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THE EFFECTS OF BRIEF MINDFULNESS-BASED INTERVENTION ON STATE MINDFULNESS AND ATTENTION REGULATION AMONG UNIVERSITY STUDENTS IN MALAYSIA

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ABSTRACT

The cascade of events that happened due to the outbreak of Coronavirus disease (COVID-19) has brought to light the dilemmas faced by university students who are physically constrained by the lockdown and resulted in virtual learning for the past two years. There is growing evidence that practicing mindfulness brings positive outcomes for both clinical and non-clinical populations which piques an interest in the effectiveness of an online, brief mindfulness intervention that can be easily accessible and feasible for university students during a global crisis. Hence, the present study explored the potential impact of a two-week brief mindfulness-based intervention (MBI) on state mindfulness and attention regulation among university students in Malaysia. Specifically, the hypotheses examined if the brief MBI can significantly increase state mindfulness, reduce attention deficit, and increase selective attention after the two-week intervention. Fifty-three students were allocated to either the experimental group (n = 28) to immediately start the brief MBI or into the waitlist control group (n = 25). Measures of state mindfulness (MAAS), attention deficit (ASRS), and selective attention (Computerized Stroop Task) were administered before and after the intervention/waiting period. Based on a mixed factorial ANOVA analysis, participation in the brief MBI identified significant improvement in attention deficit ($p = .01$) and selective attention ($p = .01$) after the two weeks as compared to the waitlist control group. However, state mindfulness was significantly increased ($p = .03$) across all participants after the two weeks. This provides further insight on the effectiveness of digital, audio-guided mindfulness interventions that are brief and can be embedded in university courses or counselling programs to promote positive outcomes for students in those challenging environments.

Keywords: mindfulness, mindfulness-based intervention, state mindfulness, attention deficit, selective attention

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LIST OF ABBREVIATIONS

COVID-19	Coronavirus disease
MCO	Movement control order
MBI	Mindfulness-based intervention
MAAS	Mindful Attention Awareness Scale
ASRS	Adult ADHD Self-Report Scale
ADHD	Attention deficit-hyperactivity disorder
DSM	Diagnostic and Statistical Manual of Mental Disorders
MM	Mindful meditation
USM	Universiti Sains Malaysia

CHAPTER 1

INTRODUCTION

1.1 Introduction

The global disruption by the Coronavirus disease (COVID-19) has severely affected students' daily routine and learning experiences in Malaysia. Implementation of the movement control order (MCO) prohibits university students from returning to their respective institutions and has resulted in online and virtual learning for the past year. This imposes several challenges to students' mental wellbeing and executive functioning. Hence, this chapter will provide a brief overview of the study by introducing the background of mindfulness and how it can be used as a potential intervention to combat the difficulties faced during this crisis. In addition, the chapter will outline the significance, objectives, and hypotheses of the study to inform the

reader on the expectations set within this study. Finally, the variables in concern will be approached and defined according to strong empirical research.

1.2 Background of Study

Based on Jon Kabat-Zinn (2003), the practice of mindfulness is to develop purposeful attention towards the present moment and embrace the current experience without judgement. Thus, one key competence that can be developed by mindfulness practice is the ability to regulate attention through being mindful, which can therefore optimize students' attention during online learning in this COVID-19 pandemic.

Therefore, the present research proposes to examine the effects of a brief mindfulness-based intervention (MBI) on state mindfulness and attention regulation among university students in Malaysia. The present study is a two-week intervention that aims to increase state mindfulness and attention regulation in university students. It employs a pretest posttest quasi experimental research design by allocating students into either the experimental group or waitlist control group to compare effects of the intervention after the two-week period. Findings from the study can contribute to the literature review of brief MBIs to expand knowledge behind the structure of the module while practical contributions may include adapting a brief MBI for university students to cope during this global crisis.

