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RESEARCH PAPER

Efficacy of a School-Based Mental Health Intervention Based on Mindfulness and Character Strengths Use Among Adolescents: a Pilot Study of Think Happy-Be Happy Intervention

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Abstract
This study investigated the efficacy of a school-based intervention (8 sessions of 45 min) based on mindfulness and character strengths use (i.e., "Think Happy-Be Happy"). A quasi-experimental study, including assessments at baseline, post-intervention (i.e., one week after the intervention), and follow-up (i.e., six months after the intervention) was performed. Results at post-intervention revealed that adolescents who participated in all intervention sessions experienced significantly increased well-being (i.e., emotional, psychological, and social well-being) and decreased hyperactivity/inattention symptoms and peer-related problems compared to adolescents who did not participate in the intervention. The "intention to treat" analyses showed that adolescents who started the intervention, regardless of the number of sessions they attended, experienced significantly decreased hyperactivity/inattention symptoms compared to adolescents who did not participate in the intervention. However, significant outcomes were not maintained at follow-up. Nevertheless, this study demonstrates that integrating mindfulness with strengths use in school-based interventions might have the potential to promote the mental health of adolescents in terms of both increased well-being and reduced psychological problems.

Keywords Positive mental health · Well-being · Adolescent · Strengths use · Mindfulness · School-based intervention

1 Introduction

During the twenty-first century, schools' educational goals significantly changed. There is a growing awareness that adolescents', mental health (i.e., psychological problems and well-being) is important for adolescents' development and learning (Birchwood & Dale, 2012; Chodkiewicz & Boyl, 2017). Psychological problems are associated with a significant burden such as an increased risk of academic difficulties and lower school results (Birchwood

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& Dale, 2012). Additionally, well-being is considered to be a prerequisite for learning and can lead to better learning performance (Seligman et al., 2009). Therefore, schools are required to go beyond teaching academic skills and knowledge and take on a larger role in supporting adolescents' development and mental health (Chodkiewicz & Boyl, 2017). Therefore, secondary schools seek sustainable and cost-effective practices to incorporate a focus on adolescents' mental health alongside a focus on academic achievement.School-based positive psychology interventions (SPPIs) might offer a solution since it has been shown that SPPIs improve the developmental trajectory of young people and prevent future difficulties by teaching skills that encourage positive self-perceptions, positive emotions, and positive behaviors (Chodkiewicz & Boyle, 2016). Even though SPPIs are diverse and may vary in their approach they have some important similarities. First, SPPIs generally target late childhood and early adolescence, since in this period children are able to effectively engage in the cognitive demands of internal reflection, and thought restructuring associated with psychology-based interventions (Schonert-Reichl et al., 2015). Second, SPPIs are brief in nature, typically consisting of 6 to 10 sessions (Miller et al., 2010; Ohl et al., 2013; Stallard et al., 2014; Suldo et al., 2014; Chodkiewicz & Boyle, 2016). The rationale behind these short interventions is that they are less time-consuming and it is more practical to fit them into an already full school curriculum (Chodkiewicz & Boyle, 2014; 2016). In general, SPPIs are interventions designed to foster positive emotions, positive behaviors, and positive cognitions, as well as stimulate positive effects by decreasing negative states (Owens & Waters, 2020). Since an estimated 10% to 20% of adolescents experience psychological problems (WHO, 2021), there is still a need for improving adolescents' mental health.

1.1 Comprehensive Mental Health Intervention Outcomes

Current conceptualizations of mental health view mental health as more than the absence of illness. The two-continua model (Keyes, 2002), which can also be applied to adolescents (Kennes et al., 2020), states that mental illness and mental health represent related but distinct dimensions. The absence of psychological problems is neither necessary nor sufficient to ensure well-being and vice versa. Consequently, SPPIs aiming to stimulate mental health need to reduce psychological problems as well as foster well-being. Well-being can be broadly conceptualized as consisting of emotional, psychological, and social components (Keyes, 2002). Emotional well-being, the affective component of well-being, is manifested in three components: life satisfaction, the presence of positive emotions, and the absence of negative emotions (Diener et al., 1999; Keyes, 2009). Psychological well-being represents the inter-and intraindividual levels of positive functioning such as one's relatedness with others, feelings of purpose and meaning in life, and a sense of personal growth and development (Keyes, 2009). Lastly, optimal functioning at the community level is conceptualized as social well-being and reflects social integration, social contribution, social coherence, social actualization, and social acceptance (Keyes, 1998). SPPIs should ideally increase well-being in all these dimensions as well as reduce psychological problems. However, most SPPIs for adolescents have not investigated comprehensive mental health outcomes (i.e., all dimensions of well-being and psychological problems) or these effects have not been sufficiently proven (Cilar et al., 2020; Owens & Waters, 2020; Tan, 2016; Tejada-Gallardo et al., 2020).

This study aims to investigate whether a school-based positive psychological intervention, based on the use of strengths and mindfulness results in significant and comprehensive

mental health outcomes in an adolescent sample. The current paper first argues that strengths-based SPPIs have the potential to foster adolescents' well-being, particularly in terms of emotional and psychological well-being. Furthermore, the paper reasons that mindfulness-based SPPIs have the potential to reduce adolescents' psychological problems and foster social well-being. Finally, a school-based intervention integrating strengths use and mindfulness is presented and the rationale for selecting this intervention is explained. Furthermore, the intervention is examined in terms of efficacy by means of a quasi-experimental study design.

