ORIGINAL ARTICLE

Effect of Online-Delivered Deep Breathing Technique on Anxiety among Primary School Children during COVID-19 Pandemic

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ABSTRACT

Introduction: The global outbreak of COVID-19 in 2019 generated widespread anxiety and uncertainty, impacting individuals of all ages, including children. In Malaysia, studies have revealed a troubling rate of anxiety among students, yet public health measures such as the Recovery Movement Control Order (RMCO) restricted access to in-person mental health support. This study examined whether an online deep breathing intervention could reduce anxiety among primary school students. **Methods:** A randomized controlled trial was conducted among 28 eleven-year-old students from a primary school in Kelantan. Participants were randomly allocated to either an intervention group (n=13), which engaged in a four-week, researcher-guided deep breathing program delivered online, or a control group (n=15) that received no intervention. Weekly virtual sessions were held with the intervention group. **Results:** Repeated-measures ANOVA did not reveal significant differences in both state and trait anxiety after the intervention. While the primary outcomes were not statistically significant between groups, a general decrease in both state and trait anxiety was noted, especially for state anxiety. **Conclusion:** Online deep breathing exercises appear to offer a practical and accessible approach for alleviating anxiety symptoms in children, even when traditional face-to-face methods are unavailable. This technique is straightforward to teach and implement, making it a valuable coping tool for children during periods of restricted movement or remote learning.
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INTRODUCTION

A national survey of Malaysian adolescents aged 13 to 17 revealed that 40% experience anxiety, which is notably higher compared to 20% reporting depression and 10% experiencing stress, highlighting a concerning mental health issue (1). Key contributors to these emotional challenges include peer pressure, family expectations, and academic demands. Many adolescents lack effective coping mechanisms, making them particularly vulnerable to these stressors (2). Previous studies have demonstrated that anxiety adversely affects students' academic performance, lowers self-esteem, leads to behavioral issues, and hampers their ability to form and maintain relationships (3,4). Extensive research has focused on developing interventions to help students manage anxiety, given its potential to cause more serious health problems if left unaddressed (3,4). Therefore, fostering skills that enable children to resolve problems and build resilience is essential (2).

The COVID-19 pandemic has triggered widespread anxiety due to the uncertainty and fear surrounding the crisis, while lockdowns and movement restrictions have limited access to face-to-face interventions (5–7). Children and adolescents have also been significantly impacted by the abrupt disruptions to their daily routines (8). Notably, children aged 9 to 12 have exhibited higher levels of anxiety compared to those aged 13 to 18, with reports indicating a 12% increase in depressive symptoms among the younger group (8–10). Furthermore, elevated stress levels in parents have been linked to increased anxiety and depression symptoms in their children (9). The pandemic has also transformed the global education system, compelling students to transition from traditional classroom learning to online platforms (11–13). This shift demands familiarity with internet and technology use, which is often unfamiliar to many students. Some parents have observed heightened irritability in their children, increased resistance to attending physical school, and a decline in self-care and hygiene practices during this period (13-14).

Prior to the COVID-19 pandemic, research demonstrated that online interventions were both feasible and as effective as face-to-face methods in improving mental

health (15,16). During the COVID-19 lockdown, web-based mindfulness programs were shown to reduce anxiety and alleviate mood disturbances among university students (7,17). In recent years, there has been a growing interest in applying mindfulness techniques to children and adolescents, driven by evidence of their benefits in enhancing well-being, mental health, emotional regulation, cognitive functioning, and classroom attention (3,18–24). Various mindfulness practices—including deep breathing exercises (DBE), body scans, guided imagery, and loving-kindness meditation—have been developed to support students' emotional functioning and learning (3,7,21). Among these, DBE has emerged as a particularly effective approach for reducing anxiety (24,25). This technique is simple and accessible for school-aged children, helping them manage anxiety, promote calmness, improve academic performance, and increase emotional awareness (3,4,21,25–27). Studies have also confirmed that young students can successfully perform DBE (24,28), with evidence showing significant reductions especially in state anxiety (25,29). Moreover, the benefits of DBE appear more pronounced in boys and in students with high autonomic reactivity—those more prone to worry—compared to their low-reactivity peers (25).

Despite promising findings, systematic reviews have reported small to moderate effect sizes across various interventions, including those where deep breathing exercises (DBE) were a key component (21,30). One study observed that while DBE helped students better manage their anxiety, those with higher academic scores tended to report lower anxiety levels at baseline, and vice versa (27). Similarly, another investigation found a neutral impact of mindfulness interventions, suggesting that heightened emotional awareness might have influenced post-intervention outcomes (31).

Evidence suggests that a minimum intervention duration of five weeks may be necessary to achieve significant benefits for school-aged children, and even children as young as seven can quickly learn and apply mindfulness techniques (24,28). However, the effectiveness of online interventions may be influenced by factors such as accessibility, familiarity with digital technology, and internet connectivity (32). Additionally, the impact of single versus multiple guided sessions may differ due to habituation effects, although research in this area remains limited (7,21).