1.3 Problem Statement

Time commitment and high effort are often barriers for conventional MBIs, as they are commonly embedded with individual sessions, home-based practice, homework, et cetera. MBIs with long training hours and multiple components may risk a high drop-out rate due to high commitment and discomfort among individuals. University students are potentially vulnerable to this as their daily schedule is packed with classes, subject assignments, and personal responsibilities. Besides that, the current partial lockdown due to the COVID-19 pandemic in Malaysia restricts citizens' movement. Given these circumstances, short-term or brief MBIs that are accessible online are expected to be beneficial for university students.

However, there is a gap in the standardized definition of how 'brief' a mindfulness intervention can be to produce significant effects, nor is there a guideline that constitutes the elements of the overall program that acts as a benchmark to a successful intervention that increases state mindfulness and attention regulation. While MBIs have been consistently applied to a wide range of clinical and non-clinical issues, brief versions of MBI and their positive outcomes remain unclear.

1.4 Objectives of Study

There are three objectives of the present study as following:

1. To explore if the brief MBI increases state mindfulness among university students in Malaysia.

2. To study if the brief MBI decreases attention deficit among university students in Malaysia.
3. To understand if the brief MBI increases selective attention among university students in Malaysia.

1.5 Significance of Study

The current study would expand the growing literature review of brief MBIs, adding further insight to the structure of a digital and brief MBI module. It can improve the knowledge gap regarding the optimum dosage of mindfulness training needed for mindfulness intervention to be effective in improving state mindfulness and attention regulation.

Significant results would allow the brief MBI to be adapted for university students. Time constraint and long-term commitment are often the main barriers of engaging in a MBI conducted by a professional. Hence, the brief MBI may substitute conventional MBIs for university students who are unable to commit for a long-term, while still receiving its positive cognitive and emotional outcomes. The results may shed light to university counselling departments or clinical practices to develop an appropriate program that offers online, brief MBIs to be accessible and convenient for students.

Given the COVID-19 pandemic that is currently affecting Malaysia and restricting the public's movement, an online adaptation of mindfulness training programs can be convenient and accessible for most individuals. If the current brief MBI is found to bring significant

benefits for individuals in terms of enhancing their state mindfulness and attention regulation, the intervention can be replicated during another crisis. Individuals can practice mindfulness training on their own to improve their psychological well-being during crucial times.

1.6 Definition of Variables

1.6.1 Conceptual Definition

There are three variables in concern for the present study:

1. State mindfulness integrates the traditional Buddhist and contemporary mindfulness definitions (Tanay & Bernstein, 2013), which includes the 'objects of mindful attention' which are the events the individual can be mindful about (i.e., physical sensations, patterns of thoughts, or emotions) and also focuses on the 'qualities of mindfulness as a metacognitive state' which describes the way that the individual can be mindful (i.e., awareness, deliberate attention, or curiosity).

2. Attention deficit among adults such as university students can include experiencing difficulties in maintaining attention and avoiding high-effort tasks, failure to pay attention to details, difficulties in listening to others, and losing or misplacing items (Asherson, Buitelaar, Faraone, & Rohde, 2016).

3. Selective attention in this study is the ability to resist interference during a task which measures executive functioning (e.g., Stroop task) as to reduce the test taker's reaction time in performance (Stroop, 1935).

1.6.2 Operational Definition

1. State mindfulness is operationally defined as the mean score obtained on the Mindful Attention Awareness Scale (MAAS) (Brown & Ryan, 2003). Based on the self-reported scale across 15 items, a higher mean score indicates higher state mindfulness.

2. Attention deficit is operationally defined as the total score on the 'Inattention' subdomain under the Adult ADHD Self-Report Scale (ASRS) (Kessler et. al., 2005). It is a self-rating scale, generated based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criterion for attention deficit-hyperactivity disorder (ADHD). Based on the nine items under this subdomain, a higher total score indicates a higher severity of attention deficit.

