

Development and Evaluation of a Blended Learning Mindfulness Program for High School Students During the COVID-19 Pandemic

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Abstract

Many adolescents worldwide suffer from stress or unhealthy emotional states such as depression. There is a trend toward limited physical contact via social distancing practices that developed during the coronavirus disease 2019 (COVID-19) pandemic. An experimental study aimed at investigating the effects of a mindfulness program on stress, concentration, self-esteem, and self-control in high school students. A 10-week mindfulness intervention was provided to the experimental group (n = 89) from September–November 2020, while the control group (n = 89) received general health education. Four weeks after the program, the experimental group showed reduced stress and improved concentration, self-esteem, and self-control compared to baseline.

The blended learning mindfulness program is effective improving concentration and should be incorporated into the formal high school curriculum.

Keywords

COVID-19, mindfulness, distance education, schools, adolescent, mental health, school nurses, stress, concentration, self-esteem, self-control

Introduction

The World Health Organization (WHO) declared the COVID-19 outbreak a pandemic in response to its rapid global spread in March 11, 2020 (WHO, 2021). In South Korea, the Central Disaster and Safety Countermeasures Headquarters announced the implementation of social distancing, delayed the start of schools, and encouraged working from home in order to control the spread of COVID-19 (Korea Centers for Disease Control and Prevention, 2021). These phenomena were common not only in Korea but also around the world. With the COVID-19 pandemic prolonged, demands for various strategies appropriate for designing online classes rose significantly and the blending of learning programs that combined in-person and online classes began to grow (Song & Kim, 2020).

Adolescence is a crucial period in development during which individuals must establish plans for imminent adulthood and acquire essential life skills, such as attention, self-control, awareness, and flexibility (Center on the Developing Child, 2018). A substantial number of adolescents worldwide are diagnosed with attention-deficit/hyperactivity disorder, depression, anxiety, eating disorders, addiction, and

self-destructive behaviors such as self-harm or suicidal ideation. These disorders occur in all adolescents regardless of race, education, and socioeconomic status (Luthar & Barkin, 2012).

According to the 16th Korea Youth Risk Behavior Web-Based Survey conducted in 2020, 34.2% of students had prevalence of “substantially high” or “high” stress. It was higher among high school students (31.1% in males, 45.2% in females) than middle school students (24.9% in males, 36.2% in females) (Korea Disease Control and Prevention Agency, 2021). Adolescents’ stress may be caused by an array of factors, such as dramatic social and emotional changes (Kendall & Peterman, 2015), school performance, and increased responsibility (Hussain et al., 2008).

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These factors induce unhealthy emotional states such as anxiety and depression, which in turn are associated with low academic performance (Foster, 2018). In addition to stress, adolescents' mental health is assessed using constructs such as attention, self-control, and self-esteem (Schacter et al., 2011; Seligman & Csikszentmihalyi, 2000; Shaw & Sudre, 2021). Thus, aggressive interventions that strengthen self-control and self-esteem are needed for high school students to help them achieve emotional stability by controlling their attention and stress levels. Meditation has been used as components of successful interventions to treat a variety of concerns in adolescent populations.

Meditation promotes emotional composure, physical relaxation, psychological balance, and coping with disease, thereby promoting overall health and wellbeing (National Center for Complementary and Integrative Health, 2018). The 2017 National Health Interview Survey revealed that the percentage of American adults who practiced meditation rose from 4.1% in 2012 to 14.2% in 2017, and the percentage of American children (4–17 years) who practiced meditation rose from 0.6% in 2012 to 5.4% in 2017 (Black et al., 2018). The reasons for the growing interest in meditation are that it is easy to perform, safe, and less expensive compared to other complementary and alternative medicine therapies (Cramer et al., 2016).

Mindfulness is a type of meditation that can be described as 'paying attention in a particular way, on purpose, in the present moment non-judgmentally'. It can be further divided into two subtypes: meditative mindfulness proposed by Kabat-Zinn, which is rooted in Eastern Buddhism and emphasizes the functions of meditation, and socio-cognitive mindfulness proposed by Langer, which was derived from a Western perspective and involves cognitive intervention without meditation (Hart et al., 2013; Trent et al., 2016; Yeganeh & Kolb, 2012). Both schools of mindfulness enhance awareness of the present and attention to stimuli through self-regulation, emphasize openness, and their fundamental philosophy, components, measures, and interventions are similar. However, there are differences in fundamental philosophies, components, measurement tools, and intervention methods (Hart et al., 2013). While Langer's interventions are designed to improve cognitive performance and wellbeing, Kabat-Zinn's interventions are therapeutic in orientation, and aim to lessen physical illness symptoms and psychological distress (Hart et al., 2013). Mindfulness-based interventions have been proposed as a means of improving adolescents' self-control and overall mental health (Saltzman, 2014).