This study aims to explore the effects of DBE on children's anxiety, particularly through multiple online sessions conducted during the COVID-19 lockdown. Moreover, it seeks to provide children with a practical, cost-free coping skill that can be used anytime and anywhere, as DBE requires no specialized equipment. Such a skill is especially valuable during the pandemic, when lockdowns and strict regulations may cause significant stress and overwhelm among children, helping them to achieve a sense of calm.

MATERIALS AND METHODS

Design, Participants, and Randomization

This study employed a randomized controlled trial with a 2x2 mixed-subjects pre-test and post-test design. Convenience sampling was used to recruit Year 5 students from a public primary school in Kelantan, Malaysia, with assistance from the school principal and counsellor, who also facilitated obtaining parental or guardian consent. Eligible participants were 11 years old, physically healthy, Malaysian nationals, had not previously received any intervention, and had access to an electronic device (such as a smartphone or tablet) with a stable internet connection at home. Participants were randomly allocated to either the deep breathing exercise (DBE) intervention group or a control group that did not receive the intervention, using a simple randomization method via Microsoft Excel. State and trait anxiety levels were assessed both before and after the intervention. Sample size estimation was performed using G*Power software (33), with an effect size of 0.25, power of 0.80, and alpha level of 0.05, indicating a required sample size of 34 students. To account for potential attrition, 39 participants were recruited.

Research Tools

State-Trait Anxiety Inventory for Children (STAI-C)

The State-Trait Anxiety Inventory for Children (STAI-C: Spielberger, 1973) is a self-reported measure that helps to measure anxiety in children from the age of nine and above. It consists of 40 items which are 20 items to measure state anxiety and another 20 items to measure trait anxiety based on a 3-point scale (35). The STAI-C State measures anxiety during a particular situation that the person feels threatened and it will manifest in a short duration. On the other hand, STAI-C Trait determines the stable anxiety reaction of an individual in any situation that they perceive in daily life. Trait anxiety is suggested to be constant across one's life. The assessment of these subscales can be done independently or together (36). Higher scores on both scales would indicate that the child has a high tendency to feel anxious compared to their peers. Children who score high on STAI-C Trait are likely to perceive any situation to be as more dangerous than it should be (36). In contrast, the children with low trait anxiety but high state anxiety could differentiate the danger of a situation. Thus, most of the time they would portray their anxious feelings in alarming situations only compared to the former children. STAI-C has been translated into many languages and its psychometric properties showed promising results (37-38). However, the Malay translated version is not available. Thus, the questionnaire was translated through a forward- and backward- translation process. The Malay version of STAI-C (STAI-C Malay version) was used to assess the

level of anxiety based on state and trait anxiety of the participants.

Deep Breathing Exercise (DBE) Scripts

Two DBE scripts focus on the emotional awareness and relaxation skills (34) were adapted and translated into Malay language after which were recorded as two audio tools. The duration of each script was approximately 4 minutes. The first audio script gets the listeners to focus on their breathing via inhalation through nose and exhalation through mouth. They are invited to acknowledge any distractions they may experience during the activity, yet asked to continue on their breathing. The second audio script asked listeners to imagine the air (i.e., oxygen) movement from the moment they inhale it, and as it travels through each part of their body such as lungs, muscles, and head. They are encouraged to imagine the movement of air out of their body that would carry away the toxins from their body as well as the negative thoughts or stress that they have in their mind. An informative pamphlet was developed to guide the participants to practice DBE at home.

Record Form, Mood Tracker and Feedback Form

A record form was developed to track the children's practices on DBE, that was instructed to be performed on a daily basis. The form outlines the number of weeks, days, and time when the children perform DBE. However, this data was not analyzed. A visual mood tracker that contained three different emotions (i.e., happy, neutral and sad) was developed to assess the children's mood during the weekly meeting. For the intervention group, the participants and the parents/guardians were invited to complete the feedback questionnaires post-intervention. The questionnaire explored the participants' experience and impression of the intervention as well as the feasibility effectiveness of the intervention.

Procedure

All consented children were briefed about the research and its process by the main researcher, before they were given the questionnaires to fill in using Google Form. Following briefing day, the intervention group started the session virtually. They were encouraged to turn on their camera during the session. A full list of session timetables was shared from which they could choose five preferred time slots, with a maximum of four participants per slot. Each session started and ended with mood tracking, whereby the participants were asked to indicate their current mood to the researcher via a chat box, based on the visual mood tracker presented on the screen. After that, the DBE and its benefits was introduced, followed by a breathing exercise demonstration i.e. inhaling through nose and exhaling through mouth. The participants were asked to practice breathing by placing their hands on the chest and abdomen. The rise and fall of the hand on the abdomen indicated that they performed the technique correctly. They practiced the technique for three times with the guidance from the researcher. Then, they were asked to be in a comfortable position such as sitting cross-legged, long sitting rest or lying down. The DBE audio was played on a speaker. They were encouraged to practice the DBE as they listened to the audio for the first time. However, if they were not able to perform the technique, they were asked to breathe calmly as usual. In addition, if they were distracted by random thoughts, they were asked to recognize and acknowledge the distractions and continue their breathing. Lastly, they were given a form to record the time when they performed DBE and if they were not able to do it on that day, to write "did not do". A soft copy version of pamphlet that contained the information regarding DBE as well as the suggestions of appropriate times to do the activity was distributed to the students and their parents/guardians. The recorded audio of DBE was also sent through the group WhatsApp. They also were encouraged to inform the researcher via WhatsApp text messages if they had difficulties performing the exercise. They practiced the DBE using the same audio as in Week 1. Towards the end of the meeting, the students were asked to send a photo of their record form to the researcher via WhatsApp. For Week 3 and 4, a new audio version was given to them.

