THE EFFECTS OF MINDFULNESS BASED YOGA INTERVENTION ON PRESCHOOLERS' SELF-REGULATION ABILITY

A Master's Thesis

by

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To my loving and kind family

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I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Psychology.

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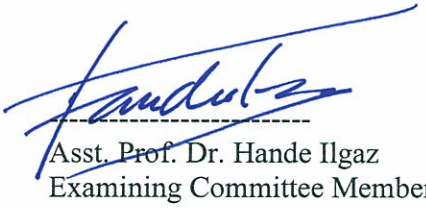

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ABSTRACT

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This thesis taps into one of the significant developments that has effects on children's academic and social life; self-regulation. Children develop this ability from early childhood to middle childhood. Research has shown that this ability can be enhanced via appropriate interventions and the current study uses mindfulness based yoga as a way to enhance preschoolers' self-regulation ability. To have a comprehensive measure of self-regulation, a child battery was developed by the researchers. This battery includes tasks that measure cognitive flexibility, interference control, working memory, motor control, and delay of gratification. In addition to this child battery, mother and teacher reported executive function (EF) scales were used. The intervention was conducted with 45 preschoolers; of these; 24 were in the yoga group and 21 were in the waitlist control group. The intervention group of children took yoga 2 times a week for 12 weeks for a total of 15 hours of

yoga per child. Both in pre-test and post-test children were tested and the intervention and waitlist control groups were compared with one another. Results of the child battery has shown that children who were in the yoga group performed better on working memory but none of the other aspects of EF that were measured revealed a difference. Teachers reported no difference between the two groups. Lastly, mothers evaluated that the two groups were different in terms of positive affect such that children in the yoga group were evaluated as higher.

Keywords: Executive Functions, Intervention, Mindfulness, Self-regulation, Yoga

ÖZET

BİLİNÇLİ FARKINDALIK TEMELLİ YOGA MÜDAHALE PROGRAMININ ANAOKULU ÇAĞI ÇOCUKLARININ ÖZ-DÜZENLEME BECERİSİ ÜZERİNE ETKİSİ

Önoğlu Yıldırım, Eda
Yüksek Lisans, Psikoloji Bölümü
Tez Danışmanı: Dr. Öğr. Üyesi Jedediah Wilfred Papas Allen

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Bu tez çocukların akademik ve sosyal yaşantılarına olan önemli etkileriyle önemli bir gelişimsel beceri olan öz-düzenleme becerisine odaklanmaktadır. Öz-düzenleme becerisi erken çocukluk dönemi ile orta çocukluk dönemi arasında gelişmektedir. Yapılan araştırmalar bu becerinin uygun müdahale programları ile geliştirilebileceğini göstermiştir ve bu çalışma bilinçli farkındalık temelli yogayı anaokulu çağı çocuklarının öz-düzenleme becerilerini desteklemek için kullanmaktadır. Öz-düzenleme becerisini kapsamlı bir şekilde ölçmek amacıyla, araştırmacılar tarafından bir çocuk bataryası oluşturulmuştur. Bu batarya bilişsel esneklik, müdahale etme kontrolü, işleyen bellek, motor kontrol, ve hazzı erteleme becerilerini ölçen görevler içermektedir. Bu çocuk bataryasına ek olarak, anne ve

öğretmenlerin yanıtladığı yönetici işlevler ölçekleri kullanılmıştır. Müdahale programı 45 çocuk üzerinde uygulanmış, bu çocukların 24'ü yoga grubunda, 21'i bekleme listesi kontrol grubunda yer almıştır. Müdahale programı çocukları 12 hafta boyunca, her hafta iki sefer, yoga programına tabii tutulmuş, programın sonunda her çocuk 15 saat yoga alarak çalışmayı tamamlanmıştır. Müdahale programının öncesi ve sonrası olmak üzere çocuklar iki defa test edilmiş, müdahale programı grubundaki çocuklar ile bekleme listesi kontrol grubundaki çocuklar karşılaştırılmıştır.Çocuk bataryasının sonuçları yoga grubundaki çocukların işleyen bellek alanında daha yüksek performansa sahip olduğunu göstermiş, diğer alanlar ise iki grup arasında herhangi bir farklılık olmadığını ortaya koymuştur. Öğretmen değerlendirmeleri iki grup arasında bir farklılık olmadığını göstermiştir. Annelerin değerlendirmeleri ise olumlu duygulanım anlamında yoga grubu çocuklarının daha iyi olduğunu ortaya koymuştur.

Anahtar Kelimeler: Bilinçli Farkındalık, Müdahale Programı, Öz-düzenleme, Yoga, Yönetici İşlevler

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CHAPTER 1

INTRODUCTION

One of the developments that is essential for physical health, psychological health, academic achievement, and wealth is the development of self-regulation (Blair & Diamond, 2008; Caspi, Moffitt, Newman, & Silva, 1996; Mcclelland, Acock, Piccinin, Rhea, & Stallings, 2013; Moffitt et al., 2011). As a broad construct, self-regulation has many definitions depending on the approach of the researcher. One comprehensive definition of self-regulation that has been given by Moilanen (2007) is the following: "the ability to flexibly activate, monitor, inhibit, persevere and/or adapt one's behavior, attention, emotions and cognitive strategies in response to direction from internal cues, environmental stimuli and feedback from others, in an attempt to attain personally-relevant goals" (p. 835). This definition suggests a relatively broad construct which includes cognitive, behavioral, and emotional functions that may be regulated by the prefrontal cortex (McClelland et al., 2013). This definition is similar to that of Executive Functions (EF) and thus, the two terms are generally used interchangeably (Carlson, 2003)

The current manuscript will begin with a discussion of how EF relates to effortful control and self-regulation. Next, I will introduce the notion of mindfulness and explain its relation to yoga. Self-determination theory will then be introduced to explain how mindfulness can be used to promote self-regulation. Following this, I will explore general characteristics of interventions aimed at improving self-regulation/EF. This discussion will then focus on mindfulness and yoga based implementations for improving self-regulation/EF. Lastly, I will explain how the current study will fill an important gap in the literature and state the research questions of the current study.

1.1 Executive Functions vs. Effortful Control

In the literature on self-regulation, there is a duality in terms of what is being measured. Since self-regulation is a broad construct, some theorists put the emphasis on behavior which is called the temperament-based approach. In contrast, others put the emphasis on cognitive mechanisms which is called the cognitive/neural systems approach. These two approaches are themselves characterized by the constructs of *effortful control* and *EF*. These two constructs are sometimes thought to be the same because they share two basic parts; attention focusing and inhibitory control. However, there are also differences between them such that EF also involves working memory, planning, and the other prefrontal cortex processes (Liew, J., 2011; Carlson, Zelazo, & Faja, 2013). Given that EF is more inclusive, interventions that focus on the development of self-regulation mostly emphasize EF. While emphasizing EF, we should also highlight a distinction between cool and hot systems which arise from top-down and bottom-up processing respectively

1.2 Executive Function as a Measure of Self-Regulation

The *Iterative Reprocessing Model* is a theory that focuses on the top-down and bottom-up processes that are effecting self-regulation (Cunningham, Zelazo, Packer, & Van Bavel, 2007). Top-down processes include those which are higher order such as: attention, inhibition, cognitive flexibility (i.e., cool EF). In contrast, bottom-up processes include those which are more basic, reflexive and involve emotional responses (i.e., hot EF). In short, top-down processes mostly involve cognitive functions; whereas bottom-up processes are more related to emotional functions. Deriving from this theory, Zelazo and Carlson (2012) define EF as a top-down neurocognitive process that is included as a central feature of self-regulation abilities. Thus, for the current study, we are using a comprehensive battery of direct and indirect EF tasks to measure children's hot and cool EF and in so doing, we are providing a comprehensive measure of their self-regulation abilities.

1.3 Definition and Origins of Mindfulness

Historically, mindfulness is thought to have originated in Buddhist meditation (Thera, 1988). However, in recent years, mindfulness is considered to be more universal because a variety of activities can be mindful without requiring meditation (Kabat-Zinn, 2013). Definitions of mindfulness differ in the literature because of the fact that everyone puts the emphasis on different aspects of the construct. One of the old definitions focused on the awareness and presence in the moment aspects; "the clear and single-minded awareness of what actually happens to us and in us at the successive moments of perception" (Thera, 2001). Another definition focuses on the consciousness and presence in the moment aspects; "keeping one's consciousness

alive to the present reality" (Hanh, 1976). Two other definitions put the emphasis on the attention, awareness and presence in the moment aspects; "the state of being attentive to and aware of what is taking place in the present" (Brown & Ryan, 2003); and "basically just a particular way of paying attention and the awareness that arises through paying attention in that way" (Kabat-Zinn, 2013).

More broadly, mindfulness can be understood as the state of being fully in the moment without having any judgements but at the same time having a whole state of observation (Kabat-Zinn, 2003). Thus, this definition of mindfulness focuses on being in the present moment and on not judging the aspects of the situation. Focusing on these two features has the benefit that they can be implemented on children through directing their attention to the present moment and by keeping them focused on that specific moment. Hence, this focus for mindfulness not only directs attention to a certain object, or breath, or to the body, but also teaches one how to monitor their attention without any emotional or other kind of judgements over the present situation. This means that mindfulness is present any time one is fully in the moment without having any judgements over their inner experience (i.e., when they have acceptance of the situation as it is). This is the definition that we will adopt in the current study.

According to Kabat-Zinn (2003), the acceptance part of mindfulness fits with one of the foundations of traditional yoga; *dharma. Dharma* is a sanskrit word which means "the way things are." As one needs to accept the whole situation as it is in mindfulness, *dharma* gives the meaning of ones' need to accept the situation as it is.

This is part of the reason why the current study uses yoga as a way to harness mindfulness with preschoolers.

1.4 Theoretical Background: Self-Determination Theory

Self-regulation is claimed to be enhanced by mindfulness according to the theory of self-determination (SDT; Deci & Ryan, 2000). In order to have self-determination, a person needs to have awareness. However, awareness is not enough to have advanced levels of self-regulation. Acceptance is also needed to have a fully mindful state. Since other kinds of self-oriented theories do not take the nonjudgemental aspects of mindfulness into account, mindfulness makes a crucial distinction between these theories by adding the non-evaluative aspect to the knowledge of self-awareness. Thus, Schultz and Ryan (2015) claim that mindfulness results in good psychological outcomes; whereas, self-awareness alone results in detrimental psychological outcomes.

The difference between these psychological outcomes arises from the distinction between self-awareness and mindfulness. Self awareness helps a person to be aware of their current emotional state; however, since it does not have the nonevaluative aspect of mindfulness, it does not help people to approach their current state nonjudgmentally. Thus, the psychological outcomes of self awareness can be negative. However, mindfulness has the nonjudgemental aspect which helps people to cope with their current emotional state while accepting it; thus, it results in better psychological outcomes. A convergent view of why mindfulness is related to higher self-regulation abilities is explained in terms of the nonjudgemental aspect increasing one's self-knowledge (Brown & Ryan, 2003). Results from their study suggest that

mindfulness results in higher level of "emotional intelligence" which in turn results in higher levels of self-regulation.

Given the theoretical and empirical links between mindfulness and self-regulation, we sought to use a mindfulness based intervention to enhance preschoolers' self-regulation ability as measured by EF tasks.

1.5 Characteristics of Interventions to Improve Executive Functions

Research has shown that EF undergoes major developments during childhood. In particular, three aspects of top down processes: *shifting attention, updating and monitoring the current situation,* and *inhibiting cognitions and responses,* are related to the development of meta-cognition and the prefrontal cortex (Miyake et al., 2000). Such developments are crucial during the preschool years and continue into middle childhood (Zelazo & Carlson, 2012; Raffaeli, Crockett, & Shen, 2005). Accordingly, interventions that target EF can start from the ages of 4-5 (Diamond, Barnett, Thomas, & Munro, 2007; Diamond & Lee, 2011) and continue to the ages of 8-9 years (Raffaelli et al., 2005). The important point is EF interventions should be in early childhood to middle childhood, but not from middle childhood to adolescence because this is the specific window to enhance self-regulation abilities (Raffaeli et al., 2005). Within this period, Diamond (2012) focuses on three basic parts of EF that can be enhanced; *inhibition, working memory,* and *cognitive flexibility.* Deriving from these three parts, she discusses six significant characteristics of EF interventions.

First, children who are least developed in EF will benefit the most from these interventions and the measures should be hard enough to detect any developmental

differences. This means that children who have lower levels of EF will benefit the most which means that there is a window for these children to catch up with their peers who have higher levels of EF. In addition to this, Diamond and Lee (2011) suggest that we should select measures that are hard enough to detect the developments in EF because the effects of interventions have mostly been seen for difficult EF measures. It is claimed that if the measures are easy, even those who are least developed can show success; thus the measures should be hard enough to detect the developmental differences.

Second, Diamond (2012) raises the idea of transfer effects that might occur in EF interventions. According to this idea, interventions that target certain areas of EF might show their effects on other areas. Thorell, Lindqvist, Nutley, Bohlin and Klinberg (2009) provided some empirical support for this idea through a study that used a computerized training program. Results from this study showed transfer from working memory to better performance on spatial and verbal working memory as well as attention tasks. Thus, an EF intervention may show effects on areas of EF that were not targeted.

There are also important characteristics of EF interventions that relate to the design of the intervention program itself. Repetition is the third aspect that Diamond (2012) emphasizes. Repetitions can be given in several ways. Ideally, an intervention should be embedded in the school curriculums to allow the researchers to distribute the activities throughout the day and in different kinds of contexts. Related with this, Lawson and Blackwell (2012) stated that EF interventions are more effective at the classroom level rather than just doing individual activities. In addition to the official

time slots of the intervention in the classroom, children themselves can practice (i.e. through homework) the activities at home as well.