School has a great influence on the physical, mental, and social development of adolescents and school-based nursing interventions can be important and effective. Therefore, the strengths of Kabat-Zinn's meditation-focused meditative mindfulness and Langer's socio-cognitive mindfulness should be integrated to develop an easy and systematic mindfulness program for high school students who are new to

mindfulness meditation. Most existing mindfulness programs are face-to-face programs because of the nature of the intervention, and the few non-face-to-face programs have utilized online learning using videos, with few real-time non-face-to-face programs available (Saltzman, 2014).

In keeping abreast with the strict social distancing practices due to the COVID-19 pandemic, we aimed to develop and evaluate the feasibility and effects of a blended learning mindfulness program that combined face-to-face and online classes in school settings, and integrated strengths of the aforementioned two types of mindfulness meditation. Ultimately, this program aims to help adolescents to enhance academic and psychosocial strengths and improve self-regulation capacities.

Materials and Methods

Study Design

This was a non-equivalent control group pretest-posttest experimental study aimed at investigating the effects of a mindfulness program on stress, attention, self-esteem, and self-control in high school students in Seoul, South Korea.

Study Participants

Tenth graders (first-year high school students) from one high school in Seoul were considered as candidates. Students who provided their consent and their parents' consent to participate in the study were enrolled.

The sample size was determined using G*power 3.1.9.4 software. With an effect size (f) of 0.5, significance level (α) of 0.05, and power ($1-\beta$) of 0.8, the minimum sample size was determined to be 128 (64 in each group). Of the 188 10th graders in the high school, 187 consented to participate in the study. The eight 10th grade homeroom classes with the same curriculum were paired to randomize the classes into the experimental group ($n=94$) and control group ($n=93$). After excluding 11 students with incomplete questionnaires and attendance rates below the cutoff (<80%), data from 176 students (89 students in the experimental group and 87 in the control group) were included in the final analysis. The second measurement took place four weeks later to examine the retention of the effects of the program and was conducted on only 80 students in the experimental group due to the pandemic.

Measurement

Perceived Stress Scale. The Perceived Stress Scale (PSS) developed by Cohen et al. (1983) and standardized by Park and Seo (2010), was used. This tool consists of 10 items (For e.g., In the last month, how often have you been upset because of something that happened unexpectedly? In the last month, how often have you felt that you were on top

of things?). A higher score indicated greater perceived stress. Cronbach's α , used to evaluate internal consistency, was .78 at the time of development and .92 in this study.

Harris & Harris Concentration Exercise Grid. To measure concentration, the Harris and Harris (1984) Concentration Exercise grid was used. Students looked for consecutive numbers starting with an arbitrarily presented number within a limited time (1 min), and a higher count of numbers indicates better concentration. To enhance the accuracy of measurement, the parameter was measured by a trained research assistant under the supervision of a researcher in the same place during both baseline and post-intervention measurements.

Rosenberg's Self Esteem Scale. The nine items of the Rosenberg's Self-Esteem Scale (RSES), developed by Rosenberg (1965), which were modified and adapted into Korean by Do and Lee (2011), were used. Each item was rated on a three-point Likert scale, with a higher score indicating greater self-esteem. The Cronbach's α was .85 in the study by Do and Lee (2011) and .92 in this study.

Healthy Self-Regulation Subscale. From the multiple subscales of the Mindfulness Thinking and Action Scale for Adolescents, the 12-item Healthy Self-Regulation Subscale (HSRS) that measures self-control of adolescents aged 13–17 years, adapted into Korean by Lee (2019), was used. A higher score indicated greater self-control. Cronbach's α was .84 in the study by Lee (2019) and .86 in this study.

Program Development

The program was structured with two key features: 1) It included many examples tailored to high school students and utilized activity sheets to provide hands-on experience for easy comprehension. 2) It emphasized practice by proposing daily mindfulness activities. There were seven mindfulness attitudes comprising: non-judgement, patience, beginner's mind, trust, non-striving, acceptance, and letting-go. For example, the 'eating meditation program' is to look at raisins as they are, as if they had never seen them before, so that students can learn 'non-judgement' attitude.

