# The Effect of Virtual Mode Deep Breathing Intervention on Anxiety among Primary School Children during COVID-19 Pandemic

by

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## LISTS OF ABBREVIATIONS

| | |
|---|---|
| COVID-19 | Coronavirus Disease |
| WHO | World Health Organisation |
| STAI-C | State-Trait Anxiety Intervention for Children |
| STAI-C Malay version | State-Trait Anxiety Intervention for Children Malay version |
| ANOVA | Analysis of Variance |
| SPSS | Statistical Package for Social Science |

# ABSTRAK

Pandemik COVID-19 yang melanda dunia pada tahun 2019 telah memberi kesan terhadap orang ramai di dalam pelbagai aspek kehidupan termasuk dari aspek psikologi. Hal ini terjadi akibat kegelisahan yang dihadapi oleh mereka kerana situasi yang tidak menentu serta berasa takut terhadap jangkitan pandemic itu. Kanak-kanak juga tidak terkecuali daripada kesan COVID-19 ini. Dalam pada masa yang sama, tinjauan oleh satu agensi kebangsaan menunjukkan bahawa kekerapan kes anzieti di kalangan kanak-kanak di Malaysia berada pada tahap yang membimbangkan. Oleh itu, kajian ini dilakukan untuk mengenal pasti kesan teknik pernafasan mendalam terhadap anzieti di kalangan pelajar sekolah rendah yang dilakukan secara dalam talian. Selain itu, kebolehlaksanaan secara di dalam talian juga diselidik. Ujian terkawal secara rawak telah dilakukan ke atas 28 orang pelajar sekolah rendah di Kelantan yang merangkumi pra ujian dan pasca ujian. Peserta di dalam kumpulan intervensi menjalani intervensi pernafasan mendalam selama empat minggu dan berjumap dengan pihak pengkaji pada setiap hujung minggu. Kumpulan kawalan pula tidak akan menerima apa-apa intervensi sepanjang tempoh ini. Analisis menggunakan pengukuran berulang ANOVA mendapati tiada perbezaan yang signifikan di antara kumpulan intervensi dan kumpulan kawalan selepas empat minggu intervensi. Namun bgeitu, ujian t sample berpasangan menunjukkan perbezaan yang signifikan untuk “state” anzieti di kalangan paraa peserta di dalam kumpulan intervensi dan tidak ada perbezaan yang signifikan di kalangan perserta di dalam kumpulan kawalan. Bagaimanapun, ujian t-sample berpasangan tidak menunjukkan perbezaan yang signifikan buat “trait” anzieti bagi kedua-dua kumpulan. Walaupun penemuan utama tidak menunjukkan perubahan yang signifikan, tedapat trend perngurangan di dalam tahap anzieti bagi “state” dan “trait”, terutamanya “state” anzieti. Oleh itu, ianya data

dicadangakan bahawa teknik pernafasan mendalam dapat membanti dalam mengurangkan tahap anzieti dan ianya mudah, cepat serta senang untuk dipelajari dan dilakukan oleh kanak-kanak secara di dalam talian.

**Kata kunci:** anzieti; pernafasan mendalam; sekolah rendah; kanak-kanak; COVID-19; intervensi secara dalam talian.

## ABSTRACT

CODID-19 pandemic that hits the world in 2019 impacts people in various aspects of life including the psychological aspect. It has induced anxiousness among people due to the uncertainty and fear of the pandemic and it is not exclusive towards adults only. Concurrently, a national survey suggested the prevalence of anxiety among children in Malaysia is alarming. Due to that, the current study was conducted to investigate the effect of deep breathing on the level of anxiety among primary school children via virtual-based intervention as well as to examine its feasibility. A pre-test, post-test randomised controlled design was carried out wit 28 students at a primary school in Kelantan. The students in the intervention group participated in a four-week deep breathing intervention with weekly meetings with the researcher, whereas the participants in the control group did not receive any intervention. A repeated-measures ANOVA was conducted and showed no significant difference between the intervention and control group after four-week of intervention. However, a paired sample t-test indicated a significant difference in the level of state anxiety within the participants in the intervention group and no significant difference for the control group. In contrast, there was no significant difference in the level of trait anxiety for both groups. Despite the primary findings showed no significant result, there was a trend of declination for both state and trait anxiety, particularly for state anxiety. Thus, it could be suggested that the deep breathing exercise could help in reducing the level of anxiety and it is simple, quick, and easy to be learned as well as applied by the children via virtual mode.