Preschool routines are already working on EF abilities such that self-regulation is promoted in preschool classrooms by having children wait for their turn with an activity, by thinking about classroom rules which involves inhibiting their response of doing whatever they want, by following the instructions given by the teacher, etc. (Ponitz, McClelland, Matthews, & Morrison, 2009) Diamond et al., (2007) supports the idea that EF interventions can be integrated into the routines of public preschool classrooms as well. In addition to the activities that are already in school curricula, programs such as preschool yoga can further support the development of EF abilities by helping children to practice self-control.

The fourth aspect that Diamond highlights is about how the intervention training is implemented over the course of the intervention (e.g., whether it gets harder as the intervention proceeds). Since children's EF keeps developing, the intervention should not be given at the same level of difficulty throughout. Especially for the interventions that are conducted from preschool to middle childhood, both prefrontal cortex related abilities and EF abilities keep developing rapidly and to promote these abilities, an EF intervention should get harder with time.

A fifth characteristic of designing an intervention is to determine which activities are included. Researchers need to consider the relevant activities which make a difference in terms of developing EF. Several authors have drawn our attention to mindfulness training in early childhood as a way to promote EF development (Diamond & Lee,

2011; Zelazo & Lyons, 2012; Zelazo, Forston, Masten, & Carlson, 2018). Accordingly, Diamond highlights how to implement physical practices to see the effects on EF. In contrast to just having a physical practice, Diamond claims that there needs to be a mindfulness component included in the physical practice to make the difference. Examples of physical practices that include mindfulness can be aerobic exercise, tae kwon do, and yoga (Diamond & Lee, 2011; Diamond; 2012). Thus, mindfulness based movement such as yoga can be a good way to enhance preschoolers' self regulatory abilities. Since it does not just involve physical movement or just mindfulness training; it will develop both preschoolers' physical health and EF together.

Lastly, interventions should be created in a way that children enjoy. If children do not like the intervention sessions, then there will not be any effect. Past research has used yoga with children and they seemed to enjoy it (Case-Smith, Shupe Sines, & Klatt, 2010). While the above section focused on characteristics of EF interventions in general, there are also specifics of mindfulness based interventions which can make them even more effective to improve EF.

1.6 Yoga as a Way to Implement Mindfulness

Preschoolers' attention capacity is limited regardless of the task that is given to them. For instance, even in a free-play game, three-year-olds can hold their attention for about 9 minutes, four-year-olds can hold their attention for about 12 minutes, and five-year-old children can hold their attention for about 13 minutes (see Moyer & Gilmer, 2014 for a detailed review). Hence, one needs to find ways to implement mindfulness training with children (Diamond & Lee, 2011). This kind of challenge is

illustrated by Kabat-Zinn in his 2003 paper; “The task, which is always ongoing and immediate for the mediatative or the MBSR instructor, is to translate the mediatative challenges and context into a vernacular idiom, vocabulary, methods, and forms which are relevant and compelling in the lives of the participants, yet without denaturing the dharma dimension” (p.149) Eventhough the current study is not about MBSR, the mindfulness based part needs to be designed in a way that mindfulness can be implemented with children. Since children can easily direct their attention on the present moment through moving, kids yoga was used as a different way of implementing mindfulness on children.

Yoga practice is intrinscially mindful in that yoga is movement in a mindful manner. The movement is mindful in that the person needs to keep their attention on the body and how parts of the body feel different in the various poses. When performing yoga, people maintain mindful movements. Not only the movement, but also the meditative/attentional practices involved are part of the mindfulness in terms of directing ones’ attention to their breathing or the topic of meditation (Greenberg & Harris, 2012; White, 2012). Kids yoga is different than adult yoga in terms of implementing mindfulness. In adult yoga people can hold the poses for longer and attention can be directed on the body and to breathing directly. In contrast, preschoolers’ have limited attention spans and so it is important to find ways in which yoga can be used as a tool to implement mindfulness. For instance, in savasana sessions (savasana is a pose called corpse pose which is preformed by lying on the floor and trying not to move) little toys were put on preschoolers’ stomach and chest and commands are given to feel the effect of breathing on their body via observing the movement of these toys (Zelazo & Lyons, 2012). Other techniques were also

develop for preschoolers to be able to feel alignment in the body. For example, perfect posture (sukhasana) was used to understand alignment on their bodies; in halfway lift (uttanasana) children are directed to place their hands on their back to feel if they have a flat back, and breathing commands are given in postures to feel the difference that breathing creats on their bodies etc. All of these activities can be used to help children to engage in mindfulness via yoga.

1.7 Mindfulness and Yoga Interventions in the Literature

As general interest in yoga has increased, it has also become a common research topic around the world. Specifically, a type of yoga; hatha yoga, became popular in the Western world and research has been done worldwide about it. In the last decade, the literature has started to investigate the effects of yoga on children's mental and physical health in ways that include self-regulatory abilities. Yoga, as an ancient discipline has benefits for both physiological and psychological outcomes. Through regulating hypothalamo–pituitary–adrenal axis and sympathetic nervous system (Ross & Thomas, 2010), yoga helps to decrease stress levels with corresponding changes in psychological skills such as mindfulness, self-regulation, executive functions, etc. (Nanthakumar, 2018). Hence, yoga teaches life-time coping techniques to students to maintain mind-body awareness, self-regulation, lower level of stress, and resilience (Hagen & Nayar, 2014).

Mindfulness an be implemented in several ways. Research in the areas of psychology and education tend to focus on different developmental periods and different kinds of methods for implementing mindfulness interventions. The extant literature focuses on school-aged and, to a lesser extent, preschool-aged children. A review by Gould,

Dariotis, Greenberg and Mendelson (2015) offers a general overview of school based minfulness and yoga interventions. This review distinguishes between three types of interventions: first, mindfulness based interventions; second, yoga based interventions; and third, interventions which put equal emphasis on yoga and mindfulness. Most of the literature, (63%), is dominated by mindfulness based interventions that use meditation and have their roots in a particular program called Mindfulness Based Stress Reduction (MBSR) (Kabat-Zinn, 2011). Another 23% of the literature consists of interventions that are yoga based and the last 14% of studies are the ones which put equal emhasis on mindfulness and yoga.

In the following paragraphs I will focus on mindfulness and yoga studies at different ages. First, a brief summary of the interventions will be given in terms of the different mindfulness components. Next, I will provide a short summary of mindfulness and yoga interventions on school-aged children. Last, I will discuss studies which were conducted on preschool aged children. At the end of this section, I will go into more detail about a mindfulness based yoga study that is most similar to the current one (Razza, Bergen-Cico, & Raymond, 2015).

Mindfulness based interventions are not only implemented through yoga. Some of the interventions are designed to just involve mindfulness activities such as mindful tasting, mindful listening, mindful moving etc. (Thierry, Bryant, Nobles, & Norris, 2016; Flook et al., 2010; Black, & Fernando, 2013; Emerson, Rowse, & Sills, 2017). Other self-regulation interventions are integrated with different kinds of programs such as reflection which involves reflecting upon one's own thoughts, behaviors and emotions (Zelazo et al., 2018); the MindUP program which includes social and

emotional learning in addition to mindfulness training (Schonert-Reichl et al., 2015). Also, there are mindfulness based programs that are conducted with yoga (Razza et al., 2015; Case-Smith et al., 2010; Manjunath & Telles, 2001; Bazzano, Anderson, Hylton, & Gustat, 2018). In addition to those, there are also studies in which yoga is paired with other kinds of programs such as storybook reading (Thanasetkornaa, Panprasitwajaa, Chumchuaaand, & Chutabhakdikul, 2015), or *YogaRI* program in which yoga is paired with a reflex program (Lawson & Blackwell, 2012). This means that mindfulness and yoga can be combined with many kinds of activities and this depends on the purposes of the study to figure out which combination works best. Regardless of the study; mindfulness based or not, most of the literature on self-regulation interventions is dominated by research that was done with school-aged children.

One of the oldest studies that used yoga was done on girls who were between 10 and 13 years of age (Manjunath & Telles, 2001). Twenty girls were assigned to two groups; yoga and physical practice groups. The results of the study showed that the yoga group of girls performed better in planning and the time to complete a task. In another study, the same researchers focused on children between 11 and 16 years of age (Manjunath & Telles, 2004). This study had three groups of children to assess memory skills. One group had yoga, other one was an active control group who had fine arts classes and there was also a passive control group which received nothing. The results showed that only the children in the yoga group had improvements in spatial memory after the intervention. Another yoga based study was done on elementary school aged children. The intervention group in this study received yoga and mindfulness activities together and there was a passive control group that

received usual daily care. Results showed that the intervention group developed more in terms of psychosocial and emotional quality of life (Bazzano et al., 2018). Finally, another study was done on 155 fourth and fifth grade girls. Half of the girls received a mindful yoga intervention while the other half received nothing. Results showed that girls who were in the yoga group performed better in terms of evaluating stress and coping with stress (White, 2012). These findings suggest that there are potential benefits to mindfulness and yoga based interventions for developing various abilities related to self-regulation. Although more studies are available for school-aged children from different grades, the literature about yoga and its effects on preschool aged children is more limited.

One of the examples of mindfulness based interventions over the preschool years was done by Thierry et al, 2016. They used a mindfulness based program (MindUP) to enhance preschoolers' self-regulatory and academic performances. There were 23 experimental group children and 24 control group children. The control group were doing business as usual. The study lasted for 3 years in which the students received the full MindUP program for 1 year by the preschool teachers (15 lessons over the course of a semester in which each lesson took 20-30 minutes). The MindUP curriculum taps into a definition of mindfulness with the following characteristics: how to keep a mindful state for being mindful about the senses, different ways of taking perspective, learning, experiences that they are happy about and lastly, the definition of gratitude, how to act kindly and using mindfulness while we are acting in the world. The assessment of self-regulation was done by the teachers and the mothers. Data from direct measures of children were gathered by measuring their literacy skills, vocabulary skills and receptive vocabulary skills. Results showed that

there was no difference in the receptive vocabulary skills of the two groups but that the MindUP group showed significant improvement in their vocabulary and literacy skills. Mothers evaluations did not reveal any difference between the two groups' for EF skills; whereas teachers who conducted the intervention reported a significant improvement for theMindUP group in terms of planning.

In addition to mindfulness, other kinds of programs can be integrated with yoga as well (Thanasetkorna et al., 2015). In their study, Thanasetkorna found an effect of a yoga-storybook integration program on preschoolers' EF development. For a 9 week period, children were given the intervention twice a week (each session lasted for 30 min) and the effect of the intervention was assesed by measuring mothers' view of their children's EF development. According to the results of this study, the intervention group were significantly developed in the areas of inhibition, attention shifting, emotional control, working memory, and planning/organization as compared to the passive control group.

Another study was conducted as a classroom yoga intervention for 3-5 year old children (Lawson & Blackwell, 2012). The yoga intervention lasted for a 6 week period. Each week had four days involving 10 minute sessions in which a yoga video was shown to the intervention group while the control group did fine motor activities. Since the study aimed to find the effect of yoga on preschoolers' fine and gross motor performance, performance measures of the study were designed in this way. Fine motor skills included letter and name writing. For these abilities the intervention group developed more. In contrast, the control group improved more for coloring. The author's interpreted this result to mean that there might be an effect of preschool

teachers' emphasis about their education. However, the study could not find any effect of yoga on gross-motor skills. Further, the control group developed more for the T-pose reflex integration. In addition to this, in terms of shape recognition, the intervention group developed more.

One of the most similar studies to the current study was done by Razza et al., 2015. This was the first study that looked at the impact of a mindful yoga intervention on preschoolers' self-regulation abilities. The sample size for this study was on the smaller side (29 children in total; 16 for the intervention group and 13 for the passive control group). For 25 weeks, the intervention group received 40 hours of yoga in total while the control group had their daily routine in the preschool. The yoga intervention was a modification of theYogaKids program (Wenig, 2003) however, the yoga teacher was free to do the yoga activities throughout the day (i.e., there was no a settled time for just doing yoga). Also, the duration of the yoga sessions started at 10 minutes in the fall semester and increased to 30 minutes in the spring semester for each weekday. The results of the study showed that there was significant improvement for the yoga group of children's attention and inhibition (i.e., drawing task and pencil-tapping task). As expected by the author's, the least developed children benefited more from the intervention. No difference between intervention and control groups were found in parent reported measures of self-regulation.

Some of the strengths of the study were that it had yoga throughout the day which allowed the researchers to embed yoga into their daily activities. Second, they could apply yoga for an extended duration (6 months) and in a more intense way (40 hours in total). Some of the limitations of the study were that the intervention did not follow

a structured curriculum because the yoga teacher was free to make modifications; thus it is hard to replicate; researchers applied the motor control task only for post-test and had just two subscales for their measure of effortful control, and the study did not include teacher's evaluations. In light of these limitations and the rest of the literature, we based our own study on their study's design but tried to overcome the limitations.

1.8 Gap in the Literature

The review of the literature has showed us the fact that mindfulness and yoga have been implemented in different ways within the literature. Depending on the researchers' purposes, some of the mindfulness studies were integrated with different kinds of programs (MindUP and reflection); some of the yoga studies were composed with other kinds of programs (such as storybooks and reflex); and some of the studies were done as an integration of mindfulness and yoga programs.

There are three gaps in the literature that were targeted by the current study. These gaps are; 1.) low number of participants 2.) not using both direct and indirect measures 3.) not using a structured mindfulness based yoga curriculum.