The program was designed as having 10 sessions: introduction (session 1), development (sessions 2–9), and closing (session 10), and each session was comprised of an opening (5 min), development (35 min), and a closing (5 min).

Session 1 involved students' introduction of themselves, introduction to the program, understanding of mindfulness in comparison with mindlessness, and exploration of cases of mindlessness in daily life and adopting an open mind. Session 2 included understanding two out of seven mindfulness attitudes and gaining a new experience through raisin

meditation exercise. Session 3 included understanding two mindfulness attitudes and breathing meditation to pay attention to the present. Session 4 included understanding the remaining three out of seven mindfulness attitudes and recognizing uncertainty. Session 5 was designed to help students feel their breath and body senses through body scan and focus and accept variability. Session 6 involved watching an experimental video to understand context and engaging in an activity to help switch context. Students were trained to view a situation from various angles through the gorilla experiment, changing Aesop's fables, and thinking outside the box game in session 7, and hand drawing activity and forced connection method in session 8. Session 9 was designed to help students to be more accepting and engage in more controlled responses to themselves and their learning. In session 10, students created their own mindfulness activities and examined their changes. Table 1 presents the details of the mindfulness program.

Data Collection

Data was collected from 10th graders from a single high school from September–December 2020. After asking for cooperation, the school nurse and counselor explained the purpose of the study, confidentiality, voluntary participation, and benefits and risks of participation to the students and their legal guardians, and written consent was obtained from both parties. At the time of this study, there were hybrid classes in order to control the spread of COVID-19.

The baseline survey consisted of the PSS, Harris & Harris grid, RSES, and HSRS for both the experimental and control groups. The post-intervention survey was conducted in the same manner. To examine the retention of the program effects, the same questionnaire was administered to the experimental group four weeks after the completion of the program. The Harris & Harris grid, which requires in person administration, was excluded from the four-week follow-up survey due to the pandemic. The control group received general health education during the same period and was given an opportunity to participate in the same intervention program after the completion of the study.

The intervention was implemented by school nurse. School nurse majored in psychiatric mental health nursing and is a member of the domestic meditation society and is qualified as a meditation leader. The program was used by mixing the socio-cognitive mindfulness program that worked for students in Korea and the K-MBSR program that emphasized meditative mindfulness. On-line sessions were conducted while interacting with students using Zoom. There was a difference in the way students engage in activities during online and offline programs, but the students in both groups received all the course content.

Table 1. Program Outline.

Session	Topic	Learning objective	Details of activities
1 Online	An open mind	Understand the purpose and rationale for the program. Participate and build group cohesion. Recognize automatic and habitual thinking.	(K* + SC**) Lecture about mindlessness Discover mindlessness cases in real life
2 F to F***)	Being present	Perception of the experience that is occurring at the moment	(K + SC) Engage in a new experience Mindfulness eating meditation
3 F to F		Foster ability to concentrate on the present through meditation	(K + SC) Concentration activity Mindfulness breathing meditation
4 Online	Nothing lasts forever	Recognize and accept uncertainty Foster ability to focus on variability	(SC) Lecture about mindfulness with mistakes Mind map activity: Do as you think
5 F to F		Realize distractions and foster ability to accept through meditation	(K) Mindfulness body scan Feel your breathing
6 Online	The world in context	Changing attitude Switch context through differentiation and inference	(SC) Lecture about thinking in context Infer new word Find different uses of an object
7 F to F	Think from different angles	Enhance openness Improve the flexibility of thinking	(SC) Lecture about differences in perspectives Change Aesop's fables Think outside the box game
8 Online	Different viewpoints	View yourself and others from various perspectives Improve ability to engage in a controlled response vs. an automatic response	(SC) View from a different perspective Hand drawing activity Forced connection activity
9 Online	As you think	Shift from judgmental thinking to an accepting attitude Engage in a controlled response vs. automatic response	(SC) Categorize yourself Practice mindfulness Create your own mindfulness activity
10 F to F	Mindfulness in daily life	Control stress through mindfulness Learn how to practice mindfulness in daily life Practice mindfulness to foster positive emotions	(K + SC) View your stress from a different angle Mindfulness in daily life activity Create your own mindfulness activity Summarize and re-cap program

K*: Kabat-Zinn mindfulness program.

SC**: Social Cognitive mindfulness program.

F to F***; Face to Face class.