1.2 Strengths-Based SPPIs for Adolescents

Strengths-based SPPIs are behavior change interventions aiming to stimulate the use of character strengths in daily life (Lavy, 2019; Kumar & Mohideen, 2021). The number of sessions within these strengths-based programs is diverse. That is, studies have implemented programs in schools consisting of 6 sessions (Austin, 2005), 8 sessions (Madden et al., 2010), or even up to 25 sessions (Seligman et al., 2009; Waters, 2011). Research has shown that the degree to which a person uses their strengths, rather than knowing what they are is a significant predictor of well-being. In general, people have an intrinsic motivation and need to use their strengths, and when they do so, they experience positive outcomes (Govindji & Linley, 2007). Character strengths (e.g., gratitude, love of learning) are defined as the ability to do, think, and feel in a particular way that is beneficial to oneself and others (Park & Peterson, 2009). Although strengths-based SPPIs are already implemented in schools, their mental health outcomes are not yet thoroughly investigated (Lavy, 2019; Owens &Waters, 2020; Quinlan et al., 2012). Previous studies have associated character strengths use with emotional well-being (Douglass & Duffy, 2015; Forest et al., 2012; Gillham et al., 2011; Linley et al., 2010; Shoshani & Slone, 2013). The study of Proctor and colleagues (2011), for example, showed that a strengths-based SPPI, i.e., "Strengths Gym", consisting of 24 sessions over the course of 9 months, was able to increase emotional well-being. Further, a meta-analysis of Bolier and colleagues (2013) showed that positive intervention effects on psychological well-being can be expected in an adult population sample. To our knowledge, no outcomes of single-component strengths-based school interventions on social well-being, psychological well-being as well as psychological problems, have been investigated for adolescent samples. Furthermore, most of these strengths-based SPPIs are not single-component SPPIs but interventions using a more general positive psychology framework of which strengths use represents only a part (Lavy, 2019). This makes it difficult to disentangle the specific contribution of the strengths use component with regard to the global intervention effect.

Further, although there are many pathways through which the use of specific strengths may be associated with different aspects of well-being, a number of mechanisms are common to all strengths. First, it has been argued that the association between strengths use and well-being is mediated by self-esteem. Using strengths helps adolescents to feel good about themselves, which results in increased self-esteem, which in turn leads to an increase in psychological well-being. Also, it has been shown that this increase in self-esteem is linked to higher life satisfaction, which is an aspect of emotional well-being (Douglass & Duffy, 2015). Second, strengths use enables the pursuit of self-concordant goals, which is related to goal progress and psychological need fulfilment associated with goal progress. Thus, people make progress toward personal goals that feel concordant with self-growth and autonomy and this in turn will lead to more positive affect, less negative affect, and

higher life satisfaction (Linley et al., 2010). It is suggested that strengths use is part of an affective upward spiral of success and well-being, motivating adolescents to continue using their strengths which leads to further growth (Linley et al., 2010). To our knowledge, no research is available studying the association between strengths use and social well-being. In sum, there is evidence that single-component strengths-based SPPIs have the potential to stimulate emotional well-being and psychological well-being, but no evidence is yet available that these interventions also significantly foster social well-being and/or reduce psychological problems.

1.3 Mindfulness-Based SPPIs for Adolescents

Mindfulness interventions have been widely applied within clinical psychology, however, the concept of mindfulness has a broader and greater meaning that goes beyond clinical symptom reduction and toward positive human functioning and flourishing. Recently, PPIs that incorporate mindfulness elements have shown positive effects on well-being (Allen et al., 2021). Research even goes as far as considering some mindfulness meditation interventions, designed to increase positive feelings, behaviors, or thoughts to enhance well-being and positive development, such as PPIs (Hendriks et al., 2020; Koydemir et al., 2020). Mindfulness-based SPPIs (6–16 sessions) aim to promote mental health by fostering mindfulness, i.e., self-awareness and attention, with a core characteristic of being open, receptive, and non-judgmental in youth (Kabat-Zinn, 1990; Tan, 2016). Previous research has shown that mindfulness-based SPPIs have the potential to reduce psychological problems, i.e., emotional problems, symptoms of hyperactivity/inattention, and behavioral problems (Murrell et al., 2015, Tan, 2016; van de Weijer-Bergsma et al., 2012). It has been suggested that mindfulness-based interventions for young people are effective in decreasing psychological problems by reducing cognitive reactivity (i.e., the ease with which negative thinking patterns can be (re)activated) and reducing self-coldness (i.e., self-judgment, isolation, and over-identification), which represents a negative sub-construct of self-compassion (van der Gucht et al., 2018).

In contrast, the well-being outcomes of single-component mindfulness-based SPPIs are less investigated. Few studies have examined intervention effects on emotional well-being, most of which have found no effect (Cilar et al., 2020; Tan, 2016), even though the study of Kuyken and colleagues (2013) found a small effect on emotional well-being. Huppert and Johnson (2010) found that a single-component mindfulness-based SPPI had a positive effect on psychological well-being. However, it has to be mentioned that this positive association was only found when analyzing the amount of individual practice outside the classroom and psychological well-being, within the intervention group. No between-group differences were found with regard to psychological well-being outcomes. Furthermore, to our knowledge, no intervention outcomes of single-component mindfulness-based SPPIs on social well-being have been reported yet. Nevertheless, mindfulness has been associated with adaptively self-regulating emotions (Hanley et al., 2015; Lucas-Thompson et al., 2019), which is an important skill to foster positive relationships with peers and might lead to peer acceptance (Morrish et al., 2018). Therefore, it is expected that SPPIs based on mindfulness might lead to increased social well-being via the pathway of emotion regulation. In sum, it can be expected that mindfulness-based SPPIs have the potential to reduce psychological problems, including peer-related problems, and promote emotional and psychological well-being.

