight/shape concerns*, weight and shape subscales of the Eating Disorder Examination-Questionnaire (EDE-Q)

our series of Australian studies. We also hypothesised that improvements would be greater for mid- than early-adolescent students, and a differential effect was found: while there was no improvement in mid-adolescent students, only the younger students showed mild deterioration in wellbeing and aspects of mindfulness.

Mean ratings of acceptability for this study averaged 20% lower than ratings for the feasibility trial with the same course and instructor (Johnson & Wade, 2019). One explanation might be that we conducted courses for the first time during all four school terms. Staff feedback suggested that term 1 (unfamiliarity with fellow students in the class) and term 4 (fatigue with the end of the school year) may be suboptimal times for this type of intervention delivery. However, this remains to be tested. Another difference in the current trial was shorter lessons and removal of a break. In the earlier feasibility trial, the 10-min break involved playing a fun game, unrelated to mindfulness and different each week, for a small chocolate reward. Perhaps this inclusion fostered valuable group cohesiveness, light-hearted familiarity with the instructor and a helpful pause in concentration. A range of students in the current trial also reported concerns to their teacher or the counsellor regarding ongoing participation. For two students, concerns related to perceiving the non-academic content as irrelevant. For one group within the same class ($N = 5$), perceived religious conflict was ameliorated after discussing concerns with their teacher, and these students chose to continue. This suggests that more explanation might be needed in terms of the secular nature of meditation, yoga and the use of bells as an anchoring practice. However, taking part in lessons prompted four students to speak to the counsellor or their class teacher regarding anxiety, albeit related to external causes. One of our two earlier studies, using body-based meditations limited to 10 min (Dot be curriculum; Johnson et al., 2016), also found a mild worsening of anxiety in some early adolescents. Given these effects, we postulate that the use of formal meditation in unscreened conscript school students may be unwise for early adolescents, even where preceded by safety instructions. Restricting formal meditation to voluntary programmes for adolescents in the final years of school (e.g. Bennett & Dorjee, 2016) may be safer and more beneficial, with later adolescence suggested as a particular stage when brain networks are more likely to be modified by mindfulness training (Carsley et al., 2018).

It is probable that there is more than one key entry point for mindfulness, together with some resistant periods. Within MBP research, there have now been a growing number of RCTs in primary schools (see, e.g. Black, 2015), although this body of research faces similar methodological limitations together with generally smaller sample sizes. Early adolescence had been suggested as a key window for MBPs due to the capacity for abstract thought before the escalating academic and social stresses of mid–late adolescence (Broderick & Metz, 2009; Kuyken et al., 2013); however, many new barriers emerge at this age compared

to the primary years: increasing self-awareness, self-doubt and peer distraction, less eagerness to please and more desire for autonomy, together with rotating class schedules that add implementation challenges and reduce opportunities for reinforcement of practices (Cook-Cottone, 2017, pp. 93–94). Mindfulness training has been conceived as a "neural training regime" (Shapiro et al., 2015) that repeatedly pairs activation between the prefrontal cortex and the limbic system (Zelazo & Lyons, 2012). Perhaps the benefits of strengthening this link may be even greater if this occurs before the developmental mismatch between affective processing and cognitive control that manifests in adolescence (Riediger & Klipker, 2014, p. 197). Evidence suggests that primary aged children enjoy simple MBPs that include learning about the neurobiology of the brain and brief practices to anchor themselves when dysregulated (Vickery & Dorjee, 2016). Further, these programmes may be easier to disseminate at scale using classroom teachers given the relative simplicity of concepts and practices (i.e. not requiring extensive personal meditation practice).

Limitations and Future Research

Limitations of our study largely arose due to the small size of the research team, with one investigator primarily responsible for design, intervention delivery, data collection and analysis. A single (external) facilitator delivered all mindfulness classes which produced consistency across intervention groups, but the skill of the facilitator in this delivery model potentially confounds the effectiveness of the curriculum. During our feasibility study, we therefore undertook the most rigorous fidelity and competency testing in any youth MBP to date, to our knowledge. Indeed, the use of an experienced and proficient instructor—with more mindfulness experience than is suggested for classroom teacher delivery—might have been expected to overinflate improvements in the current trial. The use of a single facilitator also necessitated staggered intervention delivery over a 12-month period, which impacted on the length of follow-up available for the whole sample (3 months) during the timeframe of this trial. While universal interventions may yield both a prevention and treatment effect across the spectrum present within a classroom, the former may take at least 6 months to emerge (e.g. Nehmy & Wade, 2015; Raes et al., 2014).