The majority of mindfulness and yoga studies that are conducted with younger children have a relatively low number of participants. One of the mindfulness based interventions used children who were 6 to 7 years old and included 26 children in total (Emerson et al., 2017). Another mindfulness based study which also had a yoga component included 27 children in total who were 3 to 5 years old (Wood, Roach, Kearney, & Zabek, 2018). Lastly, the mindful yoga study which is closest to the current study included 29 children in total (Razza et al., 2015). This shows us the fact

that current literature has low numbers of children in their samples. Therefore, in the current study, we had a higher number of children (i.e., 45) in order to improve the power and generalizability of the study.

Another gap in the literature concerns the types of measures that are used. For instance, Thierry et al, 2016 used both direct and indirect measures; however, for EF measurement, they just used indirect measurements. Further, it was the teachers who conducted the intervention that also provided the evaluations of the children. Having the teachers who conducted the intervention as data sources and having only indirect measures for EF is a weakness for this study. The other yoga and storybook integration program (Thanasetkornaa et al., 2015) only included indirect measures form teachers and parents for EF. For a yoga intervention for preschoolers, the researchers used experimenter observations to measure children's fine and gross motor abilities and teacher gradings for academic achievements and behavior codings (Lawson & Blackwell, 2012). Lastly, Razza et al., 2015 used direct child measures and indirect parent measures of attention and inhibition. These studies show inconsistent uses of different types of measure in the literature on the effect of mindfulness based yoga for self-regulation and EF. Thus, for the current study, we used a comprehensive EF battery for direct child measures (including hot and cool EF) and indirect evaluations of EF from both parents and teachers.

Lastly, to our knowledge, there is no structured mindfulness based yoga intervention for preschoolers. The literature involving structured interventions seems restricted to school-aged children while the interventions that are done on preschoolers are mostly nonstructured or partially structured. Lawson & Blackwell's (2012) yoga study was

done without a breathing component using videos, another study integrated a yoga program and storybook reading program, and another one was based on a YogaKids curriculum but the authors stated that the yoga teacher was free to make modifications (Razza et al., 2015). Thus, there is a need for a structured yoga intervention to make the fidelity and replicability of the intervention better. In light of these gaps in the literature, we developed several research questions.

1.9 Current Study

The research questions are presented in the order of importance. While some of the other research questions include both intervention/yoga and control group, some of them are specific to the intervention/yoga group.

The main research question investigated in the current study was whether there is an effect of mindfulness based yoga on children's self-regulation abilities. According to this question, we hypothesized improved performance on EF tasks as measured from children directly and from parents and teachers indirectly. Additional research questions that applied to both the yoga and control group include the following. First, which self-regulation areas benefited the most from the intervention. That is, whether the effect of the intervention depended on the type of EF; (i.e. hot vs. cool). Further, we wanted to explore whether the effect of the intervention on cool EF differed accordingly to the different aspects of EF and which aspect of cool EF would benefit the most.

Another research question investigated whether the effect of the intervention depended on the type of measurement (direct child vs. indirect parent and teacher

reported measures). To evaluate this question, we investigated whether parent, teacher, and child measures were correlated. We had a general expectation that direct and indirect measures will be correlated with one another. Specifically, we expected to see relations between our two teacher reported measures because both of them are designed to measure EF. However, we did not have any specific expectations about the relations between our parent EF measures because one of the measure was designed within the temperament literature (i.e., effortful control) while the other was designed within the EF literature (i.e., working memory, cognitive flexibility, etc.) and we are not aware of a study that has used both (Holmes, Kim-Spoon & Deater-Deckard, 2016; Hughes, Power, Oconnor, & Fisher, 2015; Thorell & Nyberg, 2008; Thorell, Veleiro, Siu, Mohammadi, 2013). Lastly, we expected to see relations within our cool EF measures but not between cool and hot EF measures because they are distinct areas of EF (Hongwanishkul, Happaney, Lee & Zelazo, 2005).

In addition to the research questions involving both yoga and control group, the next three research questions are specific to the yoga group. The first question concerns the engagement levels of children in the yoga group. This question investigated whether there was an effect of engagement on any improvements for the yoga group. Specifically, we predicted that children who had higher levels of engagement in the yoga classes would perform better in cognitive flexibility, interference control, working memory, motor control, and delay of gratification areas of EF than those with lower levels of engagement. The second question concerns the effects of children's enjoyment level. This question investigated whether there was an effect of enjoyment level on any improvements for the yoga group. Our expectation was for children who enjoyed the class more to benefit from the yoga classes more than those

who report that they did not enjoy the yoga classes. The third question concerns the effects of children's current abilities. This question investigated whether there is an effect of pre-EF level on any improved performance. We hypothesized that children who had lower EF in the beginning of the intervention would benefit more than those who had higher EF.

CHAPTER 2

METHOD

2.1 Participants

Present study was conducted in a preschool in the capital city of Turkey, Ankara which has a population of 5.503.985 million people ("Valilikler ve Kaymakamlıklar," n.d). Out of 72 consent forms that were distributed in the preschool, 45 of them were approved by both of the parents.

Over the pre-test period participants included, 45 children, their mothers and their teachers. Of these 45 children (M = 56.36, SD = 11.49, range = 38-71 months), 24 of them were female and 21 of them were male. Of these 45 children who were tested in the pre-test period, 12 of them were 3 years old (M = 40.42, SD = 2.11, range = 38-45 months), 11 of them were 4 years old (M = 53.45, SD = 2.12, range = 50-57 months), 22 of them were 5 years old (M = 66.50, SD = 3.86, range = 60-71 months).

Out of 45 pre-test children participants, one child did not have the balloon task data because the child did not know the color names; three children's marsmallow data was not available because of various reasons (one child cried out in the room and the experimenter stopped the testing and two child did not want to be alone in the room).

In addition to the child data, 43 mother (M = 37.65, SD = 4.91, N = 43) pre-test data was collected either through an online software qualtrics, or from pen paper forms. Since there were two brothers and sisters in the present data, the number of mothers was not equal to number of children. The form of one child was filled out by the grandmother who stated herself the most available caregiver for the child and one mother's age information was not available. The remaining 44 forms were filled out by mothers. Thirty one of the forms were completed through qualtrics and 14 of the forms were done by pen and paper.

After the pre-test period, the intervention and waitlist control groups were semi-randomly assigned by the experimenter. Of the 45 children, 24 were assigned to be in the experimental group and 21 of them were assigned to be in the control group. The experimental group was divided into 4 classes of 6 participants in each. Four children (one child from each group) were decided to be switched with another children by the administer of the school because of preschool demands (either because child would not agree with the other children in the class or the preschool had an elective class which was at the same time with yoga hours).

Before the waitlist control group's yoga sessions, post-test data was collected. Because 3 children were taken from the preschool, post-test participants included 42 children, their mothers and their teachers. Of these 42 children (M = 59.43, SD = 11.53, range = 42-75 months) 22 of them were female and 20 of them were male. Of these 42 children who were tested in post-test period, 11 of them were 3 years old (M = 43.55, SD = 1.63, range = 42-47 months), 9 of them were 4 years old (M = 55.67, SD = 3.08 range = 49-59 months), 14 of them were 5 years old (M = 66.14, SD =

3.55, range = 60-71 months), and 8 of them were 6 years old (*M* = 73.75, *SD* = 1.04, range = 72-75 months).Since 3 children (two of them were siblings) dropped out from the study, post-test data included 42 children. There were 41 mothers left at post-test. Mothers' age ranged from 26 to 50 years (*M* = 37.55, *SD* = 5.06, N = 41). Besides the dropouts, we also had 1 missing mother data, 1 excluded mother data (because she answered the same for both of her children) and 1 grandmother data which resulted in 39 mothers data for the post-test. Thirty of the forms were completed through qualtrics and 10 of the forms were done by pen and paper.

Mothers' education level ranged from high school to PhD. degree. Most of the mothers, 67.5%, had a university degree, 12.5% of the mothers had a masters degree or had only a high school degree followed with 7.5% of mothers who reported that they had PhD degree. In terms of job status, most of the mothers, 97.5%, reported that they had full time jobs, in addition to this, one mother reported her status as both having a full time job and still studying at school, and the other one mother reported that she had a part time job.

After the drop outs, final data included 40 fathers. Fathers' age ranged from 27 to 53 years (M = 39.53, SD = 5.24, N = 40). Fathers' education level ranged from middle school to PhD. degree. Most of the fathers, 62.5%, had a university degree, 17.5% had a masters degree, 12.5% had only a high school degree, 5% had a PhD degree and lastly 2.5% had only a middle school degree. In terms of job status, all of the fathers (100%) had full time jobs.

Almost all of the mothers (97.5%) were married and one mother stated that she was divorced (2.5%). Most of our mothers had two children (57.5%), which was followed with the ones who had one child (30%) and lastly the ones who had three children (12.5%). Family income level ranged between 1.000 TL to more than 7.000 TL. Within this range, most of the income level collapsed to the more than 7000 TL level (62.5%), which was followed with the 5000-7000 level (27.5%), which was followed with 3000-5000 level (7.5%), lastly, one family's income level was in between 1000-3000 (2.5%). While we were doing this study –February to May 2019-, state unions claimed that the poverty level was 6.622 Turkish Liras ("May 2019 Minimum Livelihood," 2019) and private unions claimed that poverty level was 6.918 Turkish Liras ("May 2019 Hunger and Poverty Limit", 2019) for a four person family. Therefore, our sample was considered to be in the low to middle income level.

All of the teacher data for the pre-test and for the post-test were collected from 6 different teachers who knew the children for at least 6 months. These teachers' average age was 50.33 and education level ranged from high school (one teacher) to open university (rest of the 5 teachers) degree. All of the teacher forms were handed out by the experimenter and collected from the preschool teachers. There was no missing data for the teacher dataset.

2.2 Materials

Three data sources were used to have a comprehensive understanding of children's self-regulation abilities. These sources were mothers, teachers, and the preschoolers themselves. Over the pretest and the posttest periods, all child, mother, and teacher data was collected in 15 weekdays.

2.2.1 Indirect child measures

2.2.1.1 Parent reported measures

Over the pretest period, mothers completed three scales for a total of 149 items which took approximately 20-25 minutes. All of the mothers received the scales in a fixed order. Besides demographics and 6 of the subscales of *Child Behavior Questionnaire,* all of the items were conducted in the post-test period too. All of the scales are available in the appendix section.

2.2.1.1.1 Demographic form

This form included 27 multiple choice or open-ended questions. The first 15 questions were about demographic information such as age, income, education level etc. of parents. Also, this demographics form included 2 questions that were asked to learn about children's allergies in order not to give children a food that they were allergic to. In addition, this form included 10 questions which were related to mothers' understanding of mindfulness and yoga. The demographic form of the current study can be found in the Appendix A for further clarification.

2.2.1.1.2 Children's Behaviour Questionnaire

The Children's Behavior Questionnaire (CBQ) (Rothbart, Ahadi, Hershey, & Fisher, 2001) is a temperament measure for children between the ages of 3-7. The short version of the form was developed by Putnam and Rothbart (2006). There are 94 items and 15 subscales in the short form. Questions were rated on a 7-point Likert scale (1: Never – 7: Always) and an additional item which was labeled as "not appropriate" was available for the parents who did not encounter with such a situation with their children. The complete scale was used for the pre-test part of the study.

Since the focus of the present study was EF abilities, the post-test part of the study included only 9 of these subscales. Within these subscales, the most relevant ones in terms of EF were attentional focusing and inhibitory control. After eliminating the unrelated parts of the scale, 7 more subscales were included in our exploratory analyses for our study; activity level, impulsivity, anger/frustration, falling, reactivity/soothability, low intensity pleasure, perceptual sensitivity, smiling and laughter. Since the CBQ scale is originally a temperament scale, we did not compare all the subscales with teacher reported measures and parent measures. We have composed the effortful control total score of the scale by putting attention focusing, inhibitory control, low intensity pleasure and perceptual sensitivity subscales together since it is a more similar construct to EF (Putnam & Rothbart, 2006). The questionnaire's validity and reliability was done by Sarı, İşeri, Yalçın, Aslan, and Şener (2012). The complete scale can be found in Appendix B.

The cronbach alphas are reported for the subscales that were included in both tests. Activity Level subscale (α= .681), Anger/Fear subscale (α=.676), Falling Reactivity subscale (α=.674), Impulsivity subscale (α=.591), Smiling and Laughter subscale (α=.660), Attentional Focusing subscale (α=.849), Inhibitory Control subscale (α=.755), Low Intensity Pleasure subscale (α=.533), Perceptual Sensitivity subscale (α=.570) and lastly a composition of last 4 subscales, effortful control total (α=.846).

2.2.1.1.3 Childhood Executive Functioning Inventory

The Childhood Executive Functioning Inventory (CHEXI; Thorell & Nyberg, 2008) is a parent and teacher report scale. The scale includes 26 items that are related to children's executive functioning abilities using a 5-point (1: never; 5: always) Likert

scale. Significantly, for this scale, having higher scores mean worse EF functioning because of the way questions are asked to the participants. The scale's validation study was done by Kayhan in her unpublished masters thesis (2010) and the scale can be found in Appendix C. Cronbach alpha values for this study this study are the following; working memory (α =.853), regulation (α =.736), inhibition (α =.695), and planning (α =.717).

2.2.1.2 Teacher reported measures

Teacher reported measures were composed of two scales; in total 43 items were filled out and took approximately 10 to 15 minutes. For each child participant, one form was filled out by the teacher. All of the teachers received the scales in a fixed order, in pen paper format. All scales were conducted on teachers both in pre-test and post-test periods. All of the measures are available in the following section and one of them can be found in Appendix section.