During the debriefing session, participants were psycho-educated about DBE. Lastly, the students completed the STAI-C Malay-version scale. The feedback regarding the activity was gained from the participants by asking responses on a) the time when they do DBE, b) the frequency of the activity and c) the experience when they did the activity. An overview of the procedures for the intervention group are provided in Figure 1.

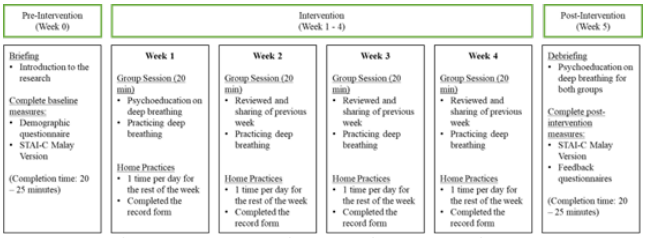

Figure 1: The experimental procedures for the intervention group.

Ethical Approvals

The study received ethical approval from the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPEM/20080449), as well as from the Ministry of Education Malaysia and the State Education Department of Kelantan. All research procedures were conducted in accordance with the approved ethical guidelines.

RESULTS

Sociodemographic information

Out of 42 participants been assessed for eligibility, 39 were recruited and randomized into either intervention or control groups. Twenty-eight (N=28) school children, 12 males (42.9%) and 16 females (57.1%) with the age

of 11 years old participated in the research. All the participants were from Malay ethnicity and Muslim. 13 participants were in the intervention group with 6 males and 7 females. The overall attrition rate for the study was 28%, whereas the differential attrition between the intervention and control group was 14%. A loss of between 5% and 20% exposed the data into intermediate levels of threats to its validity (39). Figure 2 shows the flow of the research and the number of participants.

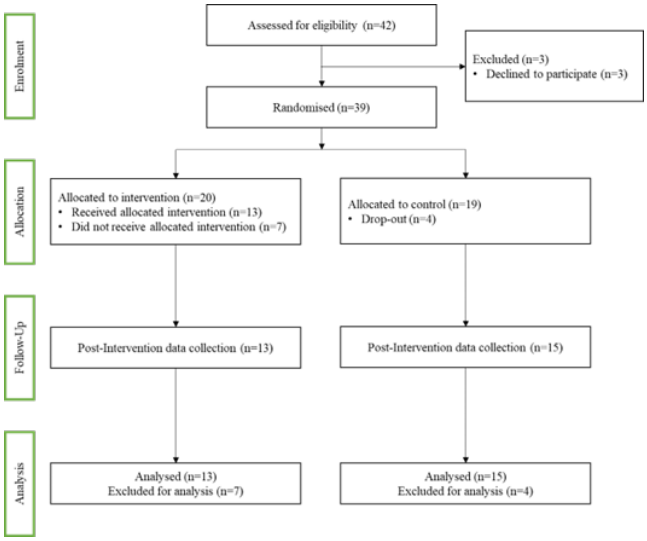

Figure 2: The study flowchart

Normality Tests and Analysis Plan

The normality of the pre- and post-intervention between the groups were assessed using Shapiro-Wilk test. Table I shows the summary of tests of normality for the participants. All data, except for the baseline State Anxiety among the intervention group, was normally distributed.

Despite the relatively small sample size per group, parametric statistical tests were used because simulation studies indicate they remain robust to mild or moderate deviations from normality in samples of this size (Blanca et al., 2017). Our sample sizes are close to this threshold, supporting the robustness of parametric analyses in this context. Normality assessments showed that all variables except one were approximately normally distributed, further supporting the appropriateness of parametric analyses in this study. Second, parametric tests offer greater statistical power compared to their nonparametric counterparts, improving sensitivity to detect true effects. Third, nonparametric tests, while not assuming normality, require additional assumptions such as equal variances or similar distribution shapes across groups, which can be challenging to meet. Sensitivity analyses using non-parametric tests, which do not require normality assumptions, were conducted and reported alongside the primary parametric analyses to assess result robustness. These sensitivity analyses used non-parametric methods corresponding to each parametric test—Mann-Whitney U test alongside independent samples t-test, Wilcoxon signed-rank test alongside paired t-test, and Friedman test alongside repeated measures ANOVA. The purpose of these non-parametric analyses was not to replace the parametric tests but to verify that the observed results were consistent even when relaxing assumptions about data normality and distribution. Consistent findings across both parametric and non-parametric approaches strengthen confidence in the validity of the conclusions drawn.