3. Selective attention is operationally defined as Stroop effect score on the computerized Stroop task from Psytoolkit (Stoet, 2010; Stoet, 2017). While there are several scoring methods for the Stroop task, the most prevalent method to measure the Stroop effect is to measure the difference in time taken to correctly complete the incongruent trials (interference card) and congruent trials (pure color card), in which a smaller time difference indicates smaller Stroop effect, which means greater selective attention (MacLeod, 1991).

1.7 Theoretical Approach and Conceptual Framework

The present research is interested in exploring further regarding the effects of a brief MBI on state mindfulness and attention regulation among university students in Malaysia. The intervention that is used involves a body scan, bringing one's attention to their breath, thoughts, and experience. Hence, it is aligned with the two-component model of mindfulness that emphasizes self-regulation of attention and orientation to experience (Bishop et. al., 2004).

Self-regulation of attention is cultivating awareness to the current thoughts, feelings, and sensations that the individual is experiencing at the moment. Through this practice of vigilance, one can develop sustained attention towards the current experience for a longer period instead of letting their mind wander away. It also allows the individual to practice switching (Bishop et. al., 2004), since the practice often involves focusing their attention onto their breath, before moving on to their thoughts or sensations they are experiencing at the given moment. Training their mind to comfortably switch from one stimulus to another would enhance the mindful individual's performance in attention-switching tasks.

As previously mentioned, self-regulation of attention fosters the awareness to the present moment instead of ruminating over fleeting thoughts (Bishop et. al., 2004). Instead of suppression, the practice guides the individual to inhibit secondary elaborative processing of thoughts, otherwise inhibiting attention towards irrelevant stimuli, which consequently allows them to improve in cognitive tasks that require response inhibition.

Following that notion, focusing to be fully present in the current moment and away from any elaborative thinking would allow more cognitive resources to process any information from the current experience (Bishop et. al., 2004). Hence, when the individual's mind is away from other stimuli such as their expectations, assumptions, and beliefs, it enhances their capacity in observing and processing information with a clearer mind. This can predict the individual's improvement in observation skills.

The second component of the model is the orientation to experience (Bishop et. al., 2004). This usually goes together with self-regulation of attention, which is maintaining an attitude of curiosity when the mind starts to wander away by taking note of the thoughts and feelings that arise after. The mindful person is advised to 'allow' these thoughts and sensations and to practice acceptance towards what is being observed. By having an intensive observation towards the sensations experienced with an open heart and mind, the individual can discern each emotion and how it gives rise to any arousal or consequences to the self.

Besides that, the present study is measuring three different outcomes of the mindfulness intervention which are state mindfulness, attention deficit, and selective attention. It is based on the theory behind the Liverpool Mindfulness Model (Malinowski, 2014) which integrates the two main components of mindfulness practice to reap its positive outcomes.

The driving motivational factors (tier one) represents the motivations, intention, expectation, and attitude for an individual to engage in mindfulness practice. These driving forces can determine involvement in mind training (tier two). Engagement in the mindfulness training will enhance the core processes (tier three), which is primarily development of one's

attention skill, and interacts with emotion and cognitive flexibility. When the attentional skills are developed, it would bring a more balanced mental stance (tier four) by having more awareness. Thus, the awareness will translate into positive outcomes (tier five) including but not limited to one's physical and mental wellbeing, as well as more refined behaviour.

Based on the Liverpool Mindfulness Model, the present study will adapt four of the model's tiers. The brief MBI that will be administered represents mind training. Engagement in the brief MBI leads to attentional skill development as represented under core processes. As the participant enhances their attention abilities through the brief MBI, the awareness will result in increased state mindfulness, reduced attention deficit, and improved selective attention as represented in outcomes. The conceptual framework of the current study is presented below in Figure 1.