2.2.1.2.1 Childhood Executive Functioning Inventory

The Childhood Executive Functioning Inventory (CHEXI; Thorell & Nyberg, 2008) is a parent and teacher report scale administered to the teacher of the child. The teacher version of the scale is exactly the same with the parent version of the inventory. Scale consists of 4 subscales; working memory, inhibition, regulation and planning. Originally, the scale is developed for children who are at least 4 year old; however, in Babaoğlu's unpublished masters thesis (2018), experimenters used inhibition subscale on children who are 36-59 month old and the internal consistency of the CHEXI inhibition subscale was found as 0.77; therefore, this scale was included for all age groups in the present study. Cronbach alpha values specific to

subscales for the current study are the following; working memory (α =.895), regulation (α =.848), inhibition (α =.744), and planning (α =.838). The scale can be found in Appendix C.

2.2.1.2.2 Child Behavior Rating Scale

The Child Behavior Rating Scale (CBRS; Bronson, Goodson, Layzer & Love, 1990) is a scale which is administered to the teacher of the child. The original scale includes 32 items that are related to children's executive functioning abilities. The adapted Turkish version of the task was used for the present study. This version of the scale includes 17 items. There are two factors of CBRS; social behavior and mastery behavior. This scale's Turkish translation, validation and reliability study was done by Sezgin and Demiriz (2016). Cronbach alpha values for the current study that are specific to subscales are the following; social behavior (α =.780) and mastery behavior (α =.948). The scale is not available in the Appendix because one needs to get it from Sezgin and Demiriz.

2.2.1.3 Experimenter Observations

2.2.1.3.1 Attendance and Engagement Level

The yoga group's attendance and engagement level was measured with a measure that was composed by the experimenter. Attendance points were given according to the child's presence in the class starting with the first class of the intervention. If the child was in the class, he received 1 point, if not 0 point. Attendance points were given for each yoga session that was conducted by the experimenter.

On the other hand, engagement points were given according to how much the child engaged in the yoga activities and engagement level coding was started after the first month of the intervention. The logic behind 1 month is that children got to know what kind of an activity yoga is and then engaged how much they wanted to. There were 2 measures of engagement level.

One was by Bilkent Psychology Developmental Laboratory masters students who came to code for engagement levels every 2-3 weeks after the first month. The same coding was done by the experimenter too. The measure was composed by the experimenter which included subsections of; How much the child knows the poses?, How much does the child do the poses?, How much does the child do poses correctly?, Does he listen to the commands while he is doing the poses? How much is he interested in the activity?, How much does he talk out of topic?, How much does he want to go out from the class?. All of these were coded out of 5 points and the last two questions were reverse coded. An average of these subsections were coded to have a general engagement level for each child. In addition to these, a second type of coding was also done by the experimenter. After 1 month intervention has started, in every 30 minutes of class, the experimenter coded every child's general engagement level and then the average of these was taken. Correlation analysis was used to determine which of these codings of engagement to use in the further analyses.

2.2.2 Direct child measures

The child measures included six tasks that took approximately 35 to 40 minutes. To complete the data collection for each child participant, one tester and one coder worked together. Data collection of children did not include the experimenter. All of

the child participants were exposed to the tasks in a fixed order. All tasks were conducted on children both in the pretest and posttest periods.

2.2.2.1 Dimensional Change Card Sort

The Dimensional Change Card Sort ((DCCS); Zelazo, 2006)) measures children's executive functioning. Materials for the task include two trays and four types of pictures. The pictures are the following; red car, blue elephant, red car with border and blue elephant with border. There are three subtasks for the DCCS. The first subtask is the color game. In the color game, children are supposed to sort the cards according to their colors. In color game, there are two training trials and six practice trials that the children need to be tested for. The second subtask is the shape game. In the shape game, children are supposed to sort the cards according to their shapes and inhibit the response for sorting according to their colors. In shape game, there are no training trials. There are six practice trials that the children need to be tested for. Out of six trials, the child should not make more than one errors to continue with the border game. The last subtask is the border game. In the border game, children should apply the given rule according to the status of the card; depending on whether the card has a border or not. If the card has a border, then the child needs to apply the color rule and if the card does not have a border, then the child needs to apply the shape rule. In border game, there are two training trials and twelve practice trials that the children need to be tested for. This subtask is ended if the child makes 4 errors. For this task, each correct answer receives one point and each wrong answer receives zero points. In total, each child can get a maximum of 24 points and a minimum of 0 points.

2.2.2.2 The Day and Night Task

This task is a measure of interference control which is designed by Gerstadt, Hong, and Diamond (1994). In the original version of this task there are two cards. One of these cards has a sun on it and the other has a moon with stars in the background. In the first part of the task training trials are followed by the test trials. There are two training trials which are done by the tester to teach the child that he has to respond as day when he sees the moon card and he has to respond as night when he sees the sun card. The training trials need to be continued until the child responds correctly. When the training trials are finished, the child is given fourteen test trials. In total, the child needs to respond to the sixteen cards, so the test is stopped when the child responds for the fourteenth test trial. Different than original version of this task, for the present study, this measure was modified and conducted through a tablet. This modification was done by using power point program by placing each of the cards in a fixed order and in a fixed time which was 3 seconds for each target card. The child needs to respond to the tablet when he sees the card and the time to show each card is three seconds. After the card is shown, there is a white blank card and when the child responds to the target card the tester touches to the tablet screen to continue with the following card. Having this procedure modification allowed us to control for the time that the target card is shown to every child as well as the speed of sequencing the cards. Each item is worth one full point if the child responds correctly for the target item and the item gets zero points if the child responds incorrectly. Practice trials gets points for this task as well. Therefore, in total, each child can get a maximum 16 full points and a minimum of 0 points.

2.2.2.3 Balloon Task

This task was developed by Bilkent University Developmental Psychology researchers (Çelik & Allen, 2018) to measure children's working memory abilities. This task is based on the reversed digit span task (Davis & Pratt, 1996). Instead of having children reversely order a sequence of numbers, they had to reverse the order of a sequence of color balloons inserted in an opaque tube. Six different colored balloons (white, red, blue, green, yellow, black) and one opaque tube are needed to administer this task. Firstly, before each test trial, the names of the colors are asked and the training of the colors is given by the experimenter if the child responds incorrectly. Next, 3 balloons are inserted into the opaque tube that is standing vertically on the table. Then, children are asked to know the order in which 3 balloons will be coming out of the opaque tube which is the reverse order of how they were placed in the tube. Same test is repeated once more with different colors. The original task has two trials, but present study used a harder modified version by adding one more trial which is applied with 4 balloons.

Since the task was developed by Bilkent University researchers we looked at the results of a previous study (Çelik & Allen, 2018) to understand the validity of the measure we are using. The validity of the measure was showed by the relations between cognitive flexibility ($r = .28$, $p < .05$) but not with inhibitory control ($r = .17$). There was an age effect such that 3 and 4-year-olds were not different than each other but 5-year-olds were different than both. A similar result for cognitive flexibility found in Mahy, Moses and Kliegel's study (2014) in which they have used backward digit span to measure working memory of 4 and 5 year old children. Results of it have shown that backward digit span task was correlated with cognitive

flexibility (r = .44, p < .01) and inhibitory control (r = .61, p < .01). Thus this task was included as a valid measure to use in this study.

For each trial of this task, if the children give full correct answers, they get 1 full point and if the children give wrong answers they get 0 points. Since there are 3 trials in the task, children can get a maximum 3 points and a minimum 0 points.

2.2.2.4 Statue Task

This task is designed to measure inhibitory motor control (Kakebeeke et al., 2017). The statue task was derived from NEPSY which is a subtask of general neuropsychological assessment that is developed by Korkman, Kirk, and Kemp (1998). Firstly, children were asked to stand in a static body position in which their right hand is up, holding like a flag, and children need not to move, vocalize, talk, or open his eyes for 75 seconds. While the child is standing, the tester does some actions that are intended to disrupt the child's focus at previously determined intervals, the tester needs to drop a pen at 10 seconds, make a cough at 20 seconds, a double knock on the table at 30 seconds and a voice to clear her throat at 50 seconds. In the original task, children are recorded and coded every 5 seconds and coding is done by giving 2 full points if the child fully apply the commands; if there is one violation gets 1 point, if there are 2 or more violations, the child gets 0 points. Thus, a child can get a maximum of 30 points and a minimum of 0 points.

However, we used a modified version of this task. All of the commands of the modified version are the same with the original task. However, the child was given prompts (reminders that are given according to the rule the child violates) up to 5

times if s/he violated any rule in the task (i.e. talking, opening eyes, moving etc.). If the child made more than 5 violations, the child was not given more prompts. In terms of scoring; both the tester and coder observed the child for 75 seconds but coded the responses of them for every 15 seconds. There were 4 basic parts that the child had the chance to make violations; talking, opening eyes, vocalizing and moving. Therefore, each 15 seconds is calculated out of 6 points in which each of these areas are scored out of 1.5 points to make the total score 30 as it is in the original task. For each subpart violation child lost 1.5 point. A maximum 30 and a minimum 0 points could be achieved for each child for this task. In addition to this type of coding, we also counted the number of violations children made. Therefore, we had two types of scores for this task.

Since we had testing limitations (e.g. not being able to record the kids responses), we used a modified version of the task. Another difference that we did in the present study is when the tester did the disturbing actions; in the original version the seconds were different, whereas; we did these disturbing actions in every 15 seconds. Also, since we did not use any video record for this study, we coded children's scores for each 15 seconds by having both tester's and coder's reports for each 15 second intervals. Other than these modifications, to our knowledge, there was no difference between two versions.

2.2.2.5 Head-Toes-Knees-Shoulders Task

This task is developed to measure behavioral regulatory abilities and motor control abilities of children (Ponitz et al., 2008). There are two different versions of this task in the current literature; but the present study used the new updated version which

includes three parts. In order to use this task, all necessary permissions were taken from Megan McClelland who is one of the authors of the original article Ponitz et al., 2008. Both the author of this masters thesis Eda Önoğlu Yıldırım and the assistants of this study have gotten the standard online HTKS training. Also, in-person trainings were done with the assistants to make sure that all the testing and coding fit with the HTKS in the current literature. All of the assistants had the necessary information to apply and code this task. Both the tester and the coder coded the responses of all children and they discussed their answers at the end of each testing period. For a few chilren, eventhough there were different responses between the coder and the tester, they decided on one response for each child.

There are two forms (form A and form B) of HTKS and form A was used for pre-test and form B was used for post-test in order to prevent the effect of learning as it was stated in the online training of the task. Each form contains three sections. The only difference between two forms is form A includes heads and toes in the first section and form B includes knees and shoulders for the first section. Besides the first section, there is no difference between two versions of HTKS. Form A was used in the pretest and form B was used in the post-test for the current study. Translation of form A was done by Esin Sezgin and the translation of form B was done by myself and shared with the original author.

The first section of form A is just about heads and toes. For this section, the child needs to show his toes and heads and then he needs to apply the rule of "When I say to touch your head, you touch your toes." and vice versa for four practice trials. Over these four practice trials, the tester can remind children about the rule up to three

times if the child gives incorrect answers. If the child makes more than 3 errors, no more reminders are given. For the following ten test trials, the child needs to apply these rules and children who make four or more errors cannot continue with the second section of this task.

The second section of this task is about all four parts of the body; knees, shoulders, heads and toes. For this section, the child needs to show his shoulders and then learn to apply the additional rules of "When I say to touch your shoulders, you touch your knees." and vice versa. There are four practice trials in which the tester can remind the rule up to 2 times if the child makes errors. If the child makes more than 2 errors, no more reminders are given. For the following ten test trials, child needs to apply all of the four rules and children who make four or more errors cannot continue with the third section of this task.

The third section of the task is the hardest part in which all the rules are mixed up. The tester of the task says all of the following commands; "When I say to touch your head, you touch your knees.", When I say to touch your knees, you touch your head.", "When I say to touch your shoulders, you touch your toes.", and lastly, "When I say to touch your toes, you touch your shoulders." There are six practice trials for this section and over these six practice trials, the tester can remind the rule up to two times if the child gives wrong answer. If the child makes more than 2 errors, no more reminders are given. For the following ten test trials, child needs to apply these rules.

Scoring of the task is done according to the protocol of HTKS. (Ponitz et al., 2008) Children can get 3 kinds of scores for this task. Zero is given when the child touches

to an area which is different then the target area. One is given when the child makes self-corrections. Two full points are given when the child touches toward the correct area. Since it is suggested to add the practice trials into the coding to increase the variability, we coded our scores with all practice and test trials (Fuhs, Nesbitt, Farran, & Dong, 2014). As a result of this, a child can get a maximum 94 points and a minimum 0 points on this task.

2.2.2.6 Mischel's Delay of Gratification Task

A modified version of Mischel's delay of gratification task (Mischel, 1974) was used for this study to measure delay of gratification. In the original task, children are given a piece of food (e.g. marsmallow) and they are said that they can eat that piece or wait for a second one. In the current study, in addition to this part, two relevant questions were added.

The first question was how hungry the child felt. The child picked how hungry he was by choosing from a sheet that showed three choices; very hungry, somewhat hungry, or full. This was added as a relevant question because all children were tested in different times and how hungry they were might affect their delay of gratification performance. The second question was about their preferences of food. Since the study was conducted in Turkey, not many children are considered to know marsmallows. Therefore, two more preferences were added on and shown to children with a sheet to pick the one they would like to eat. The possible choices were; marsmallow, chocolate cake and jelibon. After the child picked his favourite food, the coder went out from the room to place the camera and set the time to test the child. The camera did not record children but just allowed the researchers to watch what

they were doing. The time was settled by the research coder and when the tester left the room, the time started. Each child was watched by a tester and coder together who coded what the children were doing and how they were doing it. For each child the task lasted for a maximum of 15 minutes. Regardless of what the child has done (eaten or not), the child was given the second food immediately after the task was finished.

