MINDFULNESS INTERVENTION ON TRAJECTORIES OF EMOTIONAL INTELLIGENCE AND PSYCHOLOGICAL CAPITAL: GROWTH MIXTURE MODEL

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ABSTRACT

Background: Since the outbreak of COVID-19 caused adults suffer from mental disorders, it would be an essential for mental health professionals to help individuals improve their emotional intelligence (EI) and psychological capital (PsyCap) to cope mental stress under epidemic.

Objective: This longitudinal study aims to explore whether mindfulness intervention is an efficient method to enhance adolescents' EI and PsyCap as well as their trajectories to provide a theoretical basis and future directions for both targeted crisis intervention and psychological trauma recovery plans.

Design: This research was designed as randomized controlled trial and total of 782 students were evaluated statistically.

Methods: We used paired-sample t-tests and repeated measures ANOVA to compare every factor defined above by time and group. Then Growth mixture modeling approach was utilized to estimate the classes trajectories of EI and PC.

Results: The EI and PC had significantly enhancement at every time points in the experimental group but not in the control group. Trajectory of EI can be classified into 3 subgroups, with 1.07% adolescents were in low-growth group, 17.95% adolescents were in middle-growth group, 80.98% adolescents were in elevated-growth group respectively. Also, trajectories of PC can be classified into 3 subgroups, with 24.41% adolescents were in mild-growth group, 2.65% adolescents were in increasing-growth group, 72.94% adolescents were in elevated-growth group respectively. This research indicated that mindfulness should be given increasing consideration to enhance mental health during the worldwide outbreak of COVID-19.

Keywords: COVID-19 pandemic; growth mixture model; mindfulness; emotional intelligence; psychological capital

INTRODUCTION

The outbreak of COVID-19 has caused a global pandemic that threatens people's physical health and has tremendous mental health impacts, including depression, anxiety and acute stress disorder (Wang et al., 2020). Adolescents were more vulnerable to passive emotion than adults during the confinement period (Guessoum et al., 2020; Y. Li, Qin, Shi, & Han, 2021). Although some studies have reported the passive impact of individuals' mental health during pandemic (Moron & Biolik-Moron, 2021), little is known about effective intervention methods for improving psychological health issues in long-term and deeper perspective. It is essential for mental health professionals to take course of action help individuals overcome mental disorders during the pandemic.

Mindfulness is a conscious, nonjudgmental awareness of internal and external experiences that can be developed through practice (Chambers, Gullone, & Allen, 2009) which can influence emotion in a positive way (Jimenez, Niles, & Park, 2010; Spijkerman, Pots, & Bohlmeijer, 2016; Wiveka, Philippe, Paula, & John, 2004; Yuan, 2021). Researchers integrated the concept of mindfulness and emotion regulation theoretically and developed the mindfulness emotion regulation model (Chambers et al., 2009). This model claims there is no need to suppress, reevaluate or change emotional experiences but one should train his or her awareness and nonreactivity of emotion systematically, which emphasizes that mindfulness training (MT) focused on awareness of emotion rather than being aware of emotional goals. Individuals intentionally select and recognize thoughts, emotions, and feelings but do not produce habitual responses, thereby gradually eliminating the process of automatic evaluation of distressing emotions (Chambers et al., 2009). This theoretical model has been supported by some empirical studies. Clinical psychologists found mindfulness can decrease depressive symptoms (Jimenez et al., 2010), which confirmed the mindfulness emotion regulation model. Since COVID-19 caused a global pandemic with tremendous mental health impacts (Ahrens et al., 2021; Liu, Zhang, Wong, Hyun, & Hahm, 2020), we select MT as an intervention to help adolescents.