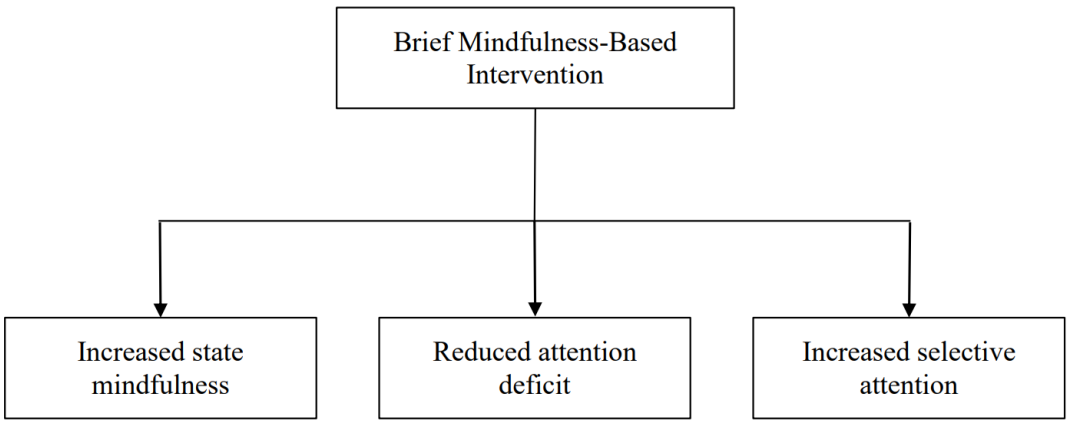

Figure 1.1: Conceptual Framework

1.8 Hypotheses

There are three hypotheses for the current study as addressed below:

1. Participants in the experimental group will show a significant increase in state mindfulness after the two-week brief MBI as compared to participants in the waitlist control group after the two-week waiting period.
2. Participants in the experimental group will show a significant decrease in attention deficit after the two-week brief MBI as compared to participants in the waitlist control group after the two-week waiting period.
3. Participants in the experimental group will show a significant increase in selective attention after the two-week brief MBI as compared to participants in the waitlist control group after the two-week waiting period.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the background knowledge on state mindfulness and attention regulation, along with a comprehensive literature review of the importance of brief mindfulness-based interventions to address the current gap within the field for university students during the COVID-19 pandemic.

2.2 State Mindfulness

2.2.1 Background of Mindfulness

Exposure to the COVID-19 pandemic may present a significant risk to mental health for university students. The closure of schools, lack of physical support, and exposure to negative news may bring a psychological impact to them. The pandemic was at a severe state in Malaysia for over a year, in which the question then arises: what can university students do to cope with this stressful situation? Practicing mindfulness may be an answer to that to reduce the negative impacts experienced during the pandemic.

Mindfulness is a term originally derived from the Pali word *sati* and was interpreted as memory, recollection and being aware of facts (Bodhi, 2011) by T. W. Rhys Davids, who is the founder of the Pali Text Society. Later, another Pali word closely intertwined with *sati* which is *upaṭṭhāna*; essentially explained the observation towards one's present experience, establishing presence. Hence, interpreting *sati* as such bridges the connection between memory and lucid awareness of present happenings; memory resembles a vivid presentation of a former action, while lucid awareness is a vivid presentation of a present awareness of bodily sensations.

According to Kuan (2008), there are four functions to mindfulness in the context of Buddhism. Firstly, it is the simple awareness of the presence or sensory information, obsolete of any judgemental observations. Next, protective awareness, also known as the 'gatekeeper'

mindfulness, exercises restraint over the individual's five senses (i.e., sight, sound, smell, taste, touch) and are discerned as skillful or unskillful mental states. If the protective awareness fails to restrain the individual's mind from any unskillful mental state, introspective awareness as the third dimension then acts to recognize and replace them with another state that is more conducive for the person's peace. Finally, mindfulness also includes deliberately forming conceptions, which is to construct positive memories in the mind, such as developing loving-kindness (metta) towards all beings in the world as if they are our child.

Eventually, one of the pioneer founders of mindfulness, Jon Kabat-Zinn, coined it as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (2003). Essentially, the three main axioms of mindfulness are intention, attention, and attitude. Shapiro, Carlson, Astin, and Freedman (2006) explained the mechanism behind it; through a conscious training of mindfulness, it allows the mindful individual to intentionally bring the right attitudes to the practice without judging or turning away from possible aversive experiences.