In terms of scoring the task, whether the child has eaten the food or not, when the child has eaten the food, which violations (i.e. licking, biting) were done, how much these were done, when the first violation was done and how much the child was hungry were coded and analysed for the results of the study.

2.2.2.7 Yoga Enjoyment

Each child in the yoga group was asked the question of if they enjoyed yoga classes at the end of the testing session. Out of 22 yoga group of children 19 reported that they enjoyed yoga classes and 3 of them reported that they did not.

2.3 Procedure

In order to start the project, the approval of Bilkent University Ethics committee was taken. After this approval, a preschool was contacted in Ankara centrium. Consent forms were distributed to all possible participants in this preschool. Both mother and father permission were taken for each child participant. Within the consent forms parents stated how they would like to receive the mother surveys; either via pen paper or online link. After the mother data collection, teacher and child data collection were

started. Each teacher was given 1-2 forms for each day and within 15 weekdays all the data was collected. All of the surveys and tasks were administered in a fixed order. The same procedure was also applied at post-test. When the pre-test data collection was finished, the experimental group's intervention was started.

Mindfulness based yoga classes were given two times in a week for each group. One of the classes took 30 minutes and the other took 45 minutes in a week; so a total of 75 minutes of yoga per week. All intervention group children were taken to these classes for 3 months; meaning 15 hours of yoga at the end of the study. To our knowledge, for preschoolers, there is no structured mindfulness based yoga intervention in the literature; therefore a structured intervention was designed by the experimenter of the study based on the literature yoga intervention studies that were conducted on school aged children. For the present study, the yoga intervention was done by the experimenter who has a 200 Yoga Allience approved training, an International Yoga Federation approved kids yoga instructor and also has a training in mindfulness.

As children's yoga is different than adult yoga, different kinds of themes and stories were used each week. Mindfulness practices were not applied just through the body, but also through other activities; breathing activities and short mindfulness meditations were given appropriate to children's ages. In addition to the practice part, being in the present moment aspect was achieved through interesting themes and stories that were included in the yoga sessions. The mindfulness aspect was included in yoga through the yoga poses, short meditations and breathing activities which did not incude voluntary control of the breath but awareness of their breathing. The

nonjudgmental part was included through the discussions that were arising by the children and this was one of the parts that was valued by the experimenter because in addition to showing nonjudgmental part of mindfulness, it gives the chance to learn how to accept the current situation.

In addition to these, the general structure of the yoga intervention can be found in Table 1. The classification of the poses within the table was done according to the explanations of the poses in "Light on Yoga" book (Iyengar, 1997) and "Yoga The Spirit and Practice of Moving Into Stillness" (Schiffmann, 1996) book. While the experimental group children were getting the yoga intervention, the control group was doing business as usual. After the intervention and data collection, the same amount of yoga was provided to the waitlist control group. At the end of the intervention period, the children, mothers, and teachers received the same measures as in pre-test and we compared if there is an effect of mindfulness based yoga intervention on children's self-regulation abilities. All of the participants and the school were informed about the results of the study at the end of analysis.

Table 1. List of Practices in the Mindfulness Based Yoga Program

Order no. Int components	No. of rounds	Approx. time	Schedule
1. Centering & start of the class		2 min	Every class
2. Preparatory practices:		2 min	Every class
a. Cat-cow pose (*Marjarasana)*			
b. Downward dog pose *(Adho Mukha Svanasana)*			
c. Basic warm-up exercises			
3. Sun salutation *(Suryanamaskar)*	2 rounds	2 min	Every class
4. Asana*(Postures)*	2 poses from each section	15-17 m	Every class
A. Standing postures			
a) Mountain posture *(Tadasana)*			
b) Half waist rotation posture *(Ardhakati Chakrasana)*			
c) Foot palm posture *(Padahastasan)*			
d) Chair Posture *(Utkatasana)*			
e) Tree posture *(Vrikshana)*			
f) Warrior two posture *(Virabhadrasana II)*			
g) Eagle posture *(Garudasana)*			
B. Sitting postures			
a) Easy posture *(Sukhasana)*			
b) Diamond *(Vajrasana)*			
c) Perfect posture *(Siddhasana)*			
d) Boat posture *(Navasana)*			
e) Rabbit posture *(Shasahankasana)*			
f) Seated Spinal Twist Pose *(Ardha Matsyendrasana)*			
g) Butterfly posture *(Baddha Konasana)*			
h) Wide-Angle Seated Forward Bend *(Upavistha Konasana)*			
C. Back-bend postures			
a) Cobra posture *(Bhujangasana)*			
b) Grasshopper posture *(Salabhasana and variations)*			
c) Bow posture *(Dhanurasana)*			
d) Upward Plank Pose *(Purvottanasana)*			
e) Camel pose *(Ustrasana)*			
D. Supine postures			
a) Happy Baby Pose *(Ananda Balasana)*			
b) Half Plough Pose *(Ardha Halasana)*			
c) Supine Spinal Twist Pose *(Supta Matsyendrasana)*			
5. Breathing Activities	One of them	6-8 min	Every class
a) Activity with hands			
b) Activities with cotton			
c) Activities with toys			
6. Corpse Pose *(Savasana)*		2 min	Every class
7. Yoga Games		12-15 min	Once a week

CHAPTER 3

RESULTS

3.1 Preliminary Analysis

In order to create a composite score for Socio-Economic-Status SES, we checked if there was any relation between mother's education and family income. Results showed that there was no relation between mother's education and family income; but, there were significant relations between father's education and family income (r = .34, p = 0.023) and between mother's education and father's education (r = .53, p < .001). Therefore, these three variables (mother's education, father's education and family income) were used to create a composite (SES) variable for each participant. This composite variable was used for the rest of the analysis when controlling for SES.

Second, we searched for outliers that were more than three standard deviations from the mean. For the direct child tasks only the day-night and balloon tasks had outliers; The day-night task had 2 outliers and the balloon task had 2 outliers. When we conducted the same outlier analysis for the indirect measures, teacher reported

measures revealed one outlier from the regulation sub-scale of CHEXI, and mother reported measures revealed one outlier from the planning sub-scale of CHEXI. All of the outliers were removed from the related analyses. Third, we checked to see if there were any effects of gender on our direct or indirect measures. Given the outliers we analyze the bulk of the EF measures separately from the day-night and balloon tasks. Accordingly, we conducted one MANOVA and two separate ANOVAs on our 6 direct child measures. A final ANOVA was conducted on the EF composite score. For all of these analyses, gender only had one effect. There was significant interaction of time by gender for the day-night task, Wilks' Lambda = .90, F (1, 38) = 4.12, p = .049, n^2 = .098 such that male performance on the day-night task increased while girls appeared to perform closer to pre-test levels.

We also checked for an effect of gender on teachers' evaluations by using two mixed measures MANOVAs and one separate ANOVA for the subscale with an outlier. For all of these analyses, there were no effects involving gender. The same set of analyses were conducted on mother reported scales by using one mixed measures MANOVA and two separate ANOVAs (one for the scale with an outlier, the other for the total scores). Again, there were no effects involving gender. Given the single significant interaction for the day-night task, gender was eliminated for the rest of the analyses.

3.2 Analysis Plan

For the rest of the results section, first, we focused on our main research question which was about the intervention effects. We also evaluated whether any of the intervention effects depended on the measurement type (i.e., direct vs. indirect measures). Further, we focused on the relations between and within our indirect and

direct measures. Through assessing the relations between measures, we also checked an alternative coding for delay of gratification measured by marsmallow task and its relations with other measures. Next, we focused on just the yoga group to evaluate the effects of engagement level, enjoyment level, and pre-test EF on any improvements in EF performance at post-test. Last, we conducted exploratory analyses to investigate the intervention effects for other mother reported measures of their children beyond those related to EF (i.e., activity level, impulsivity, positive affect etc.)

3.3 Effect of the Yoga Intervention

This current study's main purpose was to assess whether there is an effect of yoga on children's self-regulation ability. The means and standard deviations are given for both the yoga and control groups at pre and post-test in Table 2.

To test for intervention effects, we conducted one mixed-measures MANCOVA using 4 of the direct child DVs and three separate ANCOVAs for each of the two direct child DVs with the outliers and total EF composite score. For the first mixed measures MANCOVA analyses, the dependent variables were DCCS (cognitive flexibility), HTKS (motor control), statue task (inhibitory motor control), and marsmallow task (delay of gratification) with condition (yoga vs. waitlist control group) as the independent variable and age in months as the covariate (see Table 3). Preliminary assumption testing was conducted by checking Levene's Test of Equality of Error Variances and Box's Test of Equality of Covariance Matrices, with no serious violations noted. Results showed that the main effect of age for the overall test was significant F (4, 36) = 14.105, $p < .001$, $n^2 = .61$; but not condition, F (4, 36) = .556, $p = .70$, $n^2 = .06$ or time, F (4, 36) = 1.039, $p = .401$, $n^2 = .10$. The follow-up

Table 2. Mean and Standard Deviations for the Child Measures in Pre-test and Post-test

	Yoga Group Pre-test DCCS	DN	BL	STATUE	HTKS	MRSH	Yoga Group Post-test DCCS	DN	BL	STATUE	HTKS	MRSH
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total (n=45)	1.79 (0.51)	11.83 (5.41)	0.63 (0.92)	23.88 (6.33)	56.67 (32.60)	641.33 392.32	2.0 (0.53)	13.86 (4.04)	1.23 (1.02)	24.68 (6.0)	61.68 (27.51)	781.27 (246.26)
	Waitlist Control Group Pre-test DCCS	DN	BL	STATUE	HTKS	MRSH	Waitlist Control Group Post-test DCCS	DN	BL	STATUE	HTKS	MRSH
Total (n=42)	1.57 (0.60)	11.81 (5.46)	0.62 (0.80)	23.00 (5.84)	51.33 (31.22)	696.33 335.38	1.85 (0.59)	13.95 (2.76)	0.70 (0.92)	24.60 (5.70)	59.95 (29.76)	817.90 (253.93)

analyses indicated a main effect of age for the three cool EF tasks but not for the hot EF task. There was not a time by age interaction for the overall test; Wilks' Lambda = .94, F (4, 36) = .603, p = .66, n^2 = .06 and no time by condition interaction as well; Wilks' Lambda = .94, F (4, 36) = .547, p = .70, n^2 = .06. The lack of interaction effects means that there was no effect of the intervention for these four measures.

For the two direct child measures with outliers we conducted two mixed measures ANCOVAs (Table 3). First, we conducted an ANCOVA with day-night (interference control) as the dependent variable, condition as the independent variable, and age in months as the covariate. An assumption check was done for Box's Test of Equality of Covariance Matrices which revealed no serious violation. Results showed that there was a main effect of age; F (1, 37) = 16.910, p < .001, but no main effect of time F (1, 37) = .202, p = .656 or condition F (1, 37) = .056, p = .814. Also, there was no time by age interaction Wilks' Lambda = 1.0, F (1, 37) = .000, p = 1.0, n^2 = .00 and no time by condition interaction; Wilks' Lambda = .97, F (1, 37) = 1.039, p = .32, n^2 = .03.

For the second mixed measures ANCOVA the balloon task (working memory) was the dependent variable, condition was the independent variable, and age in months was the covariate. An assumption check was done for Box's Test of Equality of Covariance Matrices which revealed no serious violations. Results showed a marginally significant main effect of time F (1, 37) = 3.327, p = .076 and neither the main effect of age F (1, 37) = 2.745, p = .106 nor condition F (1, 37) = .774, p = .385 was significant. There was a significant time by age interaction for working memory performance; Wilks' Lambda = .89, F (1, 37) = 4.698, p = .037, n^2 = .11 and a

significant time by condition interaction; Wilks' Lambda = .87, F (1, 37) = 5.551, p = .024, n^2 = .13 indicating an effect of intervention on working memory.

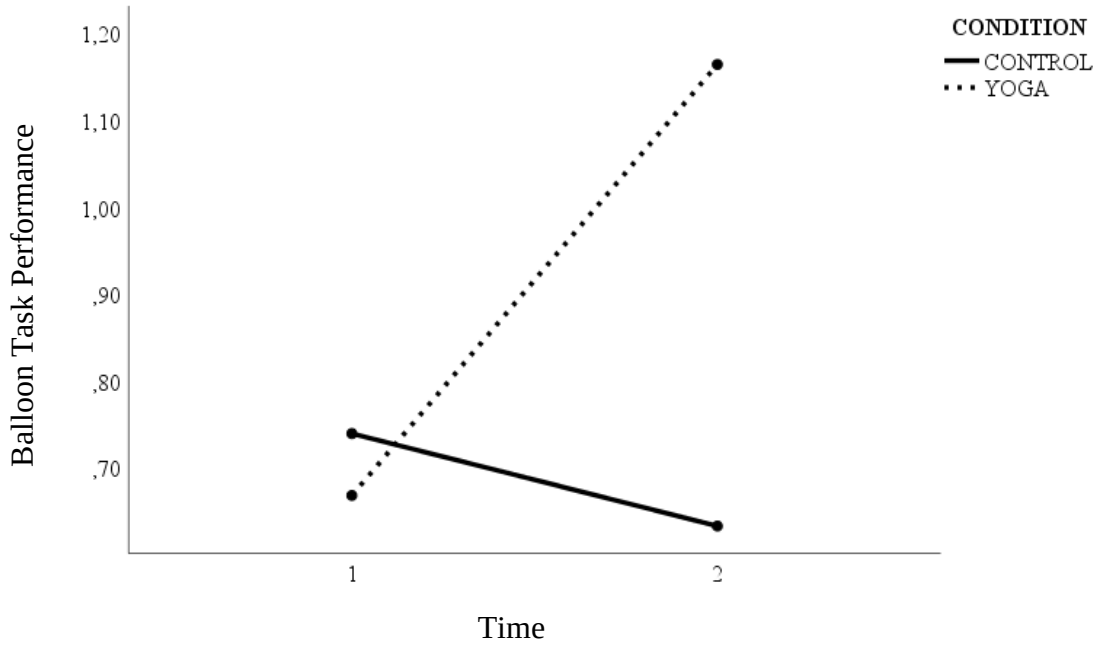

Figure 1. Time by Condition Interaction for the Balloon Task (Working Memory)

Last, we conducted an ANCOVA analysis for the composite EF score as the dependent variable, condition as the independent variable, and age in months as the covariate (Table 3). An assumption check was done for Box's Test of Equality of Covariance Matrices which revealed no serious violations. Results showed a significant main effect of age F (1, 39) = 33.042, p < 001, a marginally significant main effect of condition F (1, 39) = .065, p = .80 a nonsignificant main effect of time F (1, 39) = .088, p = .769. There was not a significant time by age interaction Wilks' Lambda = 1.0, F (1, 37) = .003, p = .959, n^2 = .00 nor a time by condition interaction on total EF performance; Wilks' Lambda = 1.0, F (1, 39) = .187, p = .668, n^2 = .01.