EI defines as a noncognitive capacity in coping with environmental demands and stress including the ability to perceive the emotions of oneself and others, use emotions to make better decisions, understand emotions and manage the emotions of oneself and others (Ain, Munir, & Suneel, 2021). EI is beneficial for coping stress under pandemic because researches showed that higher EI could improve emotional regulation, satisfaction, achievement and decrease stress (Mao, Huang, & Chen, 2021). For instance, a 12- week longitudinal research in nursing students indicated there significant association between EI and life satisfaction as well as happiness (Ruiz-Aranda, Extremera, & Pineda-Galan, 2014). Besides, a follow-up research on secondary school showed EI could foster academic success (Costa & Faria, 2015). Mindfulness is also a beneficial method to improve wellbeing (Gu, Strauss, Bond, & Cavanagh, 2015; Jha et al., 2019), since it enhances individual's awareness of their own emotion without judgement or regulation. By deciphering own emotion with more accurate and nonjudgmental perspective, individual's emotion perception and regulation abilities turns more adaptive, which is vital for improving EI (Miao, Humphrey, & Qian, 2018; Salcido-Cibrian, Ramos, Jimenez, & Blanca, 2019). Thus, we hypothesis that we can improve adolescents' EI via MT.

PsyCap represents the positive mental development and relates to an individual's personality and an his or her mental health including self-efficacy (put forth the effort necessary to successfully overcome a challenge), optimism (positive attributions toward achievement), hope (redirect their routes to achieve an aim when required) and resilience (sustain hope and bounce back to achieve goals when surrounded by adversity) (James & Teven, 2007). PsyCap resources positively predict individuals' happiness and engagement (Chen, Lai, Ma, Chen, & Shan, 2017; Datu, King, & Valdez, 2016; R. Zhang, Ewalds-Kvist, Li, & Jiang, 2018). For instance, both cross-sectional and longitudinal studies indicated PsyCap bolster motivation, engagement and achievement(Datu et al., 2016). Considering the wide range of negative emotional impacts during the outbreak of COVID-19 (Duan et al., 2020), PsyCap resources are highly related to happiness, engagement and school achievement(Fang & Ding, 2020; James & Teven, 2007). Thus, we try to promote PsyCap to help students handle the passive emotional impact during pandemic and boost their academic engagement and achievement. Besides, PsyCap represents the positive mental development and mindfulness can induce positive emotion (Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Luthans, Luthan., & Luthans, 2004). This led us to select MT to improve adolescents' PsyCap under epidemic.

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Randomize controlled trail with experiment and control group allows us to test whether the change of EI and PsyCap were induced by mindfulness intervention. By using longitudinal researches, we may obtain deeper understanding of how EI and PsyCap change by time or intervention. There are different methods can be utilized to analysis longitudinal data, such as paired sample t-test, latent curve growth model, growth mixture model et al. We choose paired sample t-test to estimate the effectiveness of MT between experiment and control group. Considering there might be heterogeneity changes in EI and PsyCap, we select growth mixture models (GMM) to investigate subtypes over long time periods.

METHODS

Participants and settings

This research conducted during the unique period filled with COVID-19 pandemic prevention in school after over a month of lockdown, and was approved by Ethical Committee of Northwest Normal University (202003015). After selecting all students in grades 8 and 9 (8 classes in each grade). we divided the 8 classes in each grade into 2 groups randomly; the experiment group comprised 4 classes (n=408; males=177, females=231; age: M (SD)=14.25(0.50)) and the control group comprised 4 classes (n=378; males=164, females=214; age: M (SD)=14.35(0.45)). Then, we conducted the Emotional Intelligence Scale (EIS) and Psychological Capital Questionnaire (PCQ) to all students on paper in class on March 16th (T1). There was no significant difference in EIS or PCQ scores between the experimental and control groups at T1 ($t_{(EIS)}$=-1.32, p=0.19; $t_{(PCQ)}$=-1.69, p=0.09).