Table I: Summary table for tests of normality: Shapiro-Wilk

Time Points	Construct	Group	Statistic	df	*p*-value
Pre-Intervention	State Anxiety	Intervention	0.84	13	0.21
		Control	0.95	15	0.53
	Trait Anxiety	Intervention	0.91	13	0.19
		Control	0.95	15	0.47
Post-Intervention	State Anxiety	Intervention	0.89	13	0.11
		Control	0.94	15	0.33
	Trait Anxiety	Intervention	0.96	13	0.77
		Control	0.94	15	0.34

The Effects of Deep Breathing Exercise on Children's Anxiety

The study aimed to examine the effects of DBE on anxiety levels among children. Independent-samples t-test was performed to determine the group differences at baseline (i.e., pre-test score) between the intervention and control group. The results demonstrated no significant difference for state anxiety t(26) = .23, p = 0.82 and trait anxiety t(26) = .70, p = 0.49 between the intervention and control group. Similarly, there were no significant differences between the gender for state anxiety score, t(26) = -.39, p = 0.70 and trait anxiety score, t(26) = -.80, p = 0.43 at the baseline using Independent t-test. Mann-Whitney U test reported similar results, to retain the null hypotheses i.e. no differences for both anxiety scores between males and females at baseline.

A mixed-model repeated-measures ANOVA was conducted to compare the effect of DBE on the level of state anxiety in intervention and control groups. It revealed that the main effect for level of state anxiety was not significant, F (1, 26) = 0.002, p = 0.96. Thus, there was no overall difference on the level of state anxiety scores of the intervention group compared to the control group. A significant main effect for Time was obtained, F (1, 26) = 5.92, p = 0.02. This suggests that overtime the level of state anxiety of the participants in both groups reduces. However, the main effect of Group x Time was not observed, F (1, 26) = 0.49, p = 0.49. A Friedman test indicated similar insignificant change, $\chi^2(1)=1.92$, p = 0.16 in the intervention group. Further paired sample t-tests revealed that there was a significant difference in the scores of state anxiety for baseline and post intervention conditions for the intervention group, t(12) = 2.65, p = 0.02. Paired sample t-test indicated that there was no significant difference in the scores of state

anxiety for baseline and post intervention conditions for control group, t(14) = 1.11, p = 0.28. These results suggest that DBE has an effect on reducing the level of state anxiety if the data were compared within the participants.

Another mixed-model repeated-measures ANOVA was conducted to compare the effect of DBE on the level of trait anxiety in intervention and control groups. It showed that the main effect for level of trait anxiety was not significant, F (1, 26) = 0.94, p = 0.34. Thus, there was no overall difference on the level of trait anxiety scores of the intervention compared to the control group. There was no significant main effect for Time as well, F (1, 26) = 1.17, p = 0.29. Additionally, the main effect of Group x Time was also not observed, F (1, 26) = 0.28, p = 0.60. Similarly, Friedman test showed no significant changes $\chi^2(1)=0.10$, p = 0.78 in the intervention group post-intervention. Further paired sample t-tests revealed that there was no significant difference in the scores of trait anxiety for baseline and post intervention conditions for the intervention group, t(12) = 0.52, p = 0.61. Paired sample t-test indicated that there was no significant difference in the scores of levels of trait anxiety for baseline and post intervention conditions for control group, t(14) = 1.00, p = 0.34. Wilcoxon Signed Ranks tests identified similar non-significant changes in scores of the related scales. These results suggest that DBE has no effect on reducing the level of trait anxiety. Figure 3 and 4 show a line graph of the level of state anxiety and trait anxiety, for the intervention and control group, respectively.

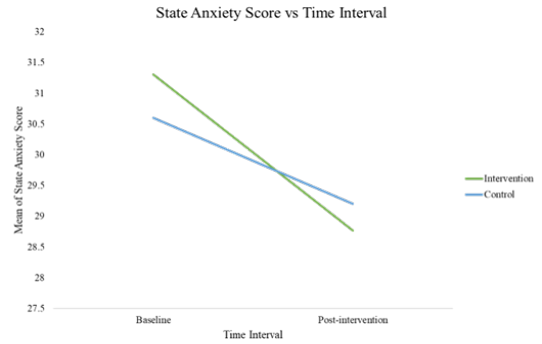

Figure 3: Changes of state anxiety score among groups between baseline and post-intervention.

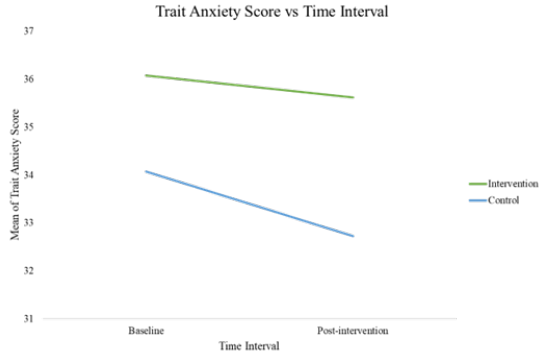

Figure 4: Changes of trait anxiety score among groups between baseline and post-intervention.