Similar to the analyses that tested for intervention effects on the direct child measures, we also conducted analyses for our indirect measures. We conducted two mixed measures MANCOVAs (one for CHEXI subscales and one for CBQ subscales) and two mixed measures ANCOVAs (one for the outlier subscale and one for total CHEXI) for the mother reported scales (Table 4). For all of these analyses, preliminary assumption testing was conducted by checking Levene's Test of Equality of Error Variances with no serious violations noted. The first analysis included three of the mother reported CHEXI subscales; working memory, regulation and inhibition as dependent variables, condition as the independent variable with the covariate as age. Results for the overall test showed that there was significant a main effect of time F (3, 34) = 3.033, p = .042 such that pre-test scores were higher then post-test for the working memory ($p < .05$) and inhibition subscales ($p < .10$). There was no significant main effect of condition F (3, 34) = .671, p = .58 or of age F (3, 34) = .953, p = .43. There was not a significant time by age interaction Wilks' Lambda = .826, F (3, 34) = 2.382, p = .087, n^2 = .17 or a time by condition interaction for total EF performance; Wilks' Lambda = .912, F (3, 34) = 1.095, p = .365, n^2 = .09.

For the other CHEXI subscale, planning, one outlier was eliminated. In this analysis, the planning subscale (CHEXI) was the dependent variable, condition was the independent variable and age in months was the covariate (Table 4). Results for the test showed a significant main effect of time F (1, 36) = 5.110, p = .030 such that pre-test scores were higher than post-test scores. However, neither of the other main effects; age F (1, 36) = 1.976, p = .168; or condition F (1, 36) = .306, p = .584 were significant. There was a marginal significant time by age interaction on the planning

subscale; Wilks' Lambda = .914, F (1, 36) = 3.395, p = .074, n^2 = .09. However, there was no significant time by condition interaction on this scale; Wilks' Lambda = 1.0, F (1, 36) = .009, p = .927, n^2 = .00.

Finally, an ANCOVA analysis was conducted for total EF. For this analysis, we included CHEXI totals the dependent variable, condition as the independent variable, and age in months as the covariate (Table 4). Results showed a significant main effect of time, F (1, 37) = 5.623, p = .02 such that pre-test is higher than post-test. Neither of the other main effects of condition, F (1, 37) = .061, p = .806 and age F (1, 37) = .001, p = .978 were significant. There was a significant time by age interaction for total EF performance; Wilks' Lambda = .890, F (1, 37) = 4.557, p = .039, n^2 = .11, but not a significant time by condition interaction, Wilks' Lambda = .999, F (1, 37) = .042, p = .839, n^2 = .00.

Last, we conducted mixed measures MANCOVA analysis that included effortful control with other CBQ subscales. Results showed that there was no significant main effect of age, F (6, 30) = 1.632, p = .17, condition F (6, 30) = .719, p = .64, or time F (6, 30) = 1.273, p = .299. There was not a significant time by age interaction Wilks' Lambda = .809, F (6, 30) = 1.183, p = .342, n^2 = .19. However, the analysis revealed a time by condition interaction for the overall test; Wilks' Lambda = .662, F (6, 30) = 2.548, p = .041, n^2 = .34 but this did not apply to effortful control (Table 4).

The same sets of analyses were conducted for the teacher reported measures (Table 5). We conducted two mixed measures MANCOVAs and one mixed measures ANCOVA. For all of these analyses, preliminary assumption testing was conducted

by checking Levene's Test of Equality of Error Variances with no serious violations noted.

The first analysis included behavioral regulation and social ability subscales from CBRS and three of the teacher reported CHEXI subscales; working memory, inhibition and planning as dependent variables, condition as independent variable, and the covariate of age (Table 5). Results for the overall test showed that there was significant main effect of age F (5, 35) = 4.132, p = .005 such that older children scored higher for all of the subscales in the analysis, but not for condition F (5, 35) = 1.353, p = .266 or time F (5, 35) = .893, p = .497. There was not a significant time by age interaction Wilks' Lambda = .886, F (5, 35) = .903, p = .490, n^2 = .11; or a time by condition interaction; Wilks' Lambda = .982, F (5, 35) = .126, p = .986, n^2 = .02.

For the other ANCOVA analysis, we eliminated one outlier from the regulation subscale of the CHEXI. In this analysis, the regulation subscale (CHEXI) was the dependent variable, condition was the independent variable, and age in months was the covariate (Table 5). Results showed a significant main effect of age F (1, 38) = 25.760, p < .001 such that older children scored higher but neither of the main effects of time F (1, 38) = 1.958, p = .410 or condition F (1, 38) = .689, p = .412 were significant. There was no significant time by condition interaction as well, Wilks' Lambda = .995, F (1, 38) = .193, p = .663, n^2 = .01. and time by age interaction, Wilks' Lambda = .970, F (1, 38) = 1.192, p = .282, n^2 = .03.

Last, we conducted a mixed measures MANCOVA analysis for total EF from both scales (CHEXI and CBRS). These totals were added as the dependent variables,

condition as the independent variable, and age in months as the covariate (Table 5). Results showed a significant main effect of age F (2, 38) = 12.894, $p < .001$, such that older children scored higher for both measures; however, neither of the other two main effects, condition F (2, 38) = .893, p = .418, time F (2, 38) = .449, p = .641 were significant. There was not a significant time by age interaction; Wilks' Lambda = .973, F (2, 38) = .531, p = .593, n^2 = .03 or a time by condition interaction Wilks' Lambda = .993, F (2, 38) = .135, p = .874, n^2 = .01.

Having assessed our main research question, we sought to assess whether the effect of the intervention depended on the type of measurement (direct child vs. indirect parent and teacher reported measures). To assess this question we looked at the relations amongst the different types of measures. Further, we were expecting to find significant correlations amongst the cool EF aspects but not hot EF. To assess these relations, we conducted bivariate correlation analyses among all the direct child measures. Then, we focused on the relations between our direct measures and indirect parent and teacher reports of EF separately for pre-test and post-test.

Table 3. Results of the repeated measures mixed MANCOVAs and ANCOVAs of child measures

Dependent Variables	Time	Condition	Age	Time x Condition	Time x Age
Dimensional Change Card Sort (DCCS)	$F_{(1,39)}$ = .003, p=.953, n_p^2=.000	$F_{(1,39)}$ = 1.876, p=.179, n_p^2=.046	$F_{(1,39)}$ = 25.026, p=.000, n_p^2=.391	$F_{(1,39)}$ = 1.353, p=.252, n_p^2=.034	$F_{(1,39)}$ = .410, p=.526, n_p^2=.010
Day-night task	$F_{(1,37)}$ = .202, p=.656, n_p^2=.005	$F_{(1,37)}$ = .056, p=.814, n_p^2=.002	$F_{(1,37)}$ = 16.910, p=.000, n_p^2=.314	$F_{(1,37)}$ = 1.039, p=.315, n_p^2=.027	$F_{(1,37)}$ = .000, p=.997, n_p^2=.000
Balloon task	$F_{(1,37)}$ = 3.32, p=.076, n_p^2=.083	$F_{(1,37)}$ = .774, p=.385, n_p^2=.020	$F_{(1,37)}$ = 2.745, p=.106, n_p^2=.069	$F_{(1,37)}$ = 5.551, p=.024, n_p^2=.130	$F_{(1,37)}$ = 4.698, p=.037, n_p^2=.113
Statue task	$F_{(1,39)}$ = .995, p=.325, n_p^2=.025	$F_{(1,39)}$ = .061, p=.806, n_p^2=.002	$F_{(1,39)}$ = 18.521, p=.000, n_p^2=.322	$F_{(1,39)}$ = .124, p=.726, n_p^2=.003	$F_{(1,39)}$ = .445, p=.509, n_p^2=.011
Head-toes-knees-shoulders (HTKS)	$F_{(1,39)}$ = .528, p=.472, n_p^2=.013	$F_{(1,39)}$ = .002, p=.968, n_p^2=.000	$F_{(1,39)}$ = 44.576, p=.000, n_p^2=.533	$F_{(1,39)}$ = .928, p=.341, n_p^2=.023	$F_{(1,39)}$ = .086, p=.771, n_p^2=.002
Marsmallow task	$F_{(1,39)}$ = 2.344, p=.134, n_p^2=.057	$F_{(1,39)}$ = .378, p=.542, n_p^2=.010	$F_{(1,39)}$ = 1.555, p=.220, n_p^2=.038	$F_{(1,39)}$ = .013, p=.908, n_p^2=.000	$F_{(1,39)}$ = 1.245, p=.271, n_p^2=.031
Composite EF	$F_{(1,39)}$ = .088, p=.769, n_p^2=.002	$F_{(1,39)}$ = .065, p=.800, n_p^2=.002	$F_{(1,39)}$ = 33.042, p=.000, n_p^2=.459	$F_{(1,39)}$ = .187, p=.668, n_p^2=.005	$F_{(1,39)}$ = .003, p=.959, n_p^2=.000

Table 4. Results of the repeated measures mixed MANCOVAs and ANCOVAs of parent reported measures

Dependent Variables	Time	Condition	Age	Time x Condition	Time x Age
Pare_CBQ_Activity Level	$F_{(1,35)}$ = .209, p=.650, n_p^2=.006	$F_{(1,35)}$ = .744, p=.394, n_p^2=.021	$F_{(1,35)}$ = .052, p=.820, n_p^2=.001	$F_{(1,35)}$ = 1.086, p=.304, n_p^2=.030	$F_{(1,35)}$ = .191, p=.665, n_p^2=.005
Pare_CBQ_Anger/Fear	$F_{(1,35)}$ = 1.900, p=.177, n_p^2=.051	$F_{(1,35)}$ = .357, p=.554, n_p^2=.010	$F_{(1,35)}$ = 5.185, p=.029, n_p^2=.129	$F_{(1,35)}$ = 2.470, p=.125, n_p^2=.066	$F_{(1,35)}$ = 1.360, p=.251, n_p^2=.037
Pare_CBQ_ Falling Reactivity	$F_{(1,35)}$ = .106, p=.746, n_p^2=.003	$F_{(1,35)}$ = 1.668, p=.205, n_p^2=.045	$F_{(1,35)}$ = .020, p=.888, n_p^2=.001	$F_{(1,35)}$ = 2.049, p=.161, n_p^2=.055	$F_{(1,35)}$ = .192, p=.664, n_p^2=.005
Pare_CBQ_ Impulsivity	$F_{(1,35)}$ = .035, p=.853, n_p^2=.001	$F_{(1,35)}$ = 1.193, p=.282, n_p^2=.033	$F_{(1,35)}$ = .096, p=.759, n_p^2=.003	$F_{(1,35)}$ = 1.598, p=.214, n_p^2=.044	$F_{(1,35)}$ = .017, p=.897, n_p^2=.000
Pare_CBQ_Smiling and Laughter	$F_{(1,35)}$ = 1.242, p=.273, n_p^2=.034	$F_{(1,35)}$ = .122, p=.729, n_p^2=.003	$F_{(1,35)}$ = 1.695, p=.201, n_p^2=.046	$F_{(1,35)}$ = 5.678, p=.023, n_p^2=.140	$F_{(1,35)}$ = 1.294, p=.263, n_p^2=.036
Pare_CBQ_Effortful Control	$F_{(1,35)}$ =.225, p=.639, n_p^2=.006	$F_{(1,35)}$ = .240, p=.628, n_p^2=.007	$F_{(1,35)}$ =1.049, p=.313, n_p^2=.029	$F_{(1,35)}$ = .005, p=.943, n_p^2=.000	$F_{(1,35)}$ = .318, p=.576, n_p^2=.009
Pare_CHEXI_WM	$F_{(1,36)}$ = 5.987, p=.019, n_p^2=.143	$F_{(1,37)}$ = .019, p=.890, n_p^2=.001	$F_{(1,37)}$ = .271, p=.606, n_p^2=.007	$F_{(1,36)}$ = .447, p=.508, n_p^2=.012	$F_{(1,36)}$ = 4.179, p=.048, n_p^2=.104
Pare_CHEXI_REG	$F_{(1,36)}$ = .027, p=.871, n_p^2=.001	$F_{(1,37)}$ = .029, p=.866, n_p^2=.001	$F_{(1,37)}$ = .185, p=.669, n_p^2=.005	$F_{(1,36)}$ = .002, p=.965, n_p^2=.000	$F_{(1,36)}$ = .020, p=.889, n_p^2=.001
Pare_CHEXI_INH	$F_{(1,36)}$ = 3.042, p=.090, n_p^2=.078	$F_{(1,37)}$ = 1.219, p=.277, n_p^2=.033	$F_{(1,37)}$ = .572, p=.454, n_p^2=.016	$F_{(1,36)}$ = 1.794, p=.189, n_p^2=.047	$F_{(1,36)}$ = 3.305, p=.077, n_p^2=.084
Pare_CHEXI_PLAN	$F_{(1,37)}$ = 6.914, p=.012, n_p^2=.157	$F_{(1,37)}$ = .011, p=.918, n_p^2=.000	$F_{(1,37)}$ = .364, p=.550, n_p^2=.010	$F_{(1,36)}$ = .466, p=.499, n_p^2=.012	$F_{(1,36)}$ = 5.914, p=.020, n_p^2=.138
Pare_CHEXI_TOT	$F_{(1,37)}$ = 5.623, p=.023, n_p^2=.132	$F_{(1,37)}$ = .061, p=.806, n_p^2=.002	$F_{(1,37)}$ = .001, p=.978, n_p^2=.000	$F_{(1,37)}$ = .042, p=.839, n_p^2=.001	$F_{(1,37)}$ = 4.557, p=.039, n_p^2=.110