In experimental group, we conducted Mindfulness Course developed by instructors Tong HuiQi and Guo HaiFeng three times a week, while no intervention in control group. In every mental health class, we played 2 courses. After every course, we would take 10 minutes to let students share their feeling. 3 assessments after 8 weeks, 16 weeks and 24 weeks of intervention in May (T2), September (T3), and November (T4) were conducted. In control group, we only performed assessments before intervention(T1) and in November (T4). All assessments conducted in paper at class. There was no intervention or assessment in June and July since it was the summer holiday for school. 12 participants were absent in assessment T2 and T3 respectively, 6 were absent in T4 in experiment group, and 5 subjects absent in control group in T4. Finally, there were 378 (males=164, females=214; age: M(SD)=14.50(0.25)) participants in experimental group and 399 (males=178, females=221; age: M(SD)=14.35(0.45)) participants in control group.

Data Analysis Strategy

Firstly, we use paired-sample t-test to compare every factor's difference in different time point. Then, repeated ANOVA was used to measure 2 (group: experiment, control) × 2 (time: T1, T4) to compare the difference in experiment and control group at time point of T1 and T4. Finally, we use Mplus Version 8.3 to build GMM in the experiment group. GMM identifies subgroup development type according to a set of observed information. It also examining individual's psychological difference from a dynamic developmental perspective, which is an analysis based person-centered. GMM indicators that can be referred to when determining the class of subgroups of individual's developmental trajectory are AIC, BIC, ABIC, VLMR-LRT, LMR-ALRT, BLRT, Entropy. Among them, the value of BIC is vital for examining model fit, lower BIC suggests better model fit. Besides, the p value of VLMR and BLRT exams favor the k class model over the k-1 class model. Also, the value of entropy and latent class probabilities exam the parsimony, the higher value of entropy and latent class probabilities, the greater parsimony of model (Nylund, Asparouhov, & Muthén, 2007). Latent class register joins the model when the optimal model was opted.

Materials

Emotional Intelligence Scale

The Emotional Intelligence Scale (EIS) was established by Schutte et al. (1998) and translated by Wang (2002). Responses to the 33-item scale were measured on a 5-point Likert scale ranging from 1 (completely inconsistent) to 5 (complete consistent). The EIS consists of 4 dimensions: managing one's own emotions, perceiving emotions, using emotions, and manning others' own emotions. Higher scores indicate higher levels of emotional intelligence. In current sample, the Cronbach's α values of the EIS at T1, T2, T3, and T4 were 0.93, 0.92, 0.92, and 0.91, respectively.

The Psychological Capital Questionnaire

In this study, we used Chinese version of Psychological Capital Questionnaire (PCQ) (K. Zhang, Zhang, & Dong, 2002), which showed nice reliability and validity to the Chinese adolescents (Chen et al., 2017). PCQ consists of 26 items across 4 dimensions: hope, resilience, optimism, and efficacy. Responses to each item were provided on a 5-point Likert scale from 0 to 4. Higher scores indicate higher levels of psychological capital. The reliability coefficients of the PCQ at T1, T2, T3, and T4 were 0.93, 0.86, 0.87, and 0.88, respectively.

RESULT

Contrast of experiment and control group

In order to exam how EI and PsyCap affected by mindfulness intervention in every time point, we performed pair sample t-test. The result of the experiment group demonstrated that the score of EIS were in significant difference at 0.05 levels over time, which implied that mindfulness can enhance EI from T2 to T1(M=2.36, SD=14.36, t=3.28**, p<.01), from T3 to T2(M=0.97, SD=8.67, t=2.20*, p<.05), and from T4 to T3(M=1.06, SD=2.20, t=9.31**, p<.01). Nonetheless, no significant difference was found in the control group (M=0.81, SD=15.36, t=1.04, p>.05), which proving there is no improvement of EI over time. Besides, the result of PCQ showed there was significant different in experiment group from T2 to T1(M=1.30, SD=12.81, t=2.02*, p<.05), T3 to T2(M=0.89, SD=7.37, t=2.37*, p<.05), and T4 to T3(M=7.37, SD=1.94, t=7.52**, p<.01), while no significant difference was found in the control group (M=-0.46, SD=5.89, t=-1.56, p>.05). This result strongly indicated that PsyCap can be improved by the intervention of mindfulness, but won't improve over time. Table 1 illustrated the descriptive statistics details of the experiment group and control group at T1, T2, T3 and T4 respectively.