The Feasibility of Online Deep Breathing Exercise

The feasibility of the online deep breathing intervention was examined from the angle of internet accessibility, frequency of performing DBE at home, and the feedback from the participants as well as their parents. All of the participants attended the four-week online intervention session. The internet access conditions could be divided into three categories which were very reliable (no disruption during the meeting while the camera was turned on), reliable (no disruption but the camera was turned off) and not reliable (camera was turned off and recurrent internet disconnection). Most of the participants turned on their camera during the session, except those turned off their camera due to the unstable internet connection. Table II shows the number of participants, and their internet access conditions throughout four intervention weeks.

Table II: The quality of internet connectivity during the intervention

Internet Access	Week 1	Week 2	Week 3	Week 4
Very reliable	9	8	9	9
Reliable	3	4	3	3
Not reliable	1	1	1	1

The record form showed the majority of the participants performed DBE daily. Some of them forget, whilst others were busy with their daily tasks. Table III shows the frequency of the participants performing DBE on a daily basis.

Table III: The frequency of the participants performing deep breathing exercises daily

Week	Frequency of Performing Deep Breathing Exercise Daily Day (s)							
	7	6	5	4	3	2	1	0
1	10	2	1	0	0	0	0	0
2	11	1	1	0	0	0	0	0
3	10	1	2	0	0	0	0	0
4	11	2	0	0	0	0	0	0

Despite some of the participants having poor internet access, they managed to engage with the researcher during the sessions and were able to comprehend the technique of deep breathing. This could be observed from the response of the feedback questionnaires of the participants and the parents/guardians. Based on the feedback questionnaire, 7 participants (53.8%) responded as "very agree" to comprehend the technique and all of participants responded in the range of "very agree" to "agree" to the comprehension of the instructions during the activity. Other than that, all the parents/guardians' responses are in the range of "very agree" to "agree" for the similar questions.

DISCUSSION

Effects of Online Deep Breathing Exercises on Children's Anxiety

Despite utilization of an online platform that had resulted technical glitches to some participants, majority of the children participated in the weekly meetings and claimed to perform the DBE on a daily basis. The feedback from the participants and their parents demonstrated that the online DBE is feasible, useful and beneficial. Useful online activities, when they are delivered onto the children appropriately, would become a medium to with their friends in a pleasure and entertaining environment. Yet, the study reported no significant difference between two groups in anxiety scores at pre and post intervention as reported by the children, contrasted with the previous findings (4, 24-25, 29). Online deep breathing intervention may not be seen as helpful in reducing anxiety among primary school children during COVID-19 pandemic. However, several explanations are possible.

First, relaxation exercises, such as DBE and mindfulness require ample time before they can work to improve one's psychological state (31,40). Doss and Bloom (41) justified that children might have struggles to comprehend the purposes or the possible benefits that they could obtain when they practice any type of relaxation exercise. This might have reduced their ability to stay focused or to practice the exercise regularly, on their own (42). Other than that, as DBE or mindfulness was a relatively new exercise to the majority of the current research participants, it might work at specific setting and when they were guided only. Post-intervention, some children reported that they found the DBE and mindfulness were effective to create calmness when they practiced online, with the researcher's assistance only (41).

Secondly, despite randomization, children in the intervention group reported higher trait anxiety scores at baseline, compared to the control group, by 2-point. Spielberger indicated that those with a high trait anxiety would be more susceptible to feel overwhelmed and react intensely, thus elevating the state anxiety (35), as compared to their counterparts with a relatively low trait anxiety. William & Lopez added that trait anxiety could be a strong predictor to state anxiety score due a strong positive correlation seen in an event when the children are under an intense pressure, such as before an examination (43). Similarly, Horikawa and Yagi discovered the level of state anxiety was intensified among people that had high trait anxiety which impaired their performance compared with people that had low trait anxiety (44).

Finally, insufficient score differences between the groups could be rather due to a situational factor, that have triggered acute anxiety responses by many. During post-intervention data collection, a rapid increase of COVID-19 cases in Kelantan, including those transmitted from schools was evident (45). When the study started, Kelantan had recorded a good statistic by reporting a decreased by 11% cases of COVID-19 (46). However, as the study ended, new cases had increased by approximately 103%, rising from 68 to 138 cases (46-47). Six out of ten districts in Kelantan were categorized as red zone – one with more than 41 cases (48), compared with only three districts four weeks prior when the study started (47-48). This alarming development especially when the rest of the states in Malaysia showing a declining trend (46) may have resulted in higher reported anxiety not only by the participated children, but possibly the affected community in general.

Deep Breathing, State and Trait Anxiety

The presence of significant differences within the intervention group, unlike the control group, indicated that there was a trend in reduction of the state anxiety due to DBE, consistent with other findings (4, 25, 29). Mascioli (42) justified the insignificant differences between groups results post 6-weeks mindfulness intervention as the abundant academic workloads making it harder for the participants to focus on the present moment when answering the questionnaire. Yet, the anxiety reduction pattern provides evidence that the STAI-C State items are sensitive to immediate changes that occur in surroundings (35). Additionally, Spielberger recommended the STAI-C State scale to be used in assessing the effect of desensitization in behavior therapy (35), thus this exercise might have reduced or desensitized the anxiety symptoms among the students in the intervention group as demonstrated by the scores' reduction. However, the observed significant main effect of time indicates that anxiety levels decreased from pre- to post-intervention across all participants, regardless of group allocation. This suggests that factors such as natural recovery, repeated exposure to the assessment, or nonspecific effects may have contributed to the reduction in anxiety over time. Lack of between group and interaction effects indicated that the data do not provide strong evidence that DBE specifically reduces anxiety beyond general temporal effects. These findings highlight the importance of including a control condition in intervention studies to account for placebo effects and other time-related changes. Future research with longer follow-up periods may be necessary to more definitively evaluate the specific efficacy of DBE.