1.4 Integrating Mindfulness and Character Strengths

Mindfulness-based interventions are popular school-based SPPIs and their positive impact has been widely established (Owens & Waters, 2020). As mentioned above, they have the potential to reduce psychological problems and promote emotional and psychological well-being. However, research suggests PPIs should be expanded beyond this focal area to a wider range of interventions that include highly-supported positive psychological constructs, such as strengths to provide more varied evidence-based PPIs for young people (Owens & Waters, 2020). In accordance with this view, there has been a tendency to integrate two or more psychological constructs with different theoretical pathways targeting two or more relevant well-being components into an integral program (Lavy, 2019; Tejada-Gallardo et al., 2020). Previous research has shown that mindfulness and character strengths are two constructs that can successfully be integrated into one intervention (Ivtzan et al., 2016; Niemiec, 2014; Pang & Ruch, 2019). Furthermore, mindfulness and awareness of character strengths have been shown to mutually augment each other and as a consequence facilitate greater personal change (Niemiec et al., 2012). In addition, it has been shown that both mindfulness and character strengths can be increased with practice (Borghans et al., 2008). Indeed, studies in which these two practices are combined have revealed significantly increased well-being, flourishing, and engagement in an adult population (Ivtzan et al., 2016). Furthermore, a multi-component intervention approach decreases the risk of relapse and increases the probability of spill-over effects between activities leading to more long-term intervention effects in comparison to single-component interventions (Rusk et al., 2017). Therefore, it can be hypothesized that SPPIs based on mindfulness and strengths use have the potential to have even more comprehensive mental health outcomes, i.e., reducing psychological problems and fostering all dimensions of well-being compared to single-component interventions.

1.5 Think Happy-Be Happy (THBH)

A program integrating mindfulness and character strengths use has already been developed for adults and is referred to as the mindfulness-based strengths practice (MBSP) (Niemiec, 2014). This eight-session mindfulness-based strengths program has been proven to have the potential to increase well-being, flourishing, life satisfaction, engagement and decrease perceived stress in an adult sample (Ivtzan et al., 2016; Pang & Ruch, 2019; Whelan-Berry & Niemiec, 2021) and an undergraduate sample (Wingert et al., 2020). However, evidence that this program can be effective in adolescent samples is lacking. Therefore, this program was adapted for implementation in Dutch schools for a target group of Dutch-speaking adolescents and is referred to as Think Happy-Be Happy (THBH).

The current study aimed to investigate THBH outcomes in an adolescent sample. It is hypothesized that the mindfulness component in the intervention will increase adolescents' level of well-being (i.e., emotional well-being, and social well-being) and decrease psychological problems (i.e., emotional problems, behavioral problems, peer-related problems, and symptoms of hyperactivity/inattention) at post-intervention and follow-up. It is hypothesized that the strength-based component in the intervention will increase adolescents' level of well-being (i.e., emotional well-being, and psychological well-being) at post-intervention and follow-up. Thus, it can be expected that the intervention, integrating mindfulness and character strengths use has the potential to promote the mental health

of adolescents in terms of both increased overall well-being and reduced psychological problems.

2 Methods

2.1 Study Design

A quasi-experimental study was conducted, including assessments one week before the start of the intervention (i.e., baseline), one week after intervention completion (i.e., post-intervention), and six months after intervention completion (i.e., follow-up) in both the intervention and control groups. As only one of the participating schools was able to implement the intervention during the period of research, randomly assigning the schools to the intervention and control condition was not possible.

The variables of interest were assessed using a paper-and-pencil questionnaire measuring all dimensions of well-being (i.e., emotional well-being, psychological well-being, and social well-being) and psychological problems (i.e., emotional problems, behavioral problems, peer-related problems, and symptoms of hyperactivity/inattention). Furthermore, the intervention group was questioned about their motivation toward the intervention. No data were collected regarding the out-of-session practice time. The present study was approved by the local research ethics committee of [blinded for review purposes] (U2017/09227/HVM) and was carried out following the Code of Ethics of the World Medical Association (Declaration of Helsinki) for medical research involving humans (World Medical Association, 2013). In the methods section, it is reported what measures were used and if there were any data exclusions or manipulations (Simmons et al., 2012).

2.2 Procedure

Dutch high schools were recruited in the south of the Netherlands via direct emailing and by contacting the board of directors at individual schools. Initially, all schools were invited to participate as intervention schools. One school indicated to be willing to participate as an intervention school. Three other schools indicated to be willing to participate but only as control schools because they could not implement the intervention during the period of research. The intervention took place in October and November of 2018. The research sample consisted of one intervention school with eight participating classes consisting of adolescents between 13 and 15 years and three control schools (15 classes) consisting of adolescents of the same age and same year level. The educational level of these adolescents was senior general secondary education and pre-university education.

The same data (baseline, post-intervention, and follow-up) was collected at each school, at the same time for both the intervention school and control schools: baseline, post-intervention (i.e., one week after intervention completion), and follow-up (i.e., at the end of the school year, six months after intervention completion).

In addition to being Dutch-speaking, there were no in- and exclusion criteria for participation. Before participating, written informed consent was obtained from the adolescent participants and their parents. In the informed consent, ethical and privacy issues were covered. The intervention was implemented in the curriculum during normal school hours and was not an extra school activity. Nevertheless, the sessions were not mandatory. The sessions were held once a week for 8 consecutive weeks and took place in the classroom

(chairs and desks). The sessions were given in groups of approximately 15 adolescents. Each group was led by two external trainers, which were trained psychologists and trained master psychology students with long-term experience in mindfulness meditation. School-teachers didn't participate in the intervention. In every group, an external trainer guided the meditation. Before the intervention started, the trainers followed a training (two days) in the THBH program and received an instruction manual for the intervention. Students were given a workbook in which they could write down their answers to the exercises as well as what they had learned. In the control schools, no intervention was given. No rewards were offered for adolescents participating in the research.