Therefore, the concept of state mindfulness integrates the traditional Buddhist and contemporary mindfulness definitions (Tanay & Bernstein, 2013). It includes the 'objects of mindful attention' which are the events the individual can be mindful about (i.e., physical sensations, patterns of thoughts, or emotions). It also focuses on the 'qualities of mindfulness as a metacognitive state' which describes the way that the individual can be mindful (i.e., awareness, deliberate attention, or curiosity). Hence, state mindfulness is a unidimensional model incorporating mindfulness from Buddhism origins and contemporary practice. It

primarily describes the objects that one can be mindful about, and the quality of the ways they attend to these objects.

2.2.2 Brief Mindfulness-Based Interventions for State Mindfulness

As explained by Kabat-Zinn (2003), the practice of mindfulness is not a 'rehearsal' for the future, but more so for the individual to engage in and unfold the current moment. Engaging in mindfulness comes in different ways, ranging from following regular, formal practices, to incorporating informal practices in everyday situations. There are some minimal skills that can be developed with enough practice which then can be referred to as mindfulness behaviours to some degree. There is not one single technique that defines how mindfulness should be practiced. Thus, there are a variety of MBIs today varying in the number of sessions, duration, and components that are helpful in increasing one's mindful state.

Previously, it was established that when MBI is repeated for a period, usually spanning between a few weeks to months, it would increase state mindfulness (Kiken, Garland, Bluth, Palsson, & Gaylord, 2015). The enhanced state of mindfulness brings reduction in psychological distress. Over time, it would lead to trait-like, natural tendency to practice mindfulness in daily life routine which also improves one's psychological wellbeing.

Although often beneficial, the conventional MBIs are not always feasible as they require time commitment and prolonged effort. In recognizing this, MBIs can be adapted into fewer sessions, shorter duration, or conducting them online. This is to accommodate a wider audience, making it suitable for those with low time commitment.

Recently, it was suggested that a single session of mindful meditation (MM) applied on novice college students can increase their state mindfulness, significantly improving the awareness of their physical, mental and inner state (Greif & Kaufman, 2019). The findings highlight the possibility that brief MM engagement can be effective as a stress-coping strategy for college students, such as meditating before sitting for a stressful exam.

A brief 5-minute mindfulness practice is also suggested to be effective in increasing one's state mindfulness (Mahmood, Hopthrow, & Randsley de Moura, 2016). Interestingly, the effect is only pronounced when it is conducted online rather than in the laboratory, suggesting the nature of experimental conditions as an influencing factor. Moreover, the practice can elicit state mindfulness among those without clinical symptoms. This outlines the efficacy of a brief, online MBI in alleviating state mindfulness among healthy individuals.

When comparing between a 20-minute and 45-minute body scan meditation, it was suggested that state mindfulness was significantly increased only after the shorter MBI when controlling for depression and anxiety symptoms (Bonamo, Legerski, & Thomas, 2015). This occurrence explains that a long MBI may be exhausting for certain individuals. Thus, there is a need to address the optimum dosage of MBI to produce positive outcomes.

2.3 Attention Regulation

Attention regulation can be defined as the required effort to direct attentional resources towards demanding tasks or away from the tasks if attention deficit is experienced (Randall, Oswald, & Beier, 2014). Those with more cognitive resources can sustain their attention for a

longer period and decrease the likelihood of mind-wandering away and or having an impaired performance in necessary tasks. Thus, the present study focuses on attention deficit and selective attention and the effects on a demanding that requiring attention.

2.3.1 Attention Deficit

In the event of the global COVID-19 outbreak, the Malaysian government implemented a nationwide MCO to limit movement and mass gatherings in hopes to reduce the infection rates (Tang, 2020). Hence, students of higher learning institutions (e.g., college and university) were denied permission to return for face-to-face classes. Lessons were switched to an online platform, with confusion and stress inevitably rising from the abrupt change.