In contrast, there was no significant difference for both groups in trait anxiety scores post-intervention. This finding is not consistent with the previous studies (20, 29), who found that 45-days of deep breathing intervention or 6-weeks of mindfulness had reduced the trait anxiety among secondary students. The DBE delivered through online platform maybe difficult to be modelled by the participants, the relaxation context might be difficult to comprehend (42), thus more time is

required to obtain the significant results (42). In addition, trait anxiety scores are often moderately stable across children and adolescence after 10 months (49, 50). A longitudinal study measured state and trait anxiety at different time intervals of 1 day, 1 week, 1 month, and 10 months reported that across these intervals, the mean correlation coefficient for the STAI Trait scale was .86, while for the STAI State scale it was only .52 (50).

Study Limitations

A key limitation of this study is the smaller than planned final sample size, with only 28 participants completing the study compared to the target of 34 estimated to achieve adequate power. High attrition rate despite sufficient number at recruitment could be largely due to the unprecedented COVID-19 pandemic research background. This reduction in sample size decreased the statistical power, have increased the risk of Type II error, limiting the ability to detect smaller effect sizes. Consequently, results should be interpreted with caution, especially regarding more subtle or marginal effects. Additionally, the self-report questionnaires which solely depended on the participants' report could cause self-reported bias where they would try to portray themselves in a positive way. Apart from that, the emotions of the participants could influence the response towards the questionnaire. During the first week of the intervention, the students anticipated the physical class at school and the debriefing session was held after a week they resumed the online class due to the increased number of COVID-19 cases in Kelantan. This might induce the anxiety and stress level within the children due to the uncertainties of the situation. This could influence the response towards the questionnaire as it measured the current state of the anxiety level. Additionally, the study was conducted through an online platform that requires a stable internet connection between the researcher and the participants to ensure smooth-sailing weekly meeting and technique monitoring sessions. However, due to internet connection stability, only half of the participants turned on their camera. The internet connection has influenced the interaction between the researcher and the participants as some of the participants were not able to attend the meeting comprehensively (i.e., the meeting always disrupted as the students kept getting disconnected).

Recommendations for Future Research

Despite these limitations, the current findings provide important preliminary data that can guide subsequent, larger-scale investigations. Future research should aim to recruit larger samples and implement enhanced retention strategies to mitigate attrition and ensure sufficient power to detect anticipated effects. A large, adequate sample size could provide precise information and help in reducing the sampling error. In addition, information from to the parents and teachers could also be gathered. Other than that, physical interaction between the researcher and the participants might yield different results as compared with virtual meetings. Virtual meeting and learning are a new platform to the students, and they might take a longer time to adapt with it. It is worth examining the difference between face-to-face and online interactions with the participants. Looking at the scores' trend in the current study, it might have a warranted result if a longer follow-up study is conducted.

CONCLUSION

This study contributes to the understanding of anxiety management in young children by demonstrating that anxiety levels decreased over time. While DBE are widely regarded as a practical and accessible strategy to reduce anxiety—with benefits such as simplicity, ease of learning, and feasibility for online delivery—our findings suggest that anxiety reduction cannot be attributed specifically to DBE relative to the control condition in this sample. Despite some participants facing challenges such as internet access, DBE remains a promising coping technique for children. Future research with larger samples and enhanced study designs is warranted to clarify its specific effectiveness.

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REFERENCES

1. Institute for Public Health. National Health and Morbidity Survey (NHMS) 2017: Key findings from the adolescent health and nutrition surveys. Kuala Lumpur (Malaysia): Institute for Public Health; 2018. Available from: https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2017/NHMS2017Infographic.pdf
2. Murugesan M. Raising resilient children [Internet]. New Straits Times; 2018 Oct [cited 2025 May 29]. Available from: https://www.nst.com.my/lifestyle/heal/2018/10/426376/raising-resilient-children
3. Buchler RK. Anxiety-Reducing Strategies in the Classroom [dissertation]. Kalamazoo (MI): Western Michigan University; 2013. Available from: https://scholarworks.wmich.edu/dissertations/188
4. Larson HA, El Ramahi MK, Conn SR, Estes LA, Ghibellini AB. Reducing test anxiety among third grade students through the implementation of relaxation techniques. J Sch Couns. 2010;8(n19).
5. Lakhan R, Agrawal A, Sharma M. Prevalence of depression, anxiety, and stress during COVID-19 pandemic. J Neurosci Rural Pract. 2020;11(4):519-25. doi:10.1055/s-0040-1716442
6. Wang C, Pan R, Wan X, Tan Y, Xu L, McIntyre RS,