2.3 Intervention

THBH is based on the MBSP program developed by Niemiec (2014). The intervention was adapted by an experienced lifespan psychologist for use in Dutch high schools. Compared to adults, adolescents have more difficulty focusing attention for a longer period and benefit from shorter but more repetitious exercises (Posner & Petersen, 1990). Therefore, the mindfulness exercises during the sessions were shortened (e.g., a body scan of 10 min instead of 20 min). The number of sessions was maintained since research has shown that SPPIs consisting of between 6 and 10 sessions are considered normal practice for SPPIs (Chodkiewicz & Boyle, 2014, 2016). In order to promote the repetition of mindfulness exercises in daily life, out-of-session exercises were recommended. They contained a daily rehearsal of one of the mindfulness meditations that were taught in the classroom. These mindfulness-based out-of-session exercises were supported with pre-taped audio material. The out-of-session exercises also included non-mindfulness-based exercises (in total: 10 min per week) aiming to facilitate the identification and exploration of their strengths (e.g., receiving feedback on their strengths from parents). In addition, adolescents were encouraged to translate the knowledge, and how to use their strengths, gained during the sessions into practice.

The school intervention consisted of 8 sessions of 45 min. Before the start of the intervention, the participants completed an online questionnaire, the VIA youth (Peterson & Seligman, 2004), assessing their three highest-ranked strengths. The first two sessions in the adapted MBSP program were introductions to mindfulness and character strengths, respectively. In these sessions, key concepts and the rationale behind the practices were introduced and included experiential activities, meditations, and strengths discussions. The remaining sessions, i.e., sessions 3 through 8, covered the integration of mindfulness and character strengths (Whelan-Berry & Niemiec, 2021). More specifically, each session began with an opening meditation, followed by a group discussion reviewing the out-of-session exercises. The middle part of the session contained a specific exercise that was unique to that session in which a mindfulness-based exercise was integrated with strengths use or vice versa. For example, adolescents were asked to visualize using their strengths in overcoming daily challenges or made aware that they could use their strengths to help guide them during the mindfulness exercise (i.e., walking meditation) (Niemiec et al., 2012). In sum, every exercise required adolescents' to combine strengths use and mindfulness practices, in which strengths are used to improve one's meditation practice or area of mindful living (strong mindfulness) and in turn, mindfulness is used as a lens for deepening awareness and use of strengths (mindful strengths use) (Whelan-Berry & Niemiec, 2021). After each exercise, there was a short classroom discussion. The session ended with a closing meditation.

The sessions cover the following themes:

Session 1–Mindfulness and autopilot: everything starts with awareness.
Session 2–Your signature strengths: the exploration of your character strengths.
Session 3–Obstacles and opportunities: the exploration of barriers to practice.
Session 4–Strengthening mindfulness every day: the conscious use of strengths can help to deepen and maintain a mindfulness practice.
Session 5–Valuing your relationships: how we relate to ourselves and others has implications for our self-growth.
Session 6–Mindfulness of the golden mean: mindfulness and strengths use can help to reframe problems and to find different perspectives.
Session 7–Authenticity and goodness: increased awareness of your strengths helps in formulating a realistic and self-consistent best possible self.
Session 8–Your engagement with life: engage in an approach that fosters awareness and strengths use.

2.4 Participants

Figure 1 provides an overview of the number of participants at baseline, post-intervention, and follow-up. At baseline, an intervention group of 120 adolescents (73 boys and 47 girls)

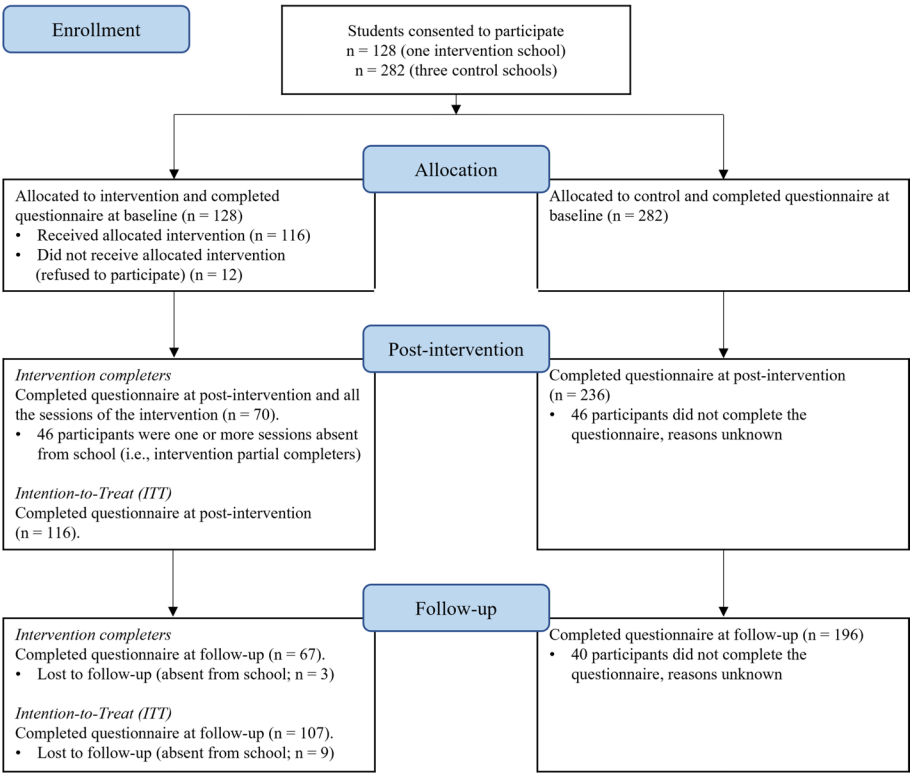

Fig. 1 CONSORT flow diagram of the participation of participants

and a control group of 236 adolescents (96 boys, 139 girls, and one transgender) participated in the study and completed a questionnaire measuring well-being and psychological problems. One week later, 116 adolescents started the intervention.

In this research two analyses have been made. Firstly a completers analysis where the intervention group consisted of participants that attended all sessions (i.e., intervention completers). Indeed, THBH was developed for being integrated into the schools' curriculum and thus participation is obligated. Secondly, an "intention to treat" analyses (ITT) where the intervention group consisted of all participants that started the intervention, independently of the number of sessions they completed (i.e., intervention starters).