Data Analysis

Data was analyzed using SPSS Statistics software (version 25.0; IBM, New York City, NY, USA). The general characteristics of the experimental group and control group were analyzed using frequencies with percentage and mean with standard deviation. The homogeneity of the two groups in general characteristics and dependent variables were analyzed using a t-test, χ^2 -test, and Fisher's exact test. Statistical significance was defined as a *P-value* of .05 or less. The effects of the program (stress, concentration, self-esteem, and self-regulation) were analyzed using a t-test and repeated measures ANOVA.

Ethical Considerations

This study was approved by the Institutional Review Board at Eulji University for ethical considerations (EU20-15).

Results

Baseline Homogeneity

Table 2 shows the general characteristics and homogeneity of the two groups. They were found to be homogeneous in general characteristics, which were speculated to influence

Table 2. Homogeneity Tests Between the two Groups at Baseline.

Characteristics	Categories	Exp.(n = 89) n (%) or Mean \pm SD	Con.(n = 87) n (%) or Mean \pm SD	Total(n = 176) n (%) or Mean \pm SD	t / χ^2	p
Sex	Male	60(67.4)	57(65.5)	117(66.5)		.873
	Female	29(32.6)	30(34.5)	59(33.5)		
	Total	89(50.6)	87(49.4)	176(100.0)		
School grades	Very good (Top 10%)	7(7.9)	8(9.2)	15(8.5)	4.35	.361
	Good (Top 11–40%)	27(30.3)	32(36.8)	59(33.5)		
	Moderate (Top 41–60%)	33(37.1)	31(35.6)	64(36.4)		
	Poor (Top 61–80%)	18(20.2)	9(10.3)	27(15.3)		
	Very poor (\geq Top 81%)	4(4.5)	7(8.0)	11(6.2)		
	Total	89(50.6)	87(49.4)	176(100.0)		
Health		7.09(2.34)	6.95(2.37)	7.02(2.35)	0.38	.702
Depression		3.02(2.65)	3.36(2.86)	3.19(2.75)	-0.80	.423
Anxiety		2.30(2.31)	2.75(2.71)	2.52(2.52)	-1.17	.244
Concentration		7.73(3.49)	6.82(3.05)	7.28(3.30)	1.85	.066
Stress		2.77(0.42)	2.74(0.40)	2.75(0.41)	0.56	.578
Self-esteem		1.79(0.55)	1.78(0.52)	1.78(0.53)	0.13	.895
Self-control		2.17(0.42)	2.14(0.47)	2.15(0.44)	0.50	.618

the dependent variables. There were no significant differences in school grades, health, depression, and anxiety, or in the baseline scores for the dependent variables, namely concentration, self-esteem, stress, and self-control between the two groups.

Differences Between the Experimental and Control Group

After the program, the experimental group scored statistically significantly higher in concentration (9.48 ± 3.34) than the control group (8.16 ± 3.21) ($p = .008$). There were no significant differences in the stress, self-esteem, and self-control scores between the two groups after the program (Table 3).

Effects Over Time in the Experimental Group

The experimental group showed changes in their stress scores over time ($F = 0.69$, $p < .001$), with 1.80 ± 0.54 at the baseline, 1.80 ± 0.55 after the program, and 1.60 ± 0.69 at the four-week follow-up. The stress score at the four-week follow-up was significantly lower than the baseline score and post-intervention score. The self-esteem score also significantly changed over time ($F = 0.54$, $p < .001$), with 2.77 ± 0.42 at the baseline, 2.81 ± 0.31 after the program, and 2.95 ± 0.54 at the four-week follow-up, showing a significantly higher self-esteem score at the four-week follow-up compared to the baseline and post intervention. The self-control score was significantly higher after the program (2.43 ± 0.51) and at four-week follow-up (2.46 ± 0.57) compared to the baseline (2.17 ± 0.042) ($F = 0.57$, $p < .001$) (Table 4).

Discussion

We developed and implemented a blended learning mindfulness program that combines face-to-face and online classes with high school students during the COVID-19 pandemic and found that the experimental group had significantly improved concentration compared to the control group. Four weeks after the program, the experimental group showed reduced stress and improved concentration, self-esteem, and self-control compared to baseline.

The literature on mindfulness has been dominated by two leading schools of thought: one advanced by Langer and her colleagues, the other developed by Kabat-Zinn and his associates (National Center for Complementary and Integrative Health, 2018). In addition, the two strands of research have been running parallel for more than 30 years, with hardly any attempt to clarify the relationship between them (National Center for Complementary and Integrative Health, 2018). For this reason, mindfulness programs have been conducted separately for the two schools of thought (Foster, 2018; Hart et al., 2013; Langer, 2000; Lee, 2019; Trent et al., 2016).