et al. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. Brain Behav Immun. 2020;87:40-8. doi:10.1016/j.bbi.2020.04.028
7. Pizzoli S, Marzorati C, Mazzoni D, Pravettoni G. Web-based relaxation intervention for stress during social isolation: randomized controlled trial. JMIR Ment Health. 2020;7(12):e22757. doi:10.2196/22757.
8. Lavigne-Cerván R, Costa-Lypez B, Juárez-Ruiz de Mier R, Real-Fernández M, Sánchez-Mucoz de Leyn M, Navarro-Soria I. Consequences of COVID-19 confinement on anxiety, sleep and executive functions of children and adolescents in Spain. Front Psychol. 2021;12:334. doi:10.3389/fpsyg.2021.565516.
9. Orgilés M, Espada JP, Delvecchio E, Francisco R, Mazzeschi C, Pedro M, Morales A. Anxiety and depressive symptoms in children and adolescents during COVID-19 pandemic: a transcultural approach. Psicothema. 2021;33(1):125-30. doi:10.7334/psicothema2020.287.
10. Fernández-Martínez I, Morales A, Méndez FX, Espada JP, Orgilés M. Spanish adaptation and psychometric properties of the parent version of the Short Mood and Feelings Questionnaire (SMFQ-P) in a non-clinical sample of young school-aged children. Span J Psychol. 2020;23:e45. doi:10.1017/SJP.2020.47.
11. Aliyyah RR, Rachmadtullah R, Samsudin A, Syaodih E, Nurtanto M, Tambunan AR. The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: a case study in Indonesia. J Ethn Cult Stud. 2020;7(2):90-109. doi:10.29333/ejecs/388.
12. Bunyan J. PM: Malaysia under movement control order from Wed until March 31, all shops closed except for essential services [Internet]. 2020 Mar 16 [cited 2025 May 29]. Available from: https://web.archive.org/web/20200316160541/https://www.malaymail.com/news/malaysia/2020/03/16/pm-malaysia-in-lockdown-from-wed-until-march-31-all-shops-closed-except-for/1847204
13. Dong C, Cao S, Li H. Young children's online learning during COVID-19 pandemic: Chinese parents' beliefs and attitudes. Child Youth Serv Rev. 2020;118:105440. doi:10.1016/j.childyouth.2020.105440.
14. Grover S, Goyal SK, Mehra A, Sahoo S, Goyal S. A survey of parents of children attending the online classes during the ongoing COVID-19 pandemic. Indian J Pediatr. 2021;88(3):280. doi:10.1007/s12098-020-03523-5.
15. Jung YH, Ha TM, Oh CY, Lee US, Jang JH, Kim J, Kang D. The effects of an online mind-body training program on stress, coping strategies, emotional intelligence, resilience and psychological state. PLoS One. 2016;11(8):e0159841. doi:10.1371/journal.pone.0159841.
16. Kemper KJ, Lynn J, Mahan JD. What is the impact of online training in mind-body skills? J Evid Based Complement Alternat Med. 2015;20(4):275-82. doi:10.1177/2156587215580882.
17. Komarudin, Hermawan H, AniHastuti T, Kusuma M. Effectiveness of progressive muscle relaxation and deep breathing based on internet method in facing student anxiety during COVID-19. Ann Trop Med Public Health. 2021;24(S03):SP24354. doi:10.36295/ASRO.2021.24354.
18. Lim CW, Othman A, Hashim HA. The effect of online-delivered guided imagery relaxation on stress and well-being of primary school children. Malays J Med Health Sci. 2023;30(4):102-15. doi:10.21315/mjms2023.30.4.10.
19. Carsley D, Khoury B, Heath N. Effectiveness of mindfulness interventions for mental health in schools: a comprehensive meta-analysis. Mindfulness (NY). 2018;9(3):693-707.
20. Ricarte JJ, Ros L, Latorre JM, Beltrán MT. Mindfulness-based intervention in a rural primary school: effects on attention, concentration and mood. Int J Cogn Ther. 2015;8(3):258-70.
21. Zenner C, Herrnleben-Kurz S, Walach H. Mindfulness-based interventions in schools - a systematic review and meta-analysis. Front Psychol. 2014;5:603. doi:10.3389/fpsyg.2014.00603.
22. Van de Weijer-Bergsma E, Langenberg G, Brandsma R, Oort F, Susan B. The effectiveness of a school-based mindfulness training as a program to prevent stress in elementary school children. Mindfulness (NY). 2014;5(3):238-48. doi:10.1007/s12671-012-0171-9.
23. Schonert-Reichl KA, Lawlor ML. The effects of a mindfulness-based education program on pre- and early adolescents' well-being and social and emotional competence. Mindfulness (NY). 2010;1(3):137-51. doi:10.1007/s12671-010-0011-8.
24. Lohaus A, Klein-Hessling J. Relaxation in children: effects of extended and intensified training. Psychol Health. 2003;18(2):237-49. doi:10.1080/0887044021000057257.
25. Kiat HK. A better state-of-mind: deep breathing reduces state anxiety and enhances test performance through regulating test cognitions in children. Cogn Emot. 2017;31(7):1502-10. doi:10.1080/02699931.2016.1233095.
26. Kajander R, Peper E. Teaching diaphragmatic breathing to children. Biofeedback. 1998;26(3).
27. Larson H, Rose J. Effects of deep breathing and muscle relaxation on ACT scores. Easter Educ J. 2011;40(1):11-22.
28. Case-Smith J, Sines J, Klatt M. Perceptions of children who participated in a school-based yoga program. J Occup Ther Sch Early Interv. 2010;3(3):226-38. doi:10.1080/19411243.2010.520246.
29. Sellakumar GK. Effect of slow-deep breathing