During the intervention, four adolescents (3%) quitted and 40 adolescents (36%) were not present at one or more sessions of the intervention with being absent from school as the main reason. 70 adolescents (i.e., intervention completers) attended all sessions, completed the questionnaire at post-intervention, and 67 also completed the follow-up questionnaire. They constitute the intervention group used in the main analyses. In ITT analyses, the intervention group consisted of all participants that started the intervention (i.e., intervention starters). 116 adolescents in this group completed the questionnaire at post-intervention and 107 adolescents completed the questionnaire at follow-up. At the same time, 236 adolescents in the control group, completed the same questionnaire at post-intervention and 196 adolescents at follow-up. In ITT analyses as well as the completers analyses, the same control group was used. Compared to the control group, the intervention completers and intervention starters were slightly but significantly older and reported a significantly higher well-being score at baseline (Table1).

3 Measures

3.1 Mental Health Continuum-Short Form for Adolescents (MHC-SF-A)

The MHC-SF-A (Kennes et al., 2020) is the validated Dutch adolescent version of the MHC-SF (Keyes et al., 2008). This self-report questionnaire consists of 14 items rating emotional well-being, psychological well-being, and social well-being. The items were scored on a 6-point Likert scale (0 = never to 5 = every day) to assess the frequency of various feelings in the past month. An example item of emotional well-being is: "During the past month, how often did you feel happy". An average score was calculated for respectively emotional well-being, psychological well-being, and social well-being. The study of Kennes and colleagues (2020) provided evidence of good internal consistency (Cronbach's α of 0.70 to 0.84) and moderate test–retest reliability of the scales over a period of four weeks (correlations of 0.45 to 0.53).

3.2 The Strengths and Difficulties Questionnaire (SDQ)

The psychological problems of adolescents were assessed with the validated Dutch version of the SDQ (Muris et al., 2003). The self-report version, used in the current study consists of five subscales. Four subscales focus on difficulties relating to behavior, emotional functioning, hyperactivity/inattention, and interaction with peers. As the fifth subscale measures prosocial behavior and does not focus on difficulties, this subscale was not included in the operationalization of psychological problems. Each subscale consists of five items scored on a 3-point Likert scale 0 = not true, 1 = a little true, 2 = certainly true).

Table 1 Group characteristics of the intervention completers, intervention starters, the control group, and tests for differences between these groups at baseline

	Control (n = 236)	Intervention completers (n = 70)	Intervention completers versus control	Intervention ITT (n = 116)	Intervention starters versus control
Age M(SD)	13.52 (.75)	14.20 (.47)	t(183) = − 9.12*	14.30 (.55)	t(300) = − 11.06*
Gender					
Boys (%)	40.7	58.6	$\chi 2$ (2) = 7.16*	61.2	$\chi 2$ (2) = 13.41*
Girls (%)	58.9	41.4		38.8	
Country of birth					
Born in the Netherlands (%)	94.5	91.4	$\chi 2$ (1) = .87	94.0	$\chi 2$ (1) = .40
Born abroad (%)	5.5	8.6		6.0	
Country of birth of parents					
Both born in the Netherlands (%)	84.3	82.9	$\chi 2$ (1) = .09	81.1	$\chi 2$ (1) = .33
Others (%)	15.7	17.1		18.9	
Living-situation					
Living with both parents (%)	77.1	80.0	$\chi 2$ (1) = .26	80.2	$\chi 2$ (1) = .42
Others (%)	22.9	20.0		18.8	
Well-being (MHC-SF-A) M(SD)	3.47 (.81)	3.73 (.56)	t(161) = − 3.01*	3.66 (.59)	t(298) = − 2.52*
Psych. problems (SDQ) M(SD)	2.05 (1.09)	1.94 (1.00)	t(304) = .71	2.09 (1.09)	t(224) = − .36

*$p < .05$; *M* Mean; *SD* standard deviation; *SDQ* The Strengths and Difficulties Questionnaire; *MHC-SF-A* Mental Health Continuum-Short form for Adolescents;

An example item (emotional problem scale) is: "I worry a lot". A total score for each subscale focusing on difficulties was constructed. For each difficulty subscale, higher scores reflected more problems. A total difficulty score was obtained by summing all difficulty subscales and indicating to what extent the adolescent suffered from socio-emotional problems. The study of Muris and colleagues (2003) provided evidence of acceptable internal consistency of the scales (Cronbach's α between 0.60 and 0.65) and satisfactory test–retest reliability over a period of two months of the various subscales used in the current paper (intraclass correlation coefficients of 0.70 or more).

3.3 Data Analysis

Data for all variables was inspected for missing values. When items were missing on a subscale, to calculate the total score of the subscale, the items were summed and divided by the number of items completed. Descriptive statistics, means, and standard deviations were calculated for the main study variables. Chi-square tests and t-tests were used to map possible baseline differences between the intervention group and the control group, as well as to map possible baseline differences between the completers and drop-outs of both groups (i.e., intervention and control), and this for the main analyses (completers analyses) as well as for tor the ITT analyses (intervention starters).

In the intervention group, adolescents were nested in training groups. In the control group, adolescents were nested in classes. As adolescents were nested within groups, linear mixed-effects models with a fixed slope and random intercepts and based on the restricted maximum likelihood estimation (REML) were applied to assess the differences between the two conditions (i.e. intervention and control) at post-intervention and at follow-up. The mixed-effects linear regression models allow for the correlation between the outcomes of adolescents within the same trainer group. The level 1 model captures the outcome variables, condition, and covariates (i.e., baseline outcomes, gender, and age). The level 2 model reflects the group to which the adolescent belongs, i.e., 'trainer group' in the intervention group or 'class' in the control group.

Intervention outcomes of each condition were compared using mixed effects linear regression models. The mean difference between the two conditions was calculated at post-intervention and follow-up. Since adolescents were not randomly allocated to the different groups, the intervention outcomes were adjusted for, gender, age, and baseline scores on the outcome variables. Further, the intraclass correlation (ICC) and the effect sizes, using Hedges's g, were calculated. The data were analyzed using SPSS 28.0 against a significance threshold of $p < 0.05$.