Mindfulness can be used to combat this issue. As explained in the theoretical approach, the model of mindfulness emphasizes self-regulation of attention and orientation to experience (Bishop et. al., 2004) which essentially trains the mind for sustained attention, thought switching, and response inhibition. At the same time, the mindfulness practice can enhance observation skills towards the sensations experienced. This can be essential for students, as one of the areas of concern related to the abrupt switch to online or virtual learning is the difficulty for students to regulate attention during online lessons. Attention deficit, which is characterized as difficulties in sustaining attention, often forgetful, easily distracted, careless in work, and avoiding tasks that require mental effort (Ellison, Johnson, & Noelle Harrell, 2019), is often brought up as an issue during this pandemic.

The dual pathway model of ADHD (Sonuga-Barke, 2002) postulates that the left-hand pathway is relevant to inattention-disorganization of the disorder. It emphasizes the

importance of thought and action regulation in an individual to have sufficient executive functioning. Deficits in inhibitory control led to executive dysfunction, which is characterised by having poor attentional flexibility, task engagement, planning, and working memory. Thus, impairments in the left-hand pathway are significantly related to cognitive or executive dysregulation, impairing an individual's ability to exercise inhibitory control and effectively process information.

It was seen that children aged between 6 to 18 years old are more likely to display symptoms of inattention during the pandemic (Jiao et. al., 2020), which is possibly due to the partial lockdown and virtual learning. In comparison to children's behavioural and emotional state before schools were closed, school-aged children with ADHD had significantly worsened symptoms when they were restricted to online learning during the lockdown in China (Zhang et. al., 2020). Parents reported that their children experienced more difficulties in staying focused in their lessons. This can potentially be due to the nature of online classes that require a long period of attention on the screen.

Interestingly, some children and adolescents with ADHD do not experience worse inattention during the lockdown period (Bobo et. al., 2020). Online learning in their home environment is reported to be more conducive for their inattention symptoms. This can be related to the reduced time constraint and familial support that the students receive at home that helped to decrease the agitation they previously experienced during physical classes prior to the pandemic.

However, it is important to note that attention deficit is often overlooked among adults, especially if there is an absence of ADHD diagnosis from their childhood. The

inattention symptoms listed in the DSM-V may not be an appropriate criterion for some adults. Besides finding difficulties in maintaining attention and avoiding high-effort tasks, other age appropriate inattention features in an adult may be displayed as failure to pay attention to details, difficulties in listening to others, and losing or misplacing items (Asherson, Buitelaar, Faraone, & Rohde, 2016). These could be displayed in adult individuals, such as university students.

Hence, despite the growing number of studies related to inattention symptoms during the COVID-19 pandemic, little is known about the severity of these symptoms among students of higher learning institutions since previous research was more inclined towards children and adolescents. Even though ADHD often occurs during childhood, some of the symptoms may manifest as attention deficit in adults as compared to hyperactivity or impulsivity.

Among university students with self-rated ADHD symptoms, their experience with attention deficit may be disclosed as dissatisfaction towards their unsatisfactory academic performance (Kwon, Kim, & Kwak, 2018). Procrastination occurs even when the deadline of the task is known in advance. Their concentration declines and often resort to completing the task the night before the deadline. Prioritizing and completing several tasks are difficult to accomplish, hence reflecting on the poor quality of work. It is difficult for them to maintain their focus on an uninteresting class or activity, and they often get distracted by the objects in their surroundings.

University students are prone to being more inattentive during this COVID-19 outbreak wherein they are unable to have face-to-face classes (Son, Hegde, Smith, Wang, &

Sasangohar, 2020). There is difficulty concentrating in online lessons since their personal homes are not a conducive place to learn as they are often distracted by family members and household chores.