Table 5. Results of the repeated measures mixed MANCOVAs and ANCOVA for teacher reported EF measures

Dependent Variables	Time	Condition	Age	Time x Condition	Time x Age
Teac_CBRS_REG	$F_{(1,39)}$ = .504, p=.482, n_p^2=.013	$F_{(1,39)}$ = .740, p=.395, n_p^2=.019	$F_{(1,39)}$ = 10.441, p=.003, n_p^2=.211	$F_{(1,39)}$ =.002, p=.962, n_p^2=.000	$F_{(1,39)}$ = .569, p=.455, n_p^2=.014
Teac_CBRS_SOC	$F_{(1,39)}$ = .026, p=.874, n_p^2=.001	$F_{(1,39)}$ = 3.310, p=.077, n_p^2=.078	$F_{(1,39)}$ = 5.454, p=.025, n_p^2=.123	$F_{(1,39)}$ = .016, p=.900, n_p^2=.000	$F_{(1,39)}$ = .025, p=.876, n_p^2=.001
Teach_CBRS_TOT	$F_{(1,39)}$ = .309, p=.581, n_p^2=.008	$F_{(1,39)}$ = 1.821, p=.185, n_p^2=.045	$F_{(1,39)}$ = 9.896, p=.003, n_p^2=.202	$F_{(1,39)}$ = .001, p=.970, n_p^2=.000	$F_{(1,39)}$ = .340, p=.563, n_p^2=.009
Teac_CHEXI_WM	$F_{(1,39)}$ = 1.678, p=.203, n_p^2=.041	$F_{(1,39)}$ = 1.402, p=.244, n_p^2=.035	$F_{(1,39)}$ = 21.835, p=.000, n_p^2=.359	$F_{(1,39)}$ = .006, p=.941, n_p^2=.000	$F_{(1,39)}$ = 1.862, p=.180, n_p^2=.046
Teac_CHEXI_REG	$F_{(1,38)}$ = .693, p=.410, n_p^2=.018	$F_{(1,38)}$ = .689, p=.412, n_p^2=.018	$F_{(1,38)}$ = 25.760, p=.000, n_p^2=.404	$F_{(1,38)}$ = .193, p=.663, n_p^2=.005	$F_{(1,38)}$ = 1.192, p=.282, n_p^2=.030
Teac_CHEXI_INH	$F_{(1,39)}$ = .024, p=.878, n_p^2=.001	$F_{(1,39)}$ = .640, p=.429, n_p^2=.016	$F_{(1,39)}$ = 10.971, p=.002, n_p^2=.220	$F_{(1,39)}$ = .333, p=.567, n_p^2=.008	$F_{(1,39)}$ = .000, p=.984, n_p^2=.000
Teac_CHEXI_PLAN	$F_{(1,39)}$ = .000, p=.991, n_p^2=.000	$F_{(1,39)}$ = .064, p=.801, n_p^2=.002	$F_{(1,39)}$ = 15.991, p=.000, n_p^2=.291	$F_{(1,39)}$ = .118, p=.733, n_p^2=.003	$F_{(1,39)}$ = .020, p=.889, n_p^2=.001
Teac_CHEXI_TOT	$F_{(1,39)}$ = .920, p=.343, n_p^2=.023	$F_{(1,39)}$ = .953, p=.335, n_p^2=.024	$F_{(1,39)}$ = 25.084, p=.000, n_p^2=.391	$F_{(1,39)}$ = .191, p=.664, n_p^2=.005	$F_{(1,39)}$ = 1.083, p=.304, n_p^2=.027

3.4 Pre-Test Results

As depicted in table 6, of the six direct child tasks, four of them cognitive flexibility (DCCS), interference control (day-night), inhibitory motor control (statue task), and motor control (HTKS) tasks were found to be significantly correlated with each other. For the remaining two direct child measures, working memory (balloon task) was only correlated with the motor control (HTKS) and the delay of gratification (marsmallow task) was not correlated with any of the other child measures. Although the amount of time children waited in the marsmallow task was not correlated with the other child measures, we sought to also look at the correlations between the other child measures and the number of violations children made while waiting in the marsmallow task. We found significant negative relations between violations in the marsmallow task (delay of gratification) and cognitive flexibility (DCCS) (r = -.53, p < .001), interference control (day-night task) (r = -.33, p = 0.025), inhibitory motor control (statue task) (r = -.40, p = .007), and motor control (HTKS) (r = -.35, p = 0.020). In addition to these, we were expecting to see relations between our direct EF and indirect EF measures which mean that child EF tasks and parent and teacher reported EF scales should be correlated with one another.

To understand these relations, we first conducted Bivariate correlation analyses between our direct child and indirect teacher reported measures (Table 6). Most of the child constructs; cognitive flexibility (DCCS), interference control (Day-Night), and motor control (HTKS and Statue task) were correlated with all the teacher reported EF scales. The working memory (balloon task) was not correlated with any of the

teacher reported measures; whereas, delay of gratification (marsmallow task) was correlated with the planning and working memory reports of teachers.

To understand the relations between direct child and mother reported measures we conducted Bivariate correlation analyses. These analyses included mother reported CHEXI and the effortful control subscales and all of the child measures including the composite EF score. Results revealed that mother's reports about children's planning ability was significantly correlated with cognitive flexibility (DCCS) (r = -.39, p=.01), working memory (balloon task) (r= -.34, p=.02), inhibitory motor control (statue task) (r= -.31, p=.04), and composite EF (r= -.35, p=.02). Mothers report of effortful control was also correlated with working memory (r= .49, p=.001). The interference control and delay of gratification (marsmallow task) abilities did not reveal any significant correlations with mother reports at pre-test.

We also explored the relations within the indirect measures (parent and teacher reports). The CHEXI scale had both teacher and parent versions and so we expected some relations. Mother and teacher reported measures of working memory, regulation, inhibition and planning on the CHEXI were suppose to measure the same construct, thus we conducted Bivariate correlation analysis between these measures too. Contrary to expectations, there was not any significant relation between mother and teacher versions of the CHEXI. However, teacher reported behavioral regulation as measured by CBRS found to be significantly correlated with mother reported working memory and planning as measured by CHEXI planning and (Table 7).

Table 6. Bivariate Correlations between Child measures and Teacher reported measures (Pre-test)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. DCCS	-													
2. DAY/NIGHT TASK	.60**	-												
3. BALLOON TASK	.22	.25	-											
4. STATUE TASK	.40**	.47**	.28	-										
5. HTKS	.57**	.60**	.14**	.50**	-									
6. MARSMALLOW TASK	-.01	.13	.22	.21	.13	-								
7. T CHEXI WORKING MEM.	-.44**	-.50**	-.11	-.55**	-.58**	-.28	-							
8. T CHEXI REGULATİON	-.40**	-.45**	-.19	-.53**	-.47**	-.31*	.74**	-						
9. T CHEXI INHIBITION	-.36*	-.53**	-.12	-.45**	-.47**	-.27	.72**	.67**	-					
10. T CHEXI PLANNING	-.39**	-.47**	-23	-.58**	-.56**	-.33*	.90**	.70**	.63**	-				
11. T CHEXI TOTAL	-.45**	-.55**	-.16	-.58**	-.59**	-.32*	.96**	.86**	.84**	.90**	-			
12. T CBRS REGULATION	.34*	.41**	.10	.48**	.44**	.11	-.72**	-.67**	-.63**	-.75**	-.77**	-		
13. T CBRS SOCIAL ABILITY	.32*	.42**	.13	.38**	.44**	.18	-.56**	-.57**	-.77**	-.45**	-.65**	.63**	-	
14. T CBRS TOTAL	.36**	.45**	.12	.49**	.48**	.15	-.73**	-.70**	-.75**	-.70**	-.80**	.95**	.84**	-

Note. *p < .05, **p < .01

The effortful control construct is close to the EF construct. Accordingly, we expected mother reported effortful control to be correlated with mother reported EF subscales. We conducted Bivariate correlation analysis for just the CBQ Effortful Control Subscale and all of the mother CHEXI subscales. In line with this expectation, Effortful Control Subscale was found to be negatively significantly correlated with mother CHEXI dimensions; working memory, inhibition, regulation and planning (Table 7).

Table 7. Bivariate Correlations between Teacher and Mother reported measures (Pre-test)

Variables	1	2	3	4	5	6	7	8	9
1. P CHEXI WM	-								
2. P CHEXI REG	.66**	-							
3. P CHEXI INH	.63**	.55**	-						
4. P CHEXI PLAN	.77**	.48**	.51**	-					
5. P CHEXI TOT	.94**	.80**	.81**	.79**	-				
6. P EFFORT CONT	.64**	-.43**	-.45**	-.55**	-.62**	-			
7. T CBRS REG	-.31*	-.08	.08	-.36*	-.20	.14	-		
8. T CBRS SOC	-.26	-.02	.06	-.28	-.15	-.05	.63**	-	
9. T CBRS TOT	-.32*	-.07	.08	-.37*	-.20	.08	.95**	.84**	-

Note. *p < .05, **p < .01

3.5 Post-test Results

In order to assess if our measures have similar relations in the post-test period, Bivariate correlation analysis was run between the same measures. Table 8 shows th

post test relations in between direct child and indirect teacher reported measures. As it can be seen from the table, similar relations were found for the post-test period. This showed us the reliability of our measures in terms of evaluating children's self-regulatory abilities. Contrary to the pre-test results, working memory (balloon task) was found to be related with cognitive flexibility (DCCS) and inhibitory motor control (statue task) in addition to the HTKS task.

Separate from Table 8, correlation analysis was conducted with the alternative coding for the marsmallow task (delay of gratification). Results for alternative coding of the marsmallow task did not find any relations with the other tasks besides a marginally significant negative relation with the statue task (inhibitory motor control) (r = -.29, p = .07).

Contrary to pre-test, there were no relations between the marsmallow task and the teacher reported measures. Interestingly, in the post-test, the balloon task was correlated with the majority of the teacher reported EF measures corresponding to social abilities, regulation, working memory and planning. The rest of the results were similar with the pre-test and can be found in Table 8.

We also repeated the correlation analyses of parent reported measures and child measures. There was positive significant relations between mothers' effortful control reports and children's interference control (day-night task) (r = .38, p = .015), motor control (HTKS) (r=.34, p = .032) and general EF performance (r = .36, p = .020),

Table 8. Bivariate Correlations between Child measures and Teacher reported measures (Post-test)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. DCCS	-													
2. DAY/NIGHT TASK	.40**	-												
3. BALLOON TASK	.30**	.25	-											
4. STATUE TASK	.32*	.48**	.51**	-										
5. HTKS	.51**	.55**	.42**	.40**	-									
6. MARSMALLOW TASK	.17	.20	.20	.08	.09	-								
7. T CHEXI WORKING MEM.	-.32*	-.58**	-.41**	-.55**	-.60**	.-12	-							
8. T CHEXI REGULATİON	-.32*	-.64**	-.47**	-.62**	-.63**	-.18	.88**	-						
9. T CHEXI INHIBITION	-.40**	-.48**	-.22	-.57**	-.34*	.02	.64**	.64**	-					
10. T CHEXI PLANNING	-.20	-.65**	-.33*	-.51**	-.51**	-.10	.92**	.87**	.55**	-				
11. T CHEXI TOTAL	-.35*	-.64**	-.41**	-.62**	-.59**	-.11	.97**	.93**	.77**	.92**	-			
12. T CBRS REGULATION	.33*	.53*	.33*	.56**	.46**	.30	-.83**	-.79**	-.68**	-.75*	-.85**	-		
13. T CBRS SOCIAL ABILITY	.23	.30	.33*	.46**	.24	.05	-.59**	-.60**	-.69**	-.51**	-.66**	.71**	-	
14. T CBRS TOTAL	.31*	.47**	.36*	.56**	.40**	.21	-.79**	-.77**	-.74**	-.71**	-.83**	.95**	.90**	-

Note. *p < .05, **p < .01

along with marginally significant relations for working memory (balloon task) (r=.29, p=.065) and inhibitory motor control (statue task) (r=.29, p=.065).

The same set of analyses were conducted for post-test teacher and mother reported measures. CHEXI reported by mothers and teachers were not significantly correlated with each other as it is in pre-test. The analysis revealed only effortful control as related to working memory measured by CHEXI reported by mothers (Table 9). Interestingly, we could not find the significant relations between post mother reported EF measured by CHEXI and teacher CBRS measures as we found in pre-test. Lastly, within our indirect mother reports of EF; the relations between effortful control and working memory, regulation, inhibition, and planning were present for the post-test too (Table 9).