4 Results

4.1 Participants' motivation toward the intervention

Table 2 shows the participants' motivation toward the intervention. Most participants were not motivated to participate or had a neutral motivation. Adolescents' motivation to participate and their perception that the intervention was educational didn't differ significantly between the two groups (i.e., completers and partial completers). Completers didn't like the intervention significantly more than partial completers.

Table 2 Participants' motivation toward the intervention

	Completers (n = 70)			Partial completers (n = 40)			Completers versus Partial completers
	Low	Neutral	High	Low	Neutral	High	
I was motivated to participate	25.7%	61.4%	12.8%	30.4%	62.5%	4.4%	$\chi 2\ (4) = 7.94$
I found this training to be educational	30.0%	45.7%	24.3%	37.0%	52.2%	10.8%	$\chi 2\ (4) = 5.32$
I liked this training	24.3%	45.7%	30.0%	39.1%	47.8%	13.1%	$\chi 2\ (4) = 7.36$
I would like to participate in future sessions	48.6%	37.1%	14.2%	45.7%	47.8%	5.5%	$\chi 2\ (4) = 5.17$

$\chi 2$ = chi-squared

Completers indicated that they didn't practice much outside of the sessions (i.e., 32.9% of the completers indicated that they nearly or never practiced). Sixty percent of the completers indicated that they practiced occasionally. Only a small percentage (i.e., 7%) of the completers indicated they practiced a lot. Partial completers practiced significantly less compared to completers (i.e., $\chi 2\ (5) = 12.65$; $p < 0.05$). Compared to the completers, 39.1% of the partial completers indicated they practiced nearly or never, 58.7% practiced occasionally and 2.2% practiced a lot).

4.2 Intervention Completers and Partial Completers

Table 3 shows the baseline characteristics of the intervention completers, who were present at all sessions of the intervention, and adolescents who were not present at all sessions (i.e., intervention partial completers). Compared to the intervention partial completers, the intervention completers were slightly but significantly younger and reported a significantly lower score on peer problems. There was no significant difference between the two groups regarding all dimensions of well-being, emotional problems, behavioral problems, and symptoms of hyperactivity and inattention at baseline.

4.3 Difference Between the Intervention and Control Conditions

The results in Tables 4 and 5 indicate that, at post-intervention, only in the completers analyses (i.e., when the intervention group consisted of adolescents who were present at all sessions), the intervention group scored significantly higher than the control group on all MHC-SF-A subscales of well-being (e.g., emotional, psychological, and social) at post-intervention.

Focusing on psychological problems, the results in Tables 4 and 5 show only a significant difference between the intervention starters group and the control group for symptoms of hyperactivity and inattention at post-intervention. Only in the completers' analyses, an additional significant difference was observed between the intervention and control group for peer-related problems. Compared to the control group, the intervention group scored significantly lower on these problems at post-intervention.

Further, the results in Tables 4 and 5 indicate that, at follow-up, there was no significant difference between the control group and the intervention group regarding all aspects of well-being and psychological problems.

Table 3 Group characteristics of the intervention partial completers, the intervention completers, and the difference between the two groups at baseline

	Intervention partial completers (n = 41)	Intervention completers (n = 70)	Completers versus partial completers
Age M(SD)	14.49 (.62)	14.20 (.47)	t(77) = − 2.39*
Gender			
Boys (%)	65.2	58.6	$\chi 2$ (1) = .52
Girls (%)	43.8	41.4	
Country of birth			
Born in the Netherlands (%)	97.8	91.4	$\chi 2$ (1) = 2.01
Born abroad (%)	2.2	8.6	
Country of birth of parents			
Both born in the Netherlands (%)	80.4	82.9	$\chi 2$ (1) = .11
Others (%)	19.6	17.1	
Living-situation			
Living with both parents (%)	80.4	80.0	$\chi 2$ (1) = .003
Others (%)	19.6	20.0	
Well-being			
Emotional well-being M(SD)	4.02 (.90)	4.14 (.53)	t(114) = 0.91
Psychological well-being M(SD)	3.68 (.65)	3.82 (.71)	t(114) = 1.07
Social well-being M(SD)	3.13 (.76)	3.35 (.75)	t(114) = 1.52
Psychological problems			
Emotional problems M(SD)	.51 (.43)	.46 (.39)	t(112) = − 0.71
Behavioral problems M(SD)	.40 (.40)	.33 (.31)	t(112) = − 1.21
Hyperactivity/inattention M(SD)	1.00 (.48)	.92 (.48)	t(112) = − 0.84
Peer problems M(SD)	.39 (.38)	.23 (.24)	t(65) = − 2.65*

*$p < .05$; *M* Mean; *SD* standard deviation

5 Discussion

The aim of the present study was to investigate the efficacy of a school-based intervention based on character strengths use and mindfulness. The outcomes of this intervention have been evaluated twice: at post-intervention (i.e., one week after the intervention) and at follow-up (i.e., six months after the intervention). In line with expectations, at post-intervention, adolescents who participated in all sessions of the intervention experienced significantly increased well-being (i.e., emotional well-being, psychological well-being, and social well-being) compared to adolescents who did not participate in the intervention. Although THBH potentially has comprehensive outcomes on well-being, it has to be seen however if these outcomes on well-being are more comprehensive than single-component SPSSIs based on mindfulness or strengths use alone. Therefore, more research is needed to compare these single-component interventions with combined programs such as THBH (Cilar et al., 2020; Tan, 2016; Tejada-Gallardo et al., 2020). Nevertheless, the ITT analyses showed that there was no significant difference between the group of intervention starters and the control group on all dimensions of well-being at post-intervention. This might suggest that causing a significant effect on well-being at post-intervention requires more practice and/or motivation with regard to the use of character strengths and mindfulness.