**Keywords:** anxiety; state anxiety; trait anxiety; deep breathing; primary school; children; COVID-19; online intervention

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

This chapter provides an overview to the study by discussing the current situation of anxiety in relation to the coronavirus disease (COVID-19) pandemic, especially in Malaysia. It follows by the problem statement, research questions as well as the research objectives.

## 1.2 BACKGROUND OF STUDY

National Health and Morbidity Survey 2017 conducted on adolescents (aged 13 – 17) in Malaysia has reported that two out of five adolescents have anxiety, as compared to depression which was one out of five and stress which was one out of ten, and this is alarming. According to Sarvananthan (2018, as cited in Murugesan, 2018) the factors that cause the issues are peer pressures, family expectations and academic performance. In addition, Ismail (2018, as cited in Murugesan, 2018) proposed that most of the children do not have the ability to manage the issues that they experience which led them to be easily affected by it. Hence, he suggested that it is important for the children to develop skills that could help them to solve the issues and to be resilient.

Currently, the world is facing a health crisis, the COVID-19 pandemic, that is continually affecting all life in terms of education, jobs, and the economy. Due to the nature of the disease, many countries are forced to implement lockdowns to reduce the spread of the disease that last for at least 10 weeks (Schleicher, 2020). Malaysia has enforced its first lockdown or known as movement control order on 18$^{th}$ March 2020 that lasted for eight weeks. During the lockdown, all the non-essential sectors are prohibited to be operated including schools and universities (Bunyan, 2020). Thus, the conventional mode of schooling (i.e., physical interactions) are interrupted which cause the school students and the teachers to adapt with the new modes of delivery teaching that is via online based (Schleicher, 2020).

For children, their daily activities change abruptly and becoming different as the schools are closed, teaching and learning are conducted through online platforms,

and their social life is now limited and restricted within their home only (Burgess & Sievertsen, 2020). The online platform of teaching affects the children especially the younger ones who are not well-verse with the technology and computer in general and it could be anxiety-provoking. Having to be satisfied with seeing their teacher merely online limits the social interaction and reassurance opportunity. In addition, it involves uncertainty for the assessments and proper research has not been conducted to test its efficacy (Burgess & Sievertsen, 2020). Thus, it might cause the children to feel anxious and develop emotional insecurity which will affect their mental health (Thevenon & Adema, 2020).

Past research showed anxiety affects students' performance negatively and it has influenced children's self-esteem, behavioural problems, and maintaining or developing relationship (Buchler, 2013; Larson, El Ramahi, Conn, Estes, & Ghibellini, 2010). Research has been done extensively to help the students cope with their anxiety as it could contribute to a more adverse effect on their health if it is not being treated (Buchler, 2013). By guiding the students to cope with their anxiety, it might help to reduce their anxiousness and the students would be able to handle it in a very effective and comprehensive way.

Research has suggested that one of the approaches that demonstrate prominent result in reducing anxiousness is by deep breathing technique (Kiat, 2017; Lohaus & Klein-Hessling, 2003). Research has been done tremendously on this technique as it is an easy, helpful tool for school children in managing their anxiousness, increasing their calmness, and improving their academic performance (Larson et al.,2010; Kajander & Peper, 1998). Other than that, it also assisted the students to be more aware of the emotions that they feel which simultaneously had helped them to be able

to cope with it in a better way (Zenner, Herrnleben-Kurz, & Walach, 2014). This occurs due to the technique of deep breathing that asks the children to experience and embrace the emotion that they have while doing the activity.

Thus, it is crucial to explore the approach to reduce or minimise the anxiety that is experienced by the children especially during the COVID-19 pandemic. By developing an effective and appropriate technique to deal with their anxiety at a young age, it might help to reduce the prevalence of it and the children might be more resilience in confronting with the issues that they have.

## 1.3 RATIONALE AND PROBLEM STATEMENT

Deep breathing intervention is effective in helping the students to reduce their anxiousness level as well as enhancing the students' performance during their exam and improving the class environment to be calmer (Kiat, 2017; Buchler, 2013; Larson & Rose, 2011). It also showed that the young students were able to perform deep breathing exercise successfully (Case-Smith, Sines, & Klatt, 2010; Lohaus & Klein-Hessling, 2003). However, there is a need to explore more in this area to gain a better understanding of deep breathing intervention.