Then, we submitted the data to 2 (group: experiment, control) × 2 (time: T1, T4) mixed-design analysis of variance. Repeated measure ANOVA emulated how EIS and PCQ were influenced by mindfulness intervention in this research. The outcome of ANOVA illustrated that the main effect of time was significant (F=7.321, p＜.01, η_p^2= 0.019) at 0.01 level, the main effect of group was significant (F=17.045, p＜.001, η_p^2= 0.043) at 0.001 level. The interaction effect of time × group was significant (F=7.884, p＜.01, η_p^2= 0.020). Figure 1 depicted that in different time point what is the contrast of EIS between groups of experimental and control. As we can see in the Figure 1, the score of EIS have been significantly improved though 24-weeks' intervention of mindfulness in the experiment group, while there's no significant enhancement in the control group. From this outcome we can easily conclude that the intervention of mindfulness conduces to the enhancement of EIS. Meanwhile, for the result of PCQ, the outcome of repeated ANOVA proved that there were significant difference in the main effect of both time (F=121.767, p＜.001, η_p^2= 0.244) and group (F=396.56, p＜.001, η_p^2= 0.053) at 0.001 level. The interaction effect of time × group

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was significant (F=34.127, p<.001, η_p^2= 0.083). Specifically, the comparison of the PCQ between experiment and control group illustrated in the Figure 2. From Figure 2 (B), we can see PCQ increased significantly after 24-week mindfulness cognitive therapy, while there is no significant different in control group at time points of T1 and T4, which indicated mindfulness cognitive therapy contributes to the growth of PCQ.

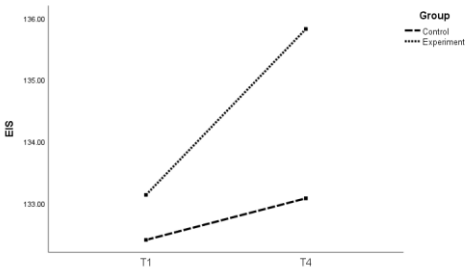

Fig. 1. Mean difference for EIS of control & experiment group on T1&T4

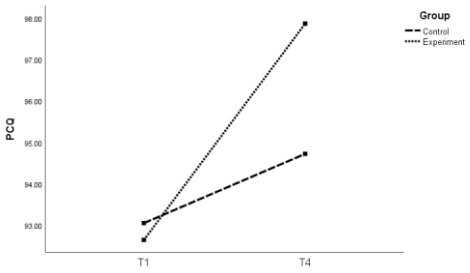

Fig. 2. Mean difference for PCQ of control & experiment group on T1&T4

Growth mixture model in experimental group

GMM was opted to estimate with 1 to 4 classes to explore the subgroups with trajectories of EIS and PCQ respectively, all result illustrated in Table 2. The result of EIS showed that 3 classes subgroup was most favorable with lower BIC=8342.11, significant value of VLMR LRT, LMR ALRT, BLRT and high entropy. Thus, the trajectories of EIS in experiment group can be classified into 3 class. As depicted in Figure 3, EIS score of 1.07% adolescents were low in the initial, named low-growth (class 1), with intercept (I=61.86, SE=5.41, p<.001) and slope (I=6.52, SE=0.21, p<.001). EIS score of 17.95% adolescents were in the middle position in time point of T1, decreased at T2 and increased at T3 & T4, named middle-growth (class 2), with intercept (I=105.90, SE=1.43, p<.001) and slope (I=0.98, SE=0.16, p<.001). The EIS score of 80.98% adolescents were in the high position in time point of T1 and increased at T2, T3 & T4, named elevated-growth (class 3), with intercept (I=139.80, SE=0.63, p<.001) and slope (I=0.76, SE=0.04, p<.001).

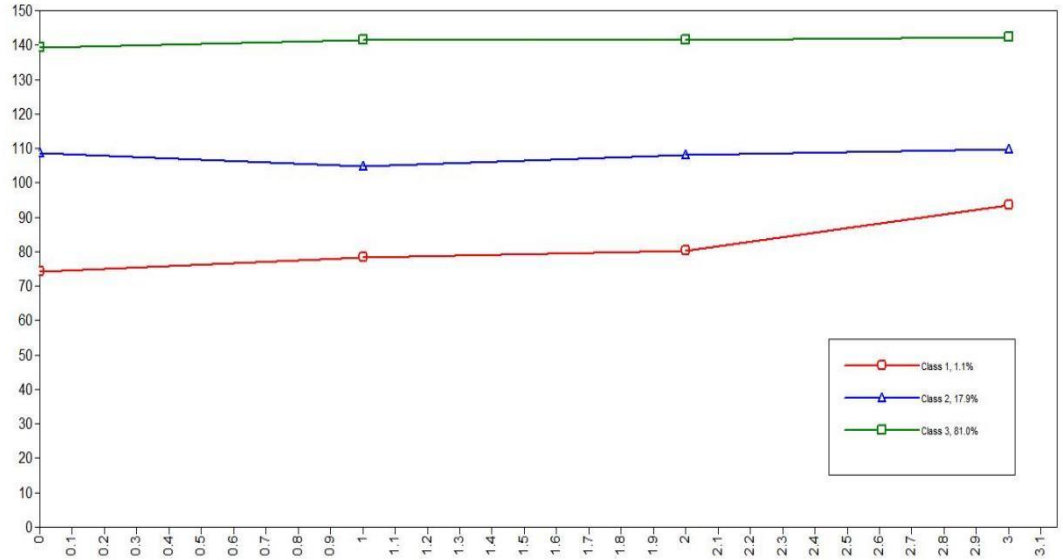

Figure 3: 3 classes trajectories of EIS

The result of PCQ showed that 3 classes subgroup was most favorable with lowest BIC=9805.49, significant value of VLMR LRT, LMR ALRT, BLRT and high entropy. Therefore, 3 classes trajectories of PCQ in experiment group were utilized. As depicted in Figure 3, PCQ score of 24.41% adolescents were middle in the initial and growth tendency is

low, named mild-growth (class 1), with intercept (*I*=78.25, *SE*=0.69, *p*<.001) and slope (*I*=1.23, *SE*=0.08, *p*<.001). PCQ score of 2.65% adolescents were in the lowest position in time point of T1 and increased rapidly at T2, T3 & T4, named increasing-growth (class 2), with intercept (*I*=59.69, *SE*=3.09, *p*<.001) and slope (*I*=17.71 *SE*=0.86, *p*<.001). PCQ score of 72.94% adolescents were in the high position in time point of T1 and increased at T2, T3 & T4, named elevated-growth (class 3), with intercept (*I*=101.15, *SE*=0.48, *p*<.001) and slope (*I*=0.45, *SE*=0.07, *p*<.001).

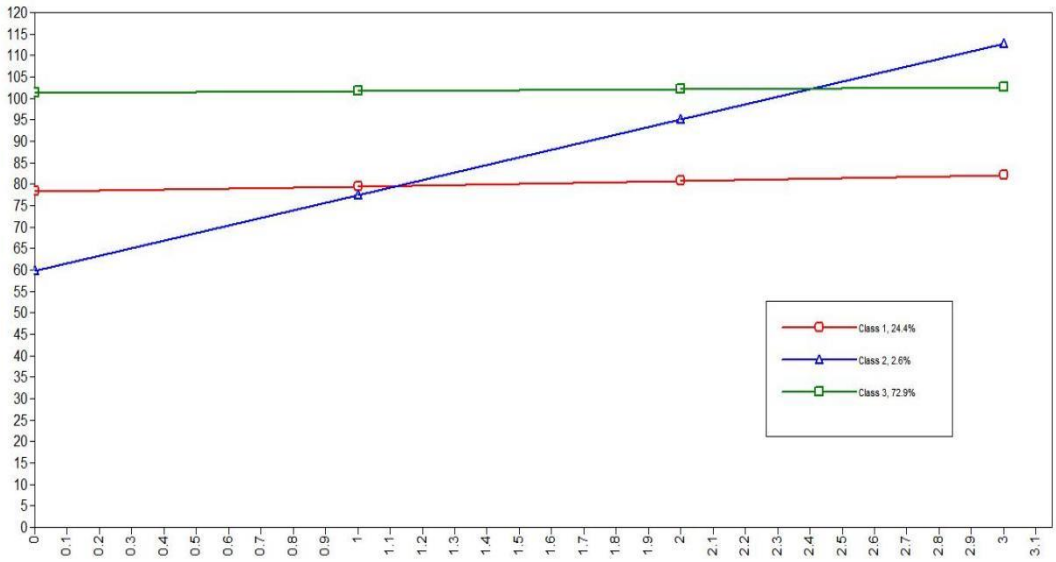

Figure 4: 3 classes trajectories of PCQ

Table 2: Model fit statistics of EIS and PCQ growth mixture model

Group	AIC	BIC	ABIC	VLMR-LRT	LMR-ALRT	BLRT	Entropy	Class Count (Percentage)
EIS-1	8614.07	8649.46	8620.91					
EIS-2	8378.55	8425.74	8387.67	<.001	<.001	<.001	1.00	71(18.57)/308(81.43)
EIS-3	**8283.13**	**8342.11**	**8294.52**	**<.05**	**0.05**	**<.001**	**0.99**	**5(1.07)/67(17.95)/ 306(80.98)**
EIS-4	8079.75	8150.53	8093.42	0.09	0.10	<.001	1.00	17(4.24)/20(5.20)/ 4(1.06)/377(89.49)
PCQ-1	10498.77	10534.18	10505.63					
PCQ-2	10103.51	10150.73	10112.66	<.01	<.01	<.001	1.00	12(3.18)/366(96.82)
PCQ-3	**9746.46**	**9805.49**	**9757.89**	**<.05**	**<.05**	**<.001**	**0.98**	**94(24.41)/10(2.65)/ 274(72.94）**
PCQ-4	9744.99	9815.82	9758.71	0.33	0.33	0.19	0.98	2(0.57)/94(24.35)/ 10(2.65)/272(72.43)

DISCUSSION

The research aimed to explore whether the intervention of mindfulness training is a constructive method in improving adolescents' EI and PsyCap during the unique period filled with COVID-19 pandemic prevention in school after over a month of lockdown. Paired-sample t-tests were utilized to exam how EI and PsyCap affected by mindfulness intervention in every time point in both experiment and control group. The result showed EI and PsyCap had significantly enhancement at every time points in the experimental group but there was

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no significant difference in the control group. Then, repeated ANOVA measures of time (T1, T4) × group (Experiment, Control) were both significant in EI and PsyCap. which indicated mindfulness training is an effective method in improving EI and PsyCap. Also, growth mixture modeling approach was utilized to estimate the classes trajectories of EI and PsyCap. Trajectories of EI can be classified into 3 subgroups, with 1.07% adolescents were in low-growth group; 17.95% adolescents were in the middle position in pretest, decreased in the second test and increased at T3 & T4, named middle-growth group; 80.98% adolescents were in elevated-growth group respectively. Also, trajectories of PsyCap can be classified into 3 subgroups, with 24.41% adolescents were in mild-growth group; 2.65% adolescents were in increasing-growth group; 72.94% adolescents were in elevated-growth group respectively. This research indicated that mindfulness should be given increasing consideration to enhance mental health during the worldwide outbreak of COVID-19.

Firstly, as we expected EI were significantly improved in the experimental group, whereas there was no significant improvement in the control group, which implied that EI was positively enhanced by mindfulness training. This consists with previous studies on the relationship between mindfulness and EI (Gu et al., 2015; Kircaburun, Griffiths, & Billieux, 2019; Salcido-Cibrian et al., 2019; Yuan, 2021). One explanation of EI being improved by mindfulness training may be that mindfulness moderates the reaction to stressful and negative emotions (Jimenez et al., 2010; van der Velden et al., 2015). As we mentioned in the introduction, the definition of mindfulness is a conscious, nonjudgmental awareness of internal and external experiences that can be developed through practice (Chambers et al., 2009; Yuan, 2021). When someone is practicing mindfulness, their emotions and cognition are more open and accepted (Chambers et al., 2009; Geschwind et al., 2011). Therefore, by MT, individuals adopt more efficient and adaptive coping and emotion regulation strategies so their EI ability is improved (Spijkerman et al., 2016; van der Velden et al., 2015). With MT intervention, individuals' proprioceptive awareness with respect to their emotions, thoughts or even bodily postures is cultivated, which is important for relaxation in this process (Chan, Han, & Cheung, 2008; Mikolajczak & Luminet, 2008; Mikolajczak, Nelis, Hansenne, & Quoidbach, 2008). Moreover, being aware of breathing is also a vital part of mindfulness practice. By focusing on breathing, especially in deep breathing, individuals may obtain feelings of relaxation from inside that extend to the body and mind (Geschwind et al., 2011; Jha et al., 2019; van den Hurk et al., 2012). During the COVID-19 pandemic, individuals with high EI may use efficient strategies to regulate negative emotions and therefore perceive less of a threat (Moron & Biolik-Moron, 2021). In addition, a previous study estimated the impact of mindfulness training via measuring the overall diurnal profile of cortisol, which is a biological basis related to stress and negative emotion. They found that individuals with mindfulness-based cognitive therapy reported less stress and negative emotion (Hargus, Crane, Barnhofer, & Williams, 2010). Thus, mindfulness training plays a protective role in improving EI and is one of the most prominent methods to help adolescents during the COVID-19 pandemic.

Secondly, the result of PCQ also indicated there was significant difference in experiment group, while no difference was found in control group, which in line with previous study (L. Li & Li, 2020). PsyCap is associated with mindfulness positively and they all trainable (L. Li & Li, 2020; Roche, Haar, & Luthans, 2014). Psychological capital is highly related to psychological well-being(Datu et al., 2016) and high level of PsyCap could control the negative effect of stress or mental health issue(Barratt & Duran, 2021). Mindfulness can provoke positive emotion (Jha et al., 2019; van der Velden et al., 2015), which is beneficial for enhancing psychological well-being of individual (Roche et al., 2014; Spijkerman et al., 2016). The neurophysiological research of mindfulness and emotion indicated that by MT,

the activation of individual's left prefrontal brain area is enhanced, while the left prefrontal brain area can provoke positive emotion (Chan et al., 2008; Davidson et al., 2003). For instance, study of mindfulness using EEG technology test subjects' brain electrical activity during mindfulness intervention, which they found increased the activation of the left prefrontal brain area while subjects were in the condition of mindfulness practicing (Chan et al., 2008). Besides, based on research that subjects with depression in the regular therapy group, their left prefrontal lobe activity decreased, marking the weakening of the positive emotion, accompanied by the worsening of depressive symptoms. However, in the group of mindfulness therapy, symptoms of depression got better associated with increased activity of left prefrontal lobe (Barnhofer, Chittka, Nightingale, Visser, & Crane, 2010). Therefore, mindfulness increased PsyCap by enhancing individual's activity of left prefrontal lobe to promote their positive emotion and psychological well-being.

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