Table 4 Outcome comparisons for MHC-SF-A subscales of well-being and different scales of psychological problems at post-intervention and follow-up (completers analysis)

	Condition mean (s.d.)						
	Control group	Intervention group	[a]Mean difference	*p*	CI (95%)	ICC	Effect size (Hedges' g)
Post-intervention							
EWB	3.86 (.92)	4.16 (.80)	.24 (.10)*	.014	.05 to .43	0	.27
PWB	3.59 (.92)	3.91 (.68)	.27 (.11)*	.015	.06 to .49	.02	.31
SWB	3.18 (.93)	3.46 (.84)	.27 (.12)*	.035	.02 to .52	.03	.29
EMO	.60 (.46)	.47 (.42)	− .03 (.05)	.536	− .12 to .07	.14	.07
BEHAV	.28 (.28)	.32 (.29)	− .01 (.03)	.796	− .07 to .06	0	.04
HYP	.87 (.54)	.83 (.49)	− .11 (.04)*	.011	− .19 to − .03	0	.21
PEER	.29 (.30)	.23 (.24)	− .07 (.03)*	.027	− 13 to − .01	0	.24
Follow-up							
EWB	3.97 (.85)	3.97 (.91)	− .02 (.15)	.917	− .33 to .29	.08	.02
PWB	3.73 (.81)	3.83 (.85)	.03 (.14)	.817	− .24 to .31	.07	.03
SWB	3.30 (.85)	3.33 (.86)	− .11 (.12)	.368	− .34 to .13	.007	.12
HYP	.84 (.55)	.83 (.47)	− .05 (.06)	.829	− .16 to − .07	0	.10
PEER	.25 (.26)	.30 (.26)	.02 (.04)	.671	− .06 to .08	0	.07

*$p < .05$; *EWB* emotional well-being; *PWB* psychological well-being; *SWB* social well-being; *EMO* emotional problems; *BEHAV* behavior problems; *HYP* hyperactivity inattention problems; *PEER* peer-related problems; *s.d.* standard deviation; *CI* confidence interval; *ICC* intraclass correlation coefficient

[a]Mean difference: intervention–control adjusted for the outcome score at baseline and the potential confounders: gender, age

Furthermore, sessions were built on conclusions made in previous sessions and their effectiveness was partly dependent on the willingness of the adolescents to practice out-of-sessions. Consequently, being absent from a session meant that the content of that session was not known to the adolescent and the homework assignment was not given to him/her. This might have resulted in later sessions to be less effective. Alternatively, the general reduction in the number of sessions might have caused the lack of between-group differences on several of the measured outcome variables.

In addition to results for well-being, intervention starters experienced significantly decreased symptoms of hyperactivity and inattention compared to adolescents who did not participate in the intervention. This might be explained by the fact that individuals with hyperactivity and inattention problems benefit from mindfulness-based interventions which lead to a reduction of their symptoms (Murrell et al., 2015). As adolescents with hyperactivity and inattention problems have an increased risk of academic difficulties, decreasing these symptoms may lead to better school results (Birchwood & Dale, 2012). Furthermore, adolescents who participated in all sessions of the intervention experienced additional significantly decreased peer problems compared to adolescents who did not participate in the intervention. However, adolescents who did not attend all sessions experienced no significant decrease in peer problems compared to adolescents who did not participate in the intervention. Further, it should be noted that students who were absent at one or more sessions scored significantly higher on peer problems. Furthermore, and not in line with our

Table 5 Outcome comparisons for MHC-SF-A subscales of well-being and different scales of psychological problems at post-intervention and follow-up (ITT analysis)

	Condition mean (s.d.)						
	Control group	Intervention group	[a]Mean difference	*p*	CI (95%)	ICC	Effect size (Hedges' g)
Post-intervention							
EWB	3.86 (.92)	4.02 (.88)	.13 (.09)	.191	− .07 to .32	.01	.14
PWB	3.59 (.92)	3.75 (.70)	.15 (.10)	.120	− .04 to .35	.02	.20
SWB	3.18 (.93)	3.34 (.85)	.18 (.12)	.154	− .07 to .43	.06	.29
EMO	.60 (.46)	.55 (.50)	− .03 (.04)	.542	− .06 to .11	.14	.07
BEHAV	.28 (.28)	.38 (.34)	− .02 (.04)	.538	− .04 to .07	0	.07
HYP	.87 (.54)	.89 (.49)	− .08 (.04)*	.037	− .16 to 0	0	.15
PEER	.29 (.30)	.31 (.33)	− .04 (.03)	.206	− 10 to .02	0	.14
Follow-up							
HYP	.84 (.55)	.85 (.46)	− .02 (.05)	.670	− .14 to .08	0	.04

*$p < .05$; *EWB* emotional well-being; *PWB* psychological well-being; *SWB* social well-being; *EMO* emotional problems; *BEHAV* behavior problems; *HYP* hyperactivity inattention problems; *PEER* peer-related problems; *s.d.* standard deviation; *CI* confidence interval; *ICC* intraclass correlation coefficient

[a]Mean difference: intervention–control adjusted for the outcome score at baseline and the potential confounders: gender, age

expectations, intervention starters did not experience significantly decreased emotional and behavioral problems compared to adolescents who did not participate in the intervention. This result might be explained by the fact that participants in THBH scored relatively low on psychological problems and high on well-being at baseline. They were in quite good mental health and might therefore have benefited less from an intervention aimed at reducing their psychological problems. Therefore, it remains unclear if THBH has less comprehensive outcomes on psychological problems compared to single-component interventions based on mindfulness which have proven to have the potential to decrease emotional problems and behavioral problems (Cilar et al., 2020; Tan, 2016; van de Weijer-Bergsma et al., 2012). Further, to our knowledge, intervention effects on psychological problems for single-component SPPIs based on strengths use have not been investigated, which makes it impossible to compare intervention outcomes of THBH and these interventions.