First, the deep breathing intervention normally combined with other intervention in a study (Zenner et al., 2014). Hence, the exclusive effect of deep breathing could not be observed. In addition, almost all the study that involves mindfulness will include breathing exercise as a part of the intervention. Thus, it

would be interesting to develop research, particularly on deep breathing intervention as it showed that deep breathing is the fundamental technique for mindfulness.

The second problem statement was there is a lack of research on the learning tools that would encourage the children to manage the anxious reactions by themselves (Buchler, 2013). By implementing this intervention, it might help the children to be able to control their anxiousness by having one specific skill that they could learn conveniently. As stated above, the prevalence of anxiety is increasing. Research has been conducted on school children to examine the best treatments for anxiety such as clinical treatments through cognitive-behavioural therapy, medication treatments, and combinations of both as well as through educational settings (Creswell, Waite, & Hudson, 2020; McLoone, Hudson, & Rapee, 2006). However, due to the situation of COVID-19 pandemic, it might induce stress and anxiousness among the children and a reliable as well as effective skill in handling the situation is needed.

## 1.4 RESEARCH QUESTIONS

The underlying question for this current study was: *What are the effects of deep breathing exercise on the anxiety level of the primary school students?* To further explore the fundamental research question, the following sub questions were also examined:

1. Can a deep breathing intervention programme be developed through an online platform for primary school students?

2. Is it feasible to conduct the deep breathing intervention programme through an online platform on young children?
3. What are the effects of a virtual deep breathing intervention programme on the anxiety level among the primary school students?

## 1.5 RESEARCH OBJECTIVES

The general objective is to evaluate the effects of deep breathing exercise in reducing the anxiety levels of primary school students.

Specific objectives are:

1. To develop a deep breathing intervention protocol for children through an online setting.
2. To examine the feasibility of the protocol to be conducted on children through an online setting.
3. To examine the effects of deep breathing on children's anxiety before and after the intervention.

## 1.6 SIGNIFICANCE OF THE STUDY

To date, there is a lack of research that examine how deep breathing exercise exclusively could improve the anxiousness in children (Zenner et al., 2014). Hence, this study would shed light on the role of deep breathing exercise. Also, it helps the children to learn a skill that they could apply at any particular time and in any place with zero cost as deep breathing exercise does not require specific tools. This skill is

important especially during COVID-19 pandemic because the lockdowns and strict regulations might be overwhelming to the children and it could help them to feel calm.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This chapter would discuss on the findings of the previous literature related to the current study, specifically on how deep breathing could help in reducing the anxiety level as well as the current research on the effect of COVID-19 pandemic towards the mental health of people. Other than that, recent studies that attempted to investigate the effectiveness of online-based mindfulness during COVID-19 will be discussed as well.

## 2.2 LITERATURE REVIEW

COVID-19 pandemic hit the world in 2019 that emerged from Wuhan, China and the disease was declared as a global pandemic by the World Health Organisation (WHO) on 11 March 2021 and after a year of the declaration, it has reported more than 3 million deaths and 176 million confirmed cases (COVID-19 Coronavirus Pandemic, 2021). The situations of early stages of COVID-19 pandemic were uncertain and worrying due to the absence of effective vaccines and lack of research regarding the treatments and transmissions (Saddik, et al., 2021). Due to the rapid transmissions, most countries including Malaysia has closed the international borders, close schools and universities, social distancing, lockdowns, and quarantines to control the trasmission of the disease (Saddik, et al., 2021; Bunyan, 2020). The restrictions of the daily activities impact the mental health of the people alongside with the fear of the pandemic (Wang, et al., 2020).

Infectious disease outbreaks could impact different levels of life, i.e., individual, community, and international levels, in terms of psychosocial factors due to the worries and fear of becoming infected and dying, increase in anxiety, and feelings of helplessness (Rubin & Wessely, 2020; Sim, Chan, Chong, Chua, & Soon, 2010). Recent research on COVID-19 showed that it has significant psychological impacts that are associated with the isolations, changes in daily routines as well as public fear and worry (Lakhan, Agrawal, & Sharma, 2020; Shevlin, et al., 2020; Verma & Mishra, 2020). This has cause moderate to severe stress, anxiety, and depression among the people (Lakhan et al., 2020; Shevlin, et al., 2020).

Children and adolescents are affected by the effect of COVID-19 pandemic as well due to the sudden changes of their daily activities (Lavigne-Cerván, et al., 2021).