Table 9. Bivariate Correlations between Mother and Teacher reported measures (Post-test)

Variables	1	2	3	4	5	6	7	8	9
1. P CHEXI WM	-								
2. P CHEXI REG	.76**	-							
3. P CHEXI INH	.46**	.41**	-						
4. P CHEXI PLAN	.61**	.42**	.37*	-					
5. P CHEXI TOT	.93**	.83**	.69**	.72**	-				
6. P EFFORT CONT	-.35*	-.30	-.30	-.27	-.39	-			
7. T CBRS REG	-.10	.06	.02	-.11	-.04	.26	-		
8. T CBRS SOC	.01	.07	.04	.09	.06	.26	.72**	-	
9. T CBRS TOT	-.05	.07	.03	-.03	-.00	.28	.95**	.90**	-

Note. *p < .05, **p < .01

3.5 Effect of Engagement, Enjoyment, and Pre-test EF on the Intervention Group

The rest of our research questions were about just the yoga group. The first question aimed to assess the effect of engagement level on our intervention. In order to decide which measure of engagement to use, we ran correlation analysis between the different types of engagement that were measured. Two measures of general engagement were done by the experimenter and other coders. The two measures were highly correlated (r = .65, p = .001). Therefore, the variable which was coded every week by the experimenter was taken as the best measure of engagement level since it included more information. This engagement level score was then dichotomized as high and low using a frequency analysis. According to this analysis, children whose engagement level was 3 or lower were categorized as low (59%) and children whose engagement level was 4 or 5 were categorized as high (41%). A mixed-measures MANOVA was conducted with engagement level as the independent variable and the dependent variables were all 6 of the child measures. For the overall test, the results did not show a main effect of engagement level, F (6, 15) = 1.860, p = .15, n^2 = .43. The main effect of time was marginally significant, F (6, 15) = 2.310, p = .088, n^2 = .48. Specifically, a marginally significant main effect of time was found for day-night F (1, 20) = 4.014, p = .059 a and significant main effect of time was found for the balloon task F (1, 20) = 5.853, p = .025. Although the omnibus test was not significant, there were main effects of engagement for half of the tasks; working memory (balloon task) F (1, 20) = 6.897, p = .016; inhibitory motor control (statue task) F (1, 20) = 10.667, p = .004, motor control (HTKS) F (1, 20) = 5.538, p = .029. The overall test for the interaction of time by engagement level was not significant; Wilks' Lambda = .88, F (6, 15) = .35, p = .90, n^2 = .12 indicating no effect of engagement level on any benefits from the yoga intervention.

The second hypothesis for the yoga group was that those who enjoyed yoga more will have better performance on the EF tasks. However, since there were only 3 (13%) children out of 22 children who reported that they did not like yoga activity, no further analysis was conducted for this hypothesis.

The last hypothesis for the yoga group was about the effect of pre-test EF performance on improvements in EF. The prediction was that those who had lower levels of EF would show more improvement on the EF tasks. Pre-test EF performance was dichotomited as high and low using a frequency analysis on the composite pre-test EF score. This resulted in an even split (i.e., 11 children in each group) between the two groups. A mixed-measures MANOVA was conducted by having pre-EF level as the independent variable and the dependent variables were all 6 of the child measures. For the overall test, the results showed a main effect of Pre-EF performance was significant, F (6, 15) = 11.993, $p < .001$, $n^2 = .83$, and a main effect of time was marginally significant, F (6, 15) = 2.472, $p = .073$, $n^2 = .50$. Specifically, a marginally significant main effect of time was found for the interference control (day-night task) F (1, 20) = 4.114, $p = .056$ and a significant main effect of time was found for the working memory (balloon task) F (1, 20) = 6.554, $p = .019$. A main effect of Pre-EF performance was found for all of the tasks; cognitive flexibility (DCCS) F (1, 20) = 7.972, $p = .010$; interference control (day-night) F (1, 20) = 14.108, $p = .001$, working memory (balloon task) F (1, 20) = 15.308, $p = .001$; inhibitory motor control (statue task) F (1, 20) = 17.399, $p < .001$, motor control (HTKS) F (1, 20) = 33.035, $p < .001$, delay of gratification (marsmallow task) F (1, 20) = 5.589, $p = .028$. The overall test for the interaction between time and Pre-EF performance was not significant; Wilks' Lambda = .78, F (6, 15) = .71, $p = .65$, $n^2 =$

.22 indicating no effect of existing EF performance on children's level of benefits from the yoga intervention.

3.6 Exploratory Analyses

We conducted some exploratory analyses. These included; correlation and mixed measures MANCOVA for additional parent reported subscales from the CBQ: effortful control, activity level, anger/fear, falling reactivity, impulsivity, and smiling and laughter. First, we assessed if there was an effect of the intervention for any of these subscales (Table 4). Preliminary assumption testing was conducted by checking Levene's Test of Equality of Error Variances with no serious violations noted. Results revealed that none of the main effects were significant; age F (6, 30) = 1.632, p = .173, condition F (6, 30) = .719, p = .637, time F (6, 30) = 1.273, p = .299. One main effect of age was found on the anger subscale. There was no time by age interaction on the overall mixed measures MANCOVA; Wilks' Lambda = 1.183, F (6, 30) = 1.183, p = .342, n^2 = .19. However, there was time by condition interaction for the overall test Wilks' Lambda = .66, F (6, 30) = 2.548, p = .041, n^2 = .34. Specifically, one significant interaction of time by condition was found for smiling and laughter (positive affect) reports of mothers such that children in the yoga group had higher reports of positive affect than children in the yoga group.

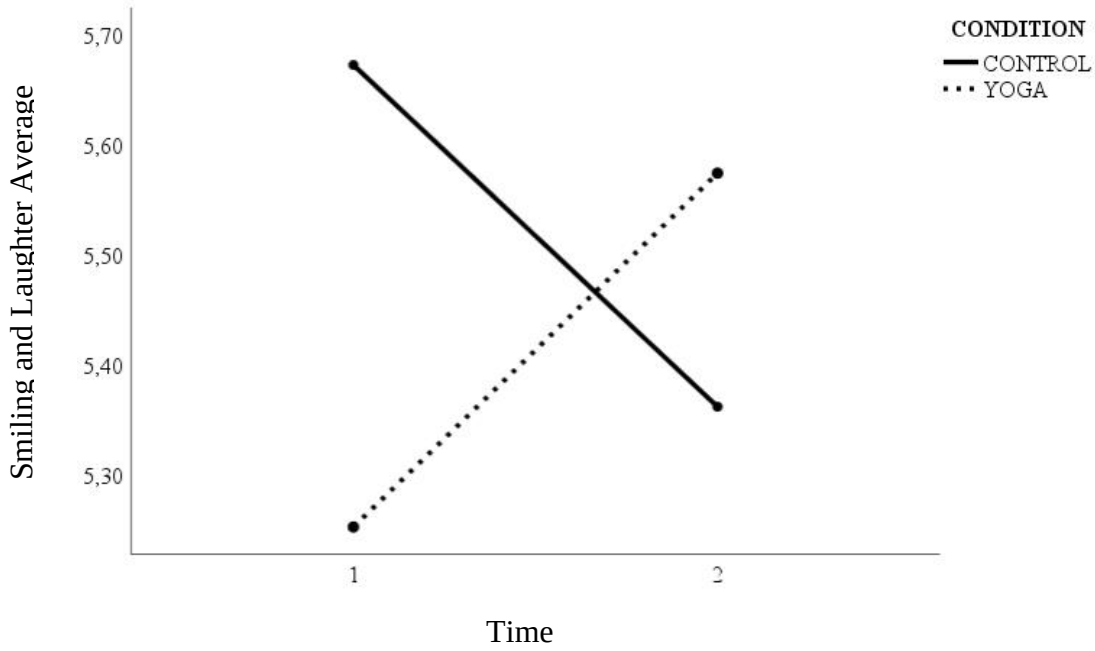

Figure 2. Time by Condition Interaction for the Smiling and Laughter Sub-scale (Positive Affect)

In addition to testing for interaction effects, we conducted separate correlation analyses for pre and post-test including the same 4 parent subscales and all 6 of the child measures. The results showed that smiling and laughter (positive affect) was significantly correlated with motor control directly measured on children (HTKS) (r=.31, p=.04) and marginally significantly correlated with cognitive flexibility (DCCS) (r=.29, p=.06). In addition to this, falling reactivity was also found to be correlated with DCCS (r=.29, p=.05). Same set of analyses were conducted for post-test. Contrary to pre-test results, only interference control (day-night) was found to be correlated with mothers reports of smiling and laughter (positive affect) (r=.32, p=.04).

CHAPTER 4

DISCUSSION

The purpose of the present study was to investigate the effect of a structured mindfulness based yoga intervention on children's self-regulatory abilities. To have a comprehensive measurement of children's self-regulatory abilities, we have used both indirect and direct measures. These measures included three kinds of data points; mother, child, and teacher. All of the measures were designed to measure different aspects related to EF. This allowed us to understand the effect of the intervention on different kinds of EF abilities.

4.1 Intervention Effects

Deriving from our main research question, we assessed our intervention effects. One of our direct child measures revealed an intervention effect for working memory. Working memory has been shown to be trainable by different kinds of interventions (Lieto et al., 2017; Blakey & Carroll, 2015; Passolunghi & Costa, 2016) and the current study supports this literature with a mindfulness based yoga intervention. Such an effect was also found for an adult yoga study which showed that even one

yoga session can effect college student's working memory performance compared to aerobic and baseline control groups (Gothe, Pontifex, Hillman, & McAuley, 2013).

Having an effect on working memory is important according to the theoretical model of Usai, Viterbori, Traverso, and Franchis (2014). According to this theory, EF is composed of two main parts; working memory and inhibition. As a main area of EF, working memory has been shown to have transfer effects on nontrained EF abilities; such as attention and cognitive flexibility (Blackey & Carroll, 2015; Diamond, 2012). However, the current study only revealed an intervention effect for working memory. These results suggest two things. The first one is that besides working memory, none of the other abilities that we measured have benefited from our intervention. The other one is that the effect on working memory did not show any transfer to other areas of EF including cognitive flexibility. It is still a possibility that our yoga group had better attention given that attention has been shown to be developed after a mindful yoga intervention with preschoolers (Razza et al., 2015). However, since we did not have a measure of attention for this study, this is just a speculation. In sum, the current study results suggest evidence against the idea of transfer effects.

As the balloon task was developed by Bilkent University researchers, we discuss its justification as a valid and reliable measure of working memory. This task has been shown to be related to one of our motor control tasks, (HTKS), at both pre-test and post-test. HTKS measures motor control and involves multiple instructions about different parts of the body which is getting more complex from the first to third trial. This makes it a demanding task in terms of working memory and so it makes sense to have relations with balloon task. In addition to the HTKS task, the balloon task was

also related with cognitive flexibility as measured by the DCCS task. Cognitive flexibility is supposed to involve working memory so this relation also suggests a valid measure of working memory. In addition to any issues of validity, there is also some evidence for the reliability of the balloon task. Specifically, the originator of the balloon task (Çelik & Allen, 2018) also found a relation with the DCCS task and did not find a relation with inhibition as measured by the day-night task. The current study also did not find any relations between the balloon task and the day-night task.

4.2 Interpretation of Other Results

Our finding of an intervention effect for one aspect of cool EF (i.e., working memory) but not for hot EF (i.e., marsmallow task) provides some support for the idea of hot and cool EF as distinct aspects of EF (Hongwanishkul et al., 2005). However, this support must be taken as tentative given that we also did not find any intervention effects for the other 4 aspects of cool EF. Further, if we had found intervention effects for both hot and cool EF they may still be distinct processes that are both open to improvements from the same type of intervention.

For teacher reported measures, we did not find any intervention effects but just at main effect of age. The lack of intervention effects on teacher reported measures has both supportive and contradictory evidence in the literature. Some studies have found intervention effects on teacher reported measures, some have not (Flook et al., 2010; Thanasetkorna et al, 2015; Thierry et al, 2016; Wood et al., 2018) Separate from intervention effect, there were relations within the teacher reported measures of EF (i.e., CHEXI and CBRS). These questionnaires (and their subscales) were found to be highly correlated with one another in the pre-test and post-test period which suggests

that they are measuring the same ability. Also, we found relations between the majority of the teacher reported subscales and the direct child measures suggesting that we are measuring the right constructs with the direct and indirect teacher measures. This kind of associations between child measures and teacher reported measures were supported by the literature as well (McClelland, et al., 2007; Ponitz et al., 2008; Sezgin & Demiriz, 2016; Tamm & Peugh, 2019).

For the mother reported measures, we did not find any intervention effect, but we did find a time by age interaction for planning; and a main effect of time on working memory and planning. We also found limited associations between mother reported measures and child measures which might be because parents are observing their children in contexts that are lower in terms of EF requirements compared to school contexts (Thorell & Nyberg, 2008). In addition to this, we did find associations between mother reported effortful control and EF reports at pre-test, but we could find only one association between parent effortful control and working memory reports at post-test. Since we have given the same measures twice, there is a possibility that mothers did not give the same effort and attention to our scales in the post-test considering the fact that they had answered those questions before.

There were two versions of the main indirect EF measure (i.e., parent reported CHEXI and teacher reported CHEXI). Contrary to expectations there were no relations parent and teacher reports amongst any of the total scores or sub-scales. There are two general reasons for why we could not find any relations amongst these two sets of measurements. First, teachers may have higher resolution in their ability to