Although school-based interventions have been proven successful in reducing psychological symptoms and improving specific dimensions of well-being (e.g., Ruini et al., 2009; Shoshani & Steinmetz, 2014; Shankland & Rosset, 2017), THBH might have the potential to foster all dimensions of well-being as well as reducing psychological problems and as such addresses more outcome measures than several previous SPPIs for adolescents (Cilar et al., 2020; Tan, 2016; Tejada-Gallardo et al., 2020). Therefore, these findings might suggest that integrating mindfulness and strengths use in one intervention might help to achieve more comprehensive outcomes on mental health. However, there is still a need for a better understanding of how the integration of mindfulness and strengths use might cause these comprehensive effects on mental health. Therefore, processes of change through which the intervention was effective need to be investigated. Outcomes should therefore not only be measured at the end of the intervention but also after each session.

This would give more insight into the dose–effect of the number of sessions given, mechanisms of action, and key practices related to each outcome.

The current study also investigated whether these results were maintained at follow-up. Not in line with our expectations, these outcomes were not maintained at six months. A possible explanation for this result might be that the duration of the intervention was not long enough to change adolescents' habits and no booster sessions were offered such that their strengths use and mindfulness practice fell back to baseline levels. Previous research has shown that participants benefit more from longer interventions because they have more time to turn positive activities into habits (Sin & Lyubomirsky, 2009; Waters, et al., 2015). Moreover, the adolescents were not motivated in doing their out-of-session exercises and often skipped these exercises, which are an essential part of the intervention aimed to promote learning transfer and good habit consolidation. This might be an alternative explanation for the non-results at follow-up. Future research should find ways to understand the reasons why adolescents are not motivated to do out-of-session exercises. This might give insight into how to stimulate adolescents to practice outside of the classroom as well as ways to encourage and remind adolescents to continue to use their strengths and be mindful. However, evidence for maintaining mental health outcomes of school-based interventions over a long period is generally limited. Although there are several exceptions (e.g., Ruini et al., 2009), most SPPIs have shown to have limited mental health outcomes in the long term, or their long-term effects have not been sufficiently proven (Cilar et al., 2020; Gee et al., 2020; Tejada-Gallardo et al., 2020). Developing new SPPIs or adapting existing SPPS that generate significant long-term outcomes still remains a major challenge for future research. Nevertheless, several suggestions have been made to maintain the effects of these interventions over time. For example, it has been proposed that these interventions should be implemented by the teachers since teachers often already have a personal, familiar relationship with the students and are able to reinforce the sessions after the program has been completed. Also, incorporating positive psychology skills (e.g., character strengths and meditation) into school subjects might have a significant impact on students' well-being in the long term (Shankland & Rosset, 2017; Waters, 2011). Lastly, to have widespread and sustainable results of SPPIs they should be adapted in a school-wide approach in such a way that students will be exposed to the program contents across multiple years. In short, to maintain positive mental health outcomes over a longer period of time SPPIs should become part of school culture.

The study has several strengths. It is the first longitudinal study to assess the outcomes of the intervention THBH. The study included a large intervention group as well as a large no-intervention control group. A completers analysis, as well as an ITT analysis, was performed. The intervention was conducted in a real-life context, examining comprehensive effects on mental health over two post-intervention time points. Nevertheless, this study also has several limitations. Firstly, to evaluate the outcomes of the intervention, self-report measures were used, which might have led to response bias. Response biases can be minimized by using a multi-modal approach in which observations, interviews, or biological parameters are combined with self-report measures (Paulhus et al., 2007). Furthermore, different contexts (e.g., school, home environment) may not provoke the same level of mental health (Mischel & Shoda, 1995). Therefore, assessing mental health in different contexts is more appropriate and can be achieved by collecting reports from informants who spend a considerable amount of time with adolescents in these contexts (e.g., teachers, parents). These reports reflect contextual variations in the mental health of adolescents (De Los Reyes et al., 2015). Secondly, the intervention group consisted of only one intervention school. Consequently, the results of the intervention study are therefore sensitive

to changes in the school atmosphere in this intervention school. Furthermore, there was a lack of diversity in the intervention group. This group mainly consisted of mentally healthy adolescents, with high levels of well-being and low levels of psychological problems leaving less room for improvement and there is no certainty that the intervention exercises are also suitable for less mentally healthy adolescents. On top of that, the intervention school was located in a small urban and less culturally diverse area, which resulted in a lack of diversity in race/ethnicity in the intervention group. Therefore, generalizing the findings to all Dutch adolescents is limited. Future studies should address whether these findings apply to adolescents with mental health problems or a different cultural background. Thirdly, the schools were not randomly assigned to the control condition and intervention condition. Nevertheless, all the schools advocated organizing interventions in their school. Only one school was available to organize the intervention during the period the research was organized. Fourthly although the intervention school and control schools were located in the same area, and efforts were made to avoid differences between the intervention group and the control group, there might be a variety of factors influencing the intervention outcomes that were different in both groups resulting in uncertainty about the true effects of the intervention. Fifthly, to eliminate the placebo effects of the intervention, a placebo training should have been presented to the control group.

6 Conclusion

THBH, a school-based program that incorporates strengths use and mindfulness, might have the potential to improve comprehensive mental health outcomes, i.e., stimulating all dimensions of well-being and reducing symptoms of hyperactivity/inattention and peer-related problems in adolescents who attend all sessions. However, these results did not sustain six months after the intervention. Future research, therefore, needs to investigate how these post-intervention outcomes can be maintained in the long term.

Data Availability The Study's data will be available at: https://osf.io/gu7qz/.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval The present study was approved by the local research ethics committee of Open University (U2017/09227/HVM) and was carried out following the Code of Ethics of the World Medical Association (Declaration of Helsinki) for medical research involving humans (World Medical Association, 2013).

Informed Consent Before participating, written informed consent was obtained from the adolescent participants and their parents. In the informed consent, ethical and privacy issues were covered.

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