Children at the age of 9 to 12 were exposed to anxiety more than chidlren at the age of 13 to 18 whereby, they were exposed more to sleep distrubance (Lavigne-Cerván, et al., 2021). Other than anxiety and sleep disturbance, the children were reported to score higher than usual for depressive symptoms by 12% (Orgilés, et al., 2021; Fernández-Martínez, Morales, Méndez, Espada, & Orgilés, 2020). The lockdowns restriction levels impacted the severity of anxiety and depression of the children whereby a strict rules of lockdowns showed greater severity (Orgilés, et al., 2021).Other than that, parents who experience higher level of stress would influence the presence of the anxiety and depression symptoms (Orgilés, et al., 2021).

COVID-19 pandemic has changed the landscape of the education system globally, where the students are required to attend online classes to replace the traditional physical classes (Aliyyah, et al., 2020; Bunyan, 2020; Dong, Cao, & Li, 2020). Online learning requires the usage of internet and technology which are uncommon for the students, parents as well as the teachers (Dong et al., 2020). Concurrently, some of the parents rejected online learning due to lack of self-regulation among their children, and inadequate time and knowledge to support the online learning (Dong et al., 2020). Also, parents reported that their children's irritability and the demand to attend the school physically have increased, and the self-hygiene/care among the children has decreased (Grover, Goyal, Mehra, Sahoo, & Goyal, 2021).

As the children spend most of their time on the screen, it reduces the physical activities as well as the interactions with parents and friends (Harjule, Rahman, & Agarwal, 2021). This has caused a rise in anxiety levels especially if they are exposed to the harmful content on the Internet. However, lack of research has been done to

solve the mental health issues facing by the children and adolescents. According to Komarudin, Hermawan, AniHastuti and Kusuma (2021), virtual-based programme of progressive muscle relaxation and deep breathing showed significant improvement in reducing anxiety among the students.

### 2.2.1 Anxiety

Anxiety is a feeling of unease that emerges because of the presence of high expectations and potentially threatening events, and it is the common response to stress (American Psychiatric Association, 2021; National Health Service, 2018; Larson et al.,2010). Anxiety affects differently to different people and not all anxiety is inappropriate. In certain situations, it is normal and can be helpful as it would help one to stay alert to dangers (American Psychiatric Association, 2021). For example, feeling anxious during the first day at a new school and feeling nervous for presentation is normal if it occurs reasonably and they are able to control it (Buchler, 2013). If anxiety is not being able to be controlled successfully, it might lead one to experience an intense physiological hyperarousal, negative emotional response and to an extent, it could cause behavioural issues among the students (Larson et al., 2010).

Anxiety can be categorised into two categories which are state anxiety and trait anxiety. State anxiety is characterised as an unpleasant emotional arousal when one is in threatening and dangerous situations, and/or has apprehensive thoughts (Jouvent, et al., 1999). In contrast, trait anxiety is defined as an individual's personality trait which is stable across time and differ from one individual to another when one is facing a

stressful situation (Jouvent, et al., 1999). Research suggested people with high trait anxiety experience a relatively high state anxiousness compared to people with low trait anxiety when they experienced the same level of anxiety (Egloff & Hock, 2001).

Anxiety disorders is one of the common mental health disorders that affects people globally (American Psychiatric Association, 2021). It causes severe impairments in terms of occupation, relationships, and performance as the feelings of anxiety and worry interrupt their ability to function normally (American Psychiatric Association, 2013). It was reported that the prevalence of anxiety among adults in Malaysia was 8.2 % and the predictors of anxiety were cancer, serious problems at work, and unhappy relationship with family (Kader Maideen, Mohd Sidik, Rample, & Mukhtar, 2015). A recent study on university students in Malaysia reported 29% of the students were at risk of anxiety due to the factors that were related to academic year, financial support for the study, and alcohol consumption (Mohamad, Mohd Sidik, Akhtari-Zavare, & Abdul Gani, 2021).

Nevertheless, anxiety is not exclusive towards adults only. Young children might feel anxious as well due to peer pressure, school performance, and family problems which may or may not fully manageable by them (National Health Service, 2020; Lohaus & Klein-Hessling, 2003). Mostly, the children are trapped in the situations because it is being controlled by adults and they have to deal with the emotions that come along with the problems (Lohaus & Klein-Hessling, 2003). To some extent, it becomes a serious problem when it affects their daily life and academic performance.