Hence, the COVID-19 pandemic has called attention to the difficulties faced by adults with ADHD, in which the symptoms are often related to attention deficit. Among university students, they may experience more hardships during this period alike to children due to long virtual classes and poor concentration, which can possibly indicate decreased ability to engage in demanding tasks.

2.3.2 Selective Attention

Another area of attention regulation that is potentially compromised due to the stay-at-home orders and constant online classes is one's performance in selective attention. Looking back at the origins of attention and information processing, earlier theories postulated two domains (Johnston & Dark, 1986). The first domain usually occupies a larger capacity that encodes environmental stimuli, is passive and operates automatically on a nonconscious level. The second domain is a relatively smaller mechanism that is responsible for conscious and controlled information processing, which is suggested as the cause of selective processing and attention.

One of the earliest conceptual frameworks of selective attention to follow the two-domain notion is Broadbent's filter theory of attention. Living in a fast-paced world indicates that people are constantly receiving input from the environment. Broadbent's original theory proposed a bottleneck model (Bater & Jordan, 2019). Stimuli enters via the largest part of the bottleneck (sensory buffer) and is filtered by the physical characteristics they possess,

wherein meaning will be attributed at the filter, while the unselected stimuli will decay over time.

Treisman's attenuation theory is a revised version of the filter theory, which suggests that unattended stimuli would be 'attenuated' or reduced before reaching the second domain, instead of completely blocked out at the filter (Bater & Jordan, 2019). The threshold for identifying the stimuli is lowered when the information stands out or is highly important, such as one's name.

In terms of measuring selective attention, the Stroop test is one of the pioneer tasks that is still widely used today to measure a person's performance when faced with interfering stimuli. The original test (Stroop, 1935) was designed to analyze if the color of the stimuli would interfere with the participants' ability to read the word (e.g., the word 'red' printed in blue is to be read as 'red'). Thus, selective attention in this context and the present study is henceforth defined as the ability to resist interference during an executive functioning task as to reduce the individual's reaction time in performance (Stroop, 1935).

Broadly, it is well established that poor attention regulation is associated with poor performance in selective attention tasks. Throughout years of extensive research, it was consistently suggested through assessments and testing that children with ADHD experience a greater interference effect in a test especially when there is a presence of competing stimuli. For example, during a computerized Stroop Test, they take more time in emitting a response towards the stimulus compared to their counterparts (dos Santos Assef, Capovilla, & Capovilla, 2007).

However, even though these children reported a greater reaction time to attend to the relevant stimuli during the Stroop test, they did not show a lower ability to respond correctly towards the target stimuli compared to their peers without ADHD (dos Santos Assef, Capovilla, & Capovilla, 2007). In summary, when they are required to ignore distracting stimuli in the Stroop test, children with attentional deficits display a longer time to attend to the target stimuli, but still show similar accurate results as children without attention difficulties. This notion is aligned to the original Stroop test (1934) which reported that the interference faced during the test increases the test taker's reaction time in performance.

Furthermore, it was suggested that children with ADHD were more influenced by the manipulated disruptions when completing a selective attention task, which they then performed worse compared to children without ADHD (Brodeur & Pond, 2001). This can be explained by their deficits in orientation and processing the relevant stimuli, or possibly a poor motor control which influences the efficiency of their task.

Children without attentional deficits performed better in the task when they were presented with irrelevant distractors, but they responded slower in the presence of meaningful distractors (Brodeur & Pond, 2001). Meanwhile, children with ADHD did not discriminate between both. An explanation for this occurrence is that the children with attention difficulties did not make a strong association between the target and response, thus there was no difference in the type of distractors and the effect it brings on emitting an incorrect response. Moreover, these children generally experience high levels of distraction, some of which are carried over from the previous trials, thereby eliminating the potential to distinguish between the two types of distractors.