We strived to comprehensively integrate the two distinct types of mindfulness in our program: quiet meditation (Kabat-Zinn's mindfulness) and active choice (Langer's socio-cognitive mindfulness); hence, developing a mindfulness program that promotes adolescents' mental health was one of the strengths of this study.

The experimental group that participated in the mindfulness program showed a significant improvement in concentration compared to the control group. Concentration not only affects academic performance but also interpersonal relationships, such as peer relationships and relationships with teachers, as it enables an individual to listen to others,

Table 3. Dependent variable Scores Between the Experimental and Control Groups.

Characteristics	Exp.(n = 89) Mean ± SD	Con.(n = 87) Mean ± SD	Total(n = 176) Mean ± SD	t	p
Concentration	9.48(3.34)	8.16(3.21)	8.83(3.34)	2.68	.008
Stress	1.77(0.56)	1.80(0.58)	1.79(0.57)	-0.29	.774
Self-esteem	2.82(0.31)	2.81(0.30)	2.81(0.30)	0.09	.927
Self-control	2.44(0.50)	2.38(0.51)	2.41(0.50)	0.78	.439

Table 4. Effects of the Program Over Time in the Experimental Group (N = 80).

Characteristics	Baseline (T1) Mean ± SD	Post-intervention (T2) Mean ± SD	4-week follow-up (T3) Mean ± SD	F	p	Post-hoc
Stress	1.80(0.54)	1.80(0.55)	1.60(0.69)	0.69***	.000	T3 < T1, T2
Self-esteem	2.77(0.42)	2.81(0.31)	2.95(0.54)	0.54***	.000	T1, T2 < T3
Self-control	2.17(0.42)	2.43(0.51)	2.46(0.57)	0.57***	.000	T1 < T2, T3

catch the essence, and appropriately respond (Kim & Song, 2014).

Ten minutes of mindfulness meditation every day enhances concentration and the ability to maintain an active working memory through electroencephalography (Malinowski, 2018). Among the various methods of mindfulness meditation, simply concentrating on breathing influences concentration and working memory. This is a type of brain network training, where repeatedly engaging in the same behavior helps maintain concentration and further activates the key network (Malinowski, 2018).

Strategies that enhance adolescents' attention and concentration should be incorporated into school curricula. Langer (2000) stated that mindfulness in school classrooms enables adolescents to break free from stereotyped thinking and confusion and to better concentrate on and flexibly respond to the current learning task. Wisner et al. (2010) also argued that schools should proactively implement mindfulness interventions because school-based mindfulness interventions are effective in enhancing adolescents' attention and concentration. These studies are consistent with the result of this study.

The stress, self-esteem, and self-control scores of the experimental and control groups did not differ significantly. The results of the control group may have been affected by class change for each subject at the high school in our study. In fact, we observed some students in the experimental group who learned about eating meditation as they demonstrated it to the students in the control group. Although the differences between the experimental and control groups were not significant initially, the experimental group showed significant changes in all dependent variables over time.

The experimental group had similar stress scores at baseline and post-intervention, but their stress scores were significantly reduced at the four-week follow-up. In other words,

the effects of the mindfulness program were not immediate but occurred after some time. Many studies have reported that mindfulness programs reduce stress in various clinical settings because they regulate individuals' abilities to employ coping strategies (Johnstone et al., 2016). A study reported that the experimental group that received mindfulness training showed reduced right amygdaloidal activity compared to the control group, showing that mindfulness reduces stress by facilitating functional changes in the brain (Bauer et al., 2019). A systematic review (Erbe & Lohrmann, 2015) also reported that mindfulness is a highly effective school health intervention for the purpose of promoting stress relief, emotional regulation, and enhancing concentration in adolescents. Mostafazadeh et al. (2019) reported that mindfulness training should be implemented in schools because they are effective in reducing depression, anxiety, and stress in high school students. Several other studies have reported that mindfulness programs are effective in lowering stress in children and adolescents (Bluth et al., 2016; Kuyken et al., 2013).