The symptoms of anxiety might be different between adults and children due to the ability to express and recognise their emotions, and language skills (Beesdo,

Knappe, & Pine, 2009). Also, it is challenging to recognise the pathological anxiety that presence in children because they have different fears and anxieties that follows their developmental milestone (Beesdo et al., 2009). For instant, a child ages between 12 to 18 months might experience separation anxiety whereas, a child ages between 2 to 4 years might fears the thunder or lightning, and no longer has separation issue (Beesdo et al., 2009). Typically, the symptoms of anxiety that presence within the children are tantrums, excessive concerns about the quality of performance and punctuality, as well as become a perfectionist. Other than that, they might have difficulty to focus, become easily irritable and feeling tense (National Health Service, 2020).

One of the anxiety situations that is always experienced by school-aged children is test anxiety or known as trait test anxiety (Larson et al., 2010). Kiat (2017) defines trait test anxiety as a constant tendency to perceive tests or evaluative circumstances as threatening events. The reason is the students would feel stress about their performance in the test which unconsciously impaired their mental states and emotional stability and leads them to have poor performance (Larson et al., 2010). If it is not being acknowledged, one would experience low self-esteem and their performance would get worse (Buchler, 2013).

Similar to adults, anxiety disorders are the common mental health disorder faced by children and adolescents (National Health and Morbidity Survey, 2017; Xiaoli, et al., 2014). Past research proposed the risk of developing psychiatric disorders during childhood or adulthood increased if the child suffers with anxiety and it was suggested to be a predictor for panic attacks, depression, and conduct disorder (Essau, Lewinsohn, Olaya, & Seeley, 2014; Bittner, et al., 2007). Essau and

colleagues (2014) conducted a longitudinal study for 15 years and discovered that childhood anxiety was a predictor for major depression disorders for adults age 30. Another longitudinal study identified the association of anxiety disorders with suicide attempts (Bolton, et al., 2008).

Due to that, research has been done extensively to explore the effective treatments for anxiety among children (Ghaffar Ab, Mohd Sidik, Ibrahim, Awang, & Rampal, 2019; James, James, Cowdrey, Soler, & Choke, 2015). Despite the concerning issue regarding the anxiety among children, the accessibility to the treatments is insufficient and some of the children are left untreated (Chavira, Stein, Bailey, & Stein, 2004). The factors that contributed to the lack of treatment were the stigmatisation of mental health problems, denials of problems as well as the treatment cost and transportation (Siti Fatimah, Nor Afiah, Anisah, & Minhat, 2015; Murry, Heflinger, Suiter, & Brody, 2011; Moskos, Olson, Halbern, & Gray, 2007). In consideration of the factors, Siti Fatimah and colleagues (2015) suggested that school-based mental health program would be able to reduce the factors.

### 2.2.2 Deep Breathing

Mindfulness is defined as to be fully focused, completely aware and to be alert and present during that moment itself without judgement (Ricarte, Ros, Latorre, & Beltrán, 2015). Previously, mindfulness was practising merely by meditation (e.g., sitting) or physical movement such as yoga or tai chi (Zenner et al., 2014). It improves mind and attention as well as enhancing the focus of their attention at the current moment. They further explained that if the mind shifts away from the current moment, it is carried back effortlessly without trying to push them. Various techniques of

mindfulness such as deep breathing, body scan and loving-kindness meditation have been developed to help the students (Zenner et al., 2014; Buchler, 2013).

According to Kajander and Peper (1998), humans breathe naturally by diaphragmatic breathing since born but slowly, the pattern of breathing would change to thoracic breathing when they reach 10 years old. Thoracic breathing is a shallow breathing pattern that utilised the upper chest to breath and normally the condition of the diaphragm is being pulled up and down during the breathing process (Kajander & Peper, 1998). Hence, it would cause a lower carbon dioxide being released from the body which could induce hyperventilation. Hyperventilation can be explained into two categories which are acute (one can feel calm promptly) and chronic which could cause one to experience physical symptoms (Kajander & Peper, 1998).

Deep breathing exercise is slow, diaphragmatic breathing that helps to regulate the air inside the belly by inhaling the air through the nose and exhaling it through the mouth (Kiat, 2017; Buchler, 2013). It focuses on the movement of diaphragm muscle where during inhalation, the diaphragm muscle would move downward, and it would move upward during exhalation. It allows maximum absorption of oxygen during inhalation in the lower lungs (Thompson, 2008). As the deep breathing exercise continues, it would automatically slow down and increase more oxygen intakes into the body which help the person to feel more relaxed and calmer (Larson et al., 2010). Frequent practice of deep breathing can help one to learn and control their focus, emotion as well as muscle movement (Sellakumar, 2015). Thus, by practicing deep breathing, it would gradually help in reducing the undesired emotional responses when someone is in distressed (Sellakumar, 2015).