There are not many distinct differences in the results when replicated using an adult sample. Adults with ADHD have an overall slower response in the Stroop test compared to their healthy counterparts (Vakil, Mass, & Schiff, 2019). These individuals have trouble in inhibiting irrelevant information and are unable to shift their focus from the distractor stimuli towards the target stimuli. During the reverse Stroop test, they fixate on the stimuli for a longer period, indicating difficulty in allocating attention towards the target stimuli.

Hence, it would be worthwhile to explore further on university students in recent times who are required to concentrate on virtual classes for long periods of time. With the distractions around them in their personal environment due to the stay-at-home orders, this may lead to a decreased ability to select and prioritize important information while filtering out other irrelevant stimuli.

2.3.3 Mindfulness-Based Interventions for Attention Regulation

Among the interventions that have been structured to improve attention regulation, there has been a growing interest in mindfulness training given its set of beliefs in cultivating attention. In clinical practice, mindfulness as a core principle has been adapted in plenty of interventions, resulting in many types of training programs with different structures and components.

Through a recent systematic review across 13 articles related to MBI (Poissant, Mendrek, Talbot, Khoury, & Nolan, 2019), it was shown that the treatment hours vary for every intervention, ranging from six up to 96 hours, in a span of a different number of

sessions. Each treatment program also had different components; some programs incorporate homework and self-practice, while others are standalone without additional practices. Qualification of the therapist also ranges between psychology graduate students, mindfulness instructors, clinical psychologists, and many more.

Even so, it was noted from the systematic review that all 13 MBIs were successful in reducing ADHD symptoms, which include alleviated inattentiveness (Poissant, Mendrek, Talbot, Khoury, & Nolan, 2019). The reduction in symptoms was retained even at the six-month follow-up, suggesting that the mindfulness intervention may bring a long-term sustained effect to an individual.

Besides that, the individuals reported a significant improvement in neuropsychological measures (Poissant, Mendrek, Talbot, Khoury, & Nolan, 2019). Those who received any forms of MBI performed better in the Stroop test, which measured their selective attention through speed and inhibitory responses. There was also improvement in the Attention Network Test (i.e., participants behaved more vigilantly and showed a better performance even in the presence of competing stimuli) and in the Continuous Performance Test (i.e., participants had better sustained attention and response inhibition). Thus, the types of MBIs appear to be effective in alleviating attentional deficits and improving performance in various attentional tasks post-treatment.

Children show an improvement in attention regulation with enhanced alerting, orienting, and conflict monitoring abilities in the Attention Network Test after attending eight weeks of MBI (Felver, Tipsord, Morris, Racer, & Dishion, 2017). The study shows support to previous mindfulness theories that posit teaching one to disengage from internal (e.g.,

thoughts and feelings) and external (e.g., sounds) stimuli and to focus on the present experience which predicts better performance in attentional tasks.

In contrast, an eight-week mindfulness-based stress reduction (MBSR) program, which is a form of meditation training, was shown to have no effect in improving sustained attention (MacCoon et. al., 2014). It encompasses of body scan, sitting meditation, yoga, and walking meditation alongside group discussion and take-home exercises. However, it is possible that the program would improve other aspects of attention, such as selective attention. The dosage of mindfulness provided in the program is also questioned, in which participants meet once a week for an average of 2.5 hours for a consecutive of eight weeks. This suggests the possibility of other types of programs with different durations in improving attention.

Another systematic review across nine articles related to the different types of MBI was conducted (Lee, Ma, Ho, Tsang, Zheng, & Wu, 2017). These are suggested mindfulness training programs that have been found effective in improving inattention symptoms at different developmental stages. Generally, the adults reap benefits from mindfulness-based training with a significant reduction in inattention symptoms. For adolescents and children, they were reported by their parents and teachers to have a significant improvement in attention. Hence, MBI holds clinical value for individuals of all age groups with attentional deficits.

Based on the systematic review, several conclusions were drawn. Firstly, there is a lack of consistency regarding the content of the MBI to consider it as a well-defined treatment (Lee, Ma, Ho, Tsang, Zheng, & Wu, 2017). Like the previous systematic review,