Difficulty with school recruitment, particularly for older students, was also reflected in our study. This impacted on eventual sample size for moderator analyses, with our year 10 mid-adolescent groups dipping below our a priori power calculations (81–86 students versus desired 91 students in each of the four cells), resulting in underpowered moderation analyses. Our study design involved clustering at the class level within schools to allow matching of demographic variables and control for school contextual differences; however, there is a risk of contamination within schools with this design. We considered this risk low given (1) the experiential nature of the course; (2) delivery by an external facilitator and (3) occurring in schools without existing mindfulness curricula and widespread knowledge of this approach; however, the potential effects of this cannot be excluded. We did not account for clustering in our power calculation, given that the same presenter delivered all lessons, and each school provided demographically matched pairs of intervention and control groups. Due to school timetabling challenges and therefore lower final participation rates, we were powered to detect an effect size of 0.30 rather than 0.25; the latter is typical for universal school-based studies (e.g. Kuyken et al., 2013; Raes et al., 2014).

Further limitations include the design employing passive (usual lesson delivery) rather than active controls. In addition to any non-specific intervention benefits, students receiving the mindfulness intervention may have actually missed out on classes they enjoyed or which also contributed to improved wellbeing (e.g. physical education), or lost extra time to complete homework compared to their peers, which may have elevated stress. Our use of anonymous surveys and explaining that there were no "right or wrong answers" reduced common method bias with our self-report surveys. However, due to constraints of school timetables, the need to minimise survey length for adolescents and the use of validated scales, we were not able to separate measurement of predictor and outcome variables (temporally or by source) nor employ different response formats to eliminate other potential common method biases (Podsakoff et al., 2003). Finally, the anonymous design of our student feedback surveys precluded us from any quantitative analysis utilising acceptability ratings (testing whether term of intervention delivery impacted engagement and whether engagement impacted outcomes). We recommend collecting course acceptability ratings linked to individual outcomes in future research designs.

Ongoing research into acceptable and effective adaptations of MBPs for early to mid-adolescents is needed (Carsley et al., 2018; Volanen et al., 2020). Based on our research results and classroom experience during four school-based RCTs, we propose that "overlearning" a small number of key concepts (Batterham et al., 2018; Scott, 1992) may be more helpful for teens still developing abstract thought capacity during a developmental dip in emotional dysregulation. The following ideas are proposed for future research into MBPs for this age band: (1) a smaller number of key ideas repeated and reinforced during activities and games across a longer period of time; (2) frequent practice of short anchoring techniques, avoiding formal meditations; (3) modelling and scaffolded application of key ideas and practices to real-life classroom challenges by teachers to embed learning and (4) ideally, reinforcement at home in the same way by parents.

Identifying the key mindfulness skills to target matched to developmental age remains an important goal for future research.

In sum, despite the limitations of real-world research in schools, this RCT study adds to the small but growing number of higher quality investigations suggesting that mindfulness programmes with early- and mid-adolescents are not yet robust. We offer cautions and suggestions for continuing to refine universal school-based programmes for early–mid-adolescent students.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12671-021-01716-3.

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Author Contribution CJ: designed the study, recruited schools, delivered the intervention, undertook the data analyses and wrote the manuscript. TW: collaborated with the design, analysis, writing and editing of the manuscript.

Declarations

Ethics Approval and Consent to Participate All procedures performed in this study were in accordance with the ethical standards of the Social and Behavioural Research Ethics Committee of Flinders University (Adelaide, South Australia; project number 2169) and the Department of Education (South Australia; project number CS-17-000747-1.1). Informed consent was obtained from all individual participants in the study.

Conflict of Interest The authors declare no competing interests.

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