### 2.2.3 Anxiety and Deep Breathing

Recent years, the application of mindfulness for children and youth showed an increasing trend in research as well as in practice due to its effectiveness to help the students to have better well-being and mental health (Zenner et al., 2014; Carsley, Khoury, & Heath, 2018). Zenner and colleagues (2014) suggested that mindfulness is the foundation for education as the students need to regulate their attention and emotions when they are learning. Mindfulness would assist the students' mind from wandering about their frustration or negative emotions and to be fully present at the current moment. Research also suggested that school-aged students have clinical problems such as anxiety and stress-related, and problems related to social pressure (Zenner et al., 2014). The mindfulness interventions done in schools have helped the students to reduce their anxiousness and stress, enhance their cognitive performance and increase their attention in the classroom (Buchler, 2013; Ricarte et al., 2015). Hence, it would be helpful to teach the children mindfulness as it might assist them to deal with their emotional reactions towards the difficult situations that they face (Lohaus & Klein-Hessling, 2003).

A systematic review conducted by Zenner and colleagues (2014), the mindfulness interventions in a school-setting found a relatively small to medium effect sizes, both in between group and within group. Through the systematic review, it indicated that most of the research consisted of more than one intervention such as combining breathing technique with psychoeducation or breathing techniques with progressive muscle relaxation (i.e., body scan). Interestingly, they found that all the interventions involved breathing techniques as a major component or a part of it.

However, they found that there were no standardised mechanisms for mindfulness interventions. Also, some of the studies did not clearly describe their interventions.

Another systematic review also supported the findings of Zenner and colleagues as they highlighted a few limitations found from the studies (Felver, Hoyos, Tezanos, & Singh, 2016). Most of the studies conducted have collected data by using student self-report questionnaires which would limit the information regarding the effectiveness of mindfulness intervention. They suggested data from the schools' authorities, teachers as well as parents could improve the validation of its effectiveness. A recent meta-analysis by Carsley and colleagues (2018) suggested the facilitator plays a significant role in determining the success of the intervention where if the programme was delivered by trained facilitators, it would yield more effective results. Lohaus and Klein-Hessling (2003) discovered that the intensity of the programme did not help the students to be less anxious and a long period of training (i.e, ten weeks) did not improve students' performance as well. Hence, from their study, they suggested that a minimum of five-week of intervention would already show a significant effect on the school children. They also suggested that children as early as nine years old could quickly learn and apply mindfulness interventions. This aligned with the findings from Larson and colleagues (2010).

Research conducted in east coast of Peninsular Malaysia discovered that school-based anxiety prevention program was effective in reducing the anxiety symptoms of the children between the ages of 10 to 11 (Ghaffar Ab et al., 2019). The study was developed based on information-motivation-behavioural theory as the cognitive development level of children under the age of 12 have not fully developed which makes them to have difficulty in understanding abstract ideas (Ghaffar Ab et

al., 2019; Piaget, 2005). The intervention was conducted for four weeks with six different modules that introduced anxiety, empathy skills, emotion regulation skills and self-esteem. After six week of intervention and a 3-month follow-up, it reduced anxiety symptoms, but the effect was not significant to increase self-esteem and improve worry coping skills among the children.

A recent study by Kiat (2017) on deep breathing techniques found significant results in reducing state anxiety when the students (n=122) took mathematical tests. The test performance was also improving for the group who received the interventions. She found that reducing state anxiety was more effective for boys compared to girls. Besides, she also identified that the students with high autonomic reactivity (i.e., prone to worry) were more affected (positively) from the intervention compared with the students with low autonomic reactivity. The reason is deep breathing exercise is associated with affective and autonomic arousal states. Hence, she suggested that deep breathing might be helpful for students who experienced high autonomic reactivity and no effect for the students with low autonomic reactivity. The reason is deep breathing exercise is associated with affective and autonomic arousal states. Thus, it might explain the decrease in the effectiveness of low autonomic reactivity students.

Kiat (2017) also discovered that fifth grade (aged 10 – 11 years) could understand physiological and somatic responses of anxiety (e.g., handshake) more compared with the emotional state (e.g., I feel nervous). Thus, it showed that deep breathing could help to enhance students' performance and would have a greater desired impact on students with high autonomic reactivity. This finding is aligned with a study by Flook and colleagues (2010) which showed improvement of executive

function and behavioural regulation of the students with lower baseline. Hence, it showed that deep breathing could help to enhance students' performance and would have a greater desired impact on students with high autonomic reactivity as well as students with a lower executive function score.

Brunye and colleagues (2013) discovered similar findings as Kiat (2017) when comparing three different breathing interventions (i.e., focused, unfocused and worry) as well as another intervention involving nutrient (i.e., tea consumption) on 36 university students. The participants were asked to listen to audios on breathing exercise that lasted for about 15 minutes for six sessions before having a mathematic test. In focused breathing exercise, instructions were given to guide the participants and the audio kept on reminding the participants to refocus if their mind deviated from the exercise. They were also asked to pay attention to the process of breathing. On the other hand, the group who received unfocused exercise were told to think freely and do not focus on anything whereas, in the worry exercise group, the participants were asked anxiety-inducing questions, but they needed to answer it to themselves only. They found that students with high math anxiety had improved their math accuracy in the group who received focused breathing exercise compared to the other interventions as well as enhancing their level of calmness. However, it did not have any significant effect on students with low math anxiety.

Van de Weijer-Bergsma, Langenberg, Brandsma, Oort and Susan (2012) conducted a study on 208 students between the ages of eight to 12 years. They have a follow-up after seven weeks they ended the experiment. They developed their programme based on MBSR and mindfulness-based cognitive therapy for adults.

During the six-week intervention, the sessions were run for 30 minutes, twice per week by a trainer who came to the class, and it involved different exercises for each week (e.g., body sensations, breath, and thoughts). The classroom teachers were asked to do five minutes exercises with the students for the remaining school days. Screen for Child Anxiety Related Emotional Disorders was given to ask the parents to assess their children's anxiety symptoms. In contrast, School as a Caring Community Profile II assessment was conducted by the teachers to evaluate the social climate in the classroom. Initially, they did not find any significant changes from baseline to pre-test. However, after the follow-up, the participants and their parents informed more effects from the mindfulness programme. Additionally, the teachers reported a huge difference in the class climate. However, it needs to be treated carefully as the number of teachers participating in this experiment was small, which is eight teachers only.

In addition, Buchler (2013) conducted research that compared different techniques of mindfulness interventions which are progressive muscle relaxation, positive self-talk and deep breathing exercises for ten sessions (i.e., two sessions per week). In addition, the students also recorded their emotions in the journal. In the study, the students were asked about the situations that could induce their anxiety and they mentioned that quizzes and public speaking. Other than that, most of the students respond as "I don't know" or "I don't understand" when they were being asked about their coping mechanism for their anxiousness in school. He discovered an increasing trend of practising breathing exercises when the students were in anxious situations compared to the other interventions. During the pre-test, they found that only 12 students practised breathing techniques when they were anxious, but it increased to 118 students. On the other hand, positive self-talk increased from 12 students to 66

students whereas progressive muscle relaxation was not mentioned during the pre-test but in the post-test, there were 64 students. The findings were aligned with the previous findings where the result of pre-test and post-test showed that mindfulness could help the students to deal with their anxiety. Also, it showed that mindfulness helped the students to be aware of their emotions and assisted them to handle it especially deep breathing. This study provided another support about the efficacy of breathing techniques as mentioned by the systematic review done by Zenner and colleagues (2014).

A research done by Larson and colleagues (2010) focused on test anxiety among school-aged children demonstrated that breathing exercises and progressive muscle relaxation intervention could help the students to improve their anxiety. They conducted the experiment on 177 third-grade students in two different schools and the students were divided into two groups which were experimental and control groups. The experimental group received training on the appropriate breathing techniques and progressive muscle relaxation for five weeks (two days per week) that took place at their school. For deep breathing exercises, the experimenters chose elevator breathing where they combined it with visualisation. Each session was conducted for five minutes. In progressive muscle relaxation, the students were asked to make themselves feel comfortable and slowly, the experimenters guided them to loosen up their muscles. This technique was combined with deep breathing and the experimenter would read a relaxation script. Each session was conducted for roughly around 8 to 10 minutes. A pre-test and post-test of Westside Test Anxiety Scale showed a significant difference between both of the groups where the experimental group showed a significant decrease in anxiety whereas the control group did not show a significant

difference. However, they did not find a significant difference in the test score between the experimental and the control group. The experimenters suggested that it might occur due to the location of the experimental group's school where it is very close to a university which might contribute to the pressure surrounding the students to perform better in their academics. Despite that, it showed that young children could easily learn the technique and apply it.

Nearly all the studies mentioned above were conducted in urban areas. A study in rural areas by Ricarte and colleagues (2015) found similar findings. They adapted the Mindfulness Emotional Intelligence Training Program that was constructed for the students. The interventions last for six weeks, and it consisted of breathing exercises, the mindfulness towards senses, and attention to the body (each component was done for two weeks). It was done daily at the same time for 15 minutes in the students' classroom. Ricarte and colleagues (2015) found that it reduced the trait anxiety levels as well as increasing the well being among the students after the interventions. They also conducted informal interviews with the school management, teachers, parents, and students and received favourable feedback and a high level of acceptance of the programme. Hence, this study demonstrated that mindfulness among students could be done in the school located in rural areas and it would still bring benefits to the students like the students in urban areas.

Research mentioned above widely explained the combination of deep breathing with other components of mindfulness which aligned with the systematic review by Zenner and colleagues (2014). Sellakumar (2015) focused his research on deep breathing exercise only on secondary school students (n=100) in 45 days of intervention. The activity of deep breathing exercise took place for 30 minutes and it

showed significant improvement in reducing the level of anxiety, for both state and trait, for the students in the intervention group.

Another study conducted by Schonert-Reichl and Lawlor (2010) that focused on mindful breathing, mindful attention and managing negative emotions demonstrated improvement in self-reported optimism and positive affect. A group of 246 students (Age, $M$ = 11.43) were recruited and 12 teachers participated in this 10-week study. The teachers involved in the study by delivering the mindfulness intervention in their class for three times a day briefly. Mindful breathing was conducted by asking the students to focus on the attention on their breathing while listening to a resonating sound instrument. The teachers also had a bi-weekly meeting with the researcher and received intensive training prior to the intervention. Report by teachers on each student also indicated improvement in the behaviour especially the attention of the students in the class and social-emotional competence. Also, the optimism among the students who were in the intervention group showed a significant improvement.

A study conducted on young students (aged 7-year-old) who came from lower socioeconomic status and had the risk of having learning problems showed promising results as well (Case-Smith et al., 2010). Mainly, the study involves the usage of yoga that included slow breathing, meditation, and physical movements for eight weeks. From the intervention, the students reported that they feel calmer, and it helped them to develop a better approach to handle their stress. A few students reported that they always applied deep breathing technique when they encountered unfavourable situations (i.e, the students encountered their mad siblings or when the students were angry). The teachers also reported that the students became more aware of their

feelings, and it had enhanced the class environment. This showed that deep breathing technique is beneficial for all students, and it is not an exclusive programme.

Despite all the research mentioned above showed the effectiveness of deep breathing intervention, Larson and Rose (2011) discovered the opposite result of the intervention. Deep breathing intervention helped the students to improve their ability to control their anxiousness compared to a control group. They also discovered the students who scored higher in their test reported lower anxiety level during the pre-test and vice versa. However, it did not improve the students' performance in their test. This showed opposite findings from the study of Kiat (2017) as well as Flook and colleagues (2010). Another similar finding was made by May (2017) showed a neutral effect of the mindfulness intervention programme (e.g., deep breathing, the mind jar and personal weather). May (2017) suggested that it might occur due to the students had become aware of their emotions which might affect the post-test results. He also noted that the sample size was small (n=21) which could influence the results as well.

### 2.2.4 Anxiety, Deep Breathing, and COVID-19 Pandemic

COVID-19 pandemic has induced anxiousness among people due to the uncertainty and fear of the pandemic (Lakhan et al., 2020). Face-to-face intervention to deal with this issue is restricted due to the lockdowns and confinement (Pizzoli, Marzorati, Mazzoni, & Pravettoni, 2020). Thus, alternative approaches need to be taken to manage the issue. Past research before the emerging of COVID-19 pandemic proved the online intervention helped in improving the mental health similar to in-person intervention and it was feasible (Jung, et al., 2016; Kemper, Lynn, & Mahan, 2015). However, the feasibility of online intervention during COVID-19 pandemic might be affected by the accessibility as well as the familiarity with the online technology as