In general, people with high self-esteem live a happier and healthier life and overcome stress more easily (Schacter et al., 2011); thus, appropriate self-esteem interventions should be implemented to promote mental health among adolescents. Biegel et al. (2009) reported that a mindfulness-based stress reduction program reduced anxiety and depression and enhanced self-esteem and sleep quality in adolescents. Hyland (2009) and Kerrigan et al. (2011) also reported that mindfulness programs are effective in improving adolescents' self-esteem.

In this study, self-esteem scores significantly improved at the four-week follow-up compared to the baseline and post-intervention scores. It is interesting that, as with the effect on stress, the effect of the mindfulness program on self-esteem is not immediate but is showcased and retained over time. This may be because students who learned about different

meditation and cognitive training methods through the mindfulness program continued with the training in their daily lives even after the completion of the program. Kuyken et al. (2013) reported that adolescents who participated in a mindfulness program personally wanted to continue mindfulness training and that 80% of the students practiced mindfulness meditation in their daily lives at two–three months after the program. This highlights a key strength of mindfulness programs: providing training that can lead to continued daily practice.

Self-control significantly increased after the mindfulness intervention and at the four-week follow-up compared to the baseline, confirming that the intervention was effective in improving self-control. In a meta-analysis of more than 100 studies, de Ridder et al. (2012) reported that people with good self-control are superior at work, school, adjustment, interpersonal relationships, and desire control. Inadequate development of self-control in adolescence leads to external problems such as aggression, hyperactivity, and internal problems such as negative emotions, intimidation, and identity confusion (Kuhl et al., 2006).

Mindfulness programs have been described as effective strategies for teaching self-control in adolescents based on their effects on psychological functions, cognitive functions, and coping processes (Perry-Parrish et al., 2016). Breslin et al. (2002) explained how mindfulness affects attention and the self-regulation process using an information processing model; mindfulness stops automatic and inadvertent habitual thinking related to maladaptive behaviors, helps individuals try to observe in a neutral stance as opposed to retaining negative emotions and trying to suppress one's memories, helps individuals to become less sensitive to various emotional factors that trigger behavior, and increase their interest in their cognitive and emotional processes.

School has a great influence on the physical, mental, and social development of adolescents and school-based nursing interventions can be important and effective. School nurses may initiate their own personal mindfulness practices to obtain the expertise to teach this skill to students. School nurses can develop programs highlighting the benefits of mindfulness while recognizing and planning for the challenges of coordinating a mindfulness intervention with adolescents. There are local and national organizations that may serve as resources for integrating meditation into schools. One such organization, *Mindfulness in Education* (<http://www.mindfuleducation.org/index.html>), offers general support and resources for those who are working toward integrating mindfulness practices in schools. *The Still Quiet Place* (<http://www.stillquietplace.com/>) also offers resources for using mindfulness with children and adolescents, including guided meditations in audio formats (Wisner et al., 2010).

School nurses, teachers, and administrators all play leadership roles in enhancing the productivity and success of students. These professionals work together to support students

in academic, social, and behavioral success. Mindfulness programs offered in schools can facilitate all of these goals through collaboration among school professionals.

Limitations

This study had several limitations. We used self-report data, as opposed to objective measurements. Subsequent studies should also include physiological measurements for stress as well as reports from teachers and parents. Second, the positive results of this study might have been influenced by the possibility that the teachers paid more attention to and more frequently interacted with the experimental group than the control group. Individuals other than the students' teachers should be designated as program facilitators. Third, the follow-up evaluation was only performed in the experimental group four weeks after the program, so we could not compare the long-term effects between the two groups. In addition to conducting a follow-up evaluation of the control group, subsequent studies could also add an eight-week follow-up assessment. Fourth, the students in the experimental and control groups could not be completely controlled to prevent the diffusion effect. Finally, this study was limited to 10th graders of one high school; generalizability of the results should be made with caution.

Conclusions

The blended learning mindfulness program developed in this study was effective in reducing stress and improving concentration, self-esteem, and self-control of students despite the COVID-19 pandemic. Based on the results, we propose that a mindfulness program should be incorporated into the formal high school curriculum. Future randomized controlled trials of mindfulness are warranted to assess the potential efficacy of the technique as a blended tool for reducing stress and improving concentration, self-esteem, and self-control of students in general, or during pandemic crises.

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M-J.K. – Conceptualization, Methodology, Funding acquisition, Validation, Visualization Writing—original draft and Writing—review and editing; H.S.K. – Conceptualization, Data curation, Analysis, Methodology, Investigation and Writing—original draft. All authors share responsibility for the final version of the work submitted and published.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.


Ethical Information

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