exercise to reduce anxiety among adolescent school students in a selected higher secondary school in Coimbatore, India. J Psychol Educ Res. 2015;23(1):54-72.
30. Felver JC, Hoyos CE, Tezanos K, Singh NN. A systematic review of mindfulness-based interventions for youth in school settings. Mindfulness (NY). 2016;7(1):34-45. doi:10.1007/s12671-015-0389-4.
31. May RM. Implementation of a mindfulness-based intervention to reduce test related stress and anxiety in third grade students [dissertation]. 2017.
32. Trevino KM, Raghunathan N, S LN, Polubriginof F, Jensen C, Atkinson T, Mao J. Rapid deployment of virtual mind-body interventions during the COVID-19 outbreak: feasibility, acceptability, and implications for future care. Support Care Cancer. 2021;29(2):543-6. doi:10.1007/s00520-020-05740-2.
33. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behav Res Methods. 2007;39(2):175-91.
34. Focus Family Resiliency Training Manual. Appendix B: calming and grounding activities [Internet]. [cited 2025 May 29]. Available from: https://www.iirp.edu/images/conf_downloads/UmqxBC_breathinig_and_guided_visualization.pdf
35. Spielberger C. State-trait anxiety inventory for children manual. Mind Garden; 1973.
36. Whitcomb SA, Merrell KW. Behavioral, social, and emotional assessment of children and adolescents. New York: Routledge; 2012.
37. Chaiyawat W, Brown JK. Psychometric properties of the Thai versions of State-Trait Anxiety Inventory for Children and Child Medical Fear Scale. Res Nurs Health. 2000;23(5):406-14.
38. Turgeon L, Chartrand E. Psychometric properties of the French Canadian version of the State-Trait Anxiety Inventory for Children. Educ Psychol Meas. 2003;63(1):174-85. doi:10.1177/0013164402239324.
39. Schulz KF, Grimes DA. Sample size slippages in randomised trials: exclusions and the lost and wayward. Lancet. 2002;359(9308):781-5. doi:10.1016/S0140-6736(02)07882-0.
40. Rieffe C, Oosterveld P, Miers AC, Terwogt MM, Ly V. Emotion awareness and internalising symptoms in children and adolescents: the Emotion Awareness Questionnaire revised. Pers Individ Dif. 2008;45(8):756-61. doi:10.1016/j.paid.2008.08.001.
41. Doss KK, Bloom L. Mindfulness in the middle school classroom: strategies to target social and emotional well-being of gifted students. Gift Educ Int. 2018;34(2):181-92. doi:10.1177/0261429417716352.
42. Mascioli K. Mindfulness and its ability to alleviate state and trait anxiety in college students [thesis]. Hartford (CT): Trinity College; 2014. Available from: https://digitalrepository.trincoll.edu/theses/427/
43. William LH, Lopez V. Do trait anxiety and age predict state anxiety of school-age children? J Clin Nurs. 2005;14(9):1083-9. doi:10.1111/j.1365-2702.2005.01223.x.
44. Horikawa M, Yagi A. The relationships among trait anxiety, state anxiety and the goal performance of penalty shoot-out by university soccer players. PLoS One. 2012;7(4):e35727. doi:10.1371/journal.pone.0035727.
45. BERNAMA. COVID-19: 20 clusters in education sector recorded [Internet]. 2021 Apr 5 [cited 2025 May 29]. Available from: https://www.bernama.com/en/general/news_covid-19.php?id=1948976
46. Jabatan Kesihatan Negeri Kelantan. Jabatan Kesihatan Negeri Kelantan [Internet]. 2021 Feb 27 [cited 2025 May 29]. Available from: https://www.facebook.com/HealthofKelantan/photos/3804575896302484
47. Jabatan Kesihatan Negeri Kelantan. Jabatan Kesihatan Negeri Kelantan [Internet]. 2021 Mar 27 [cited 2025 May 29]. Available from: https://www.facebook.com/HealthofKelantan/photos/3881312645295475
48. Kementerian Kesihatan Malaysia. Kementerian Kesihatan Malaysia [Internet]. 2020 [cited 2025 May 29]. Available from: http://covid-19.moh.gov.my/
49. Newmark C. Stability of state and trait anxiety. Psychol Rep. 1972;30(1):196-8.
50. Gullone E, King N, Ollendick T. Self-reported anxiety in children and adolescents: a three-year follow-up study. J Genet Psychol. 2001;162(1):5-19. doi:10.1080/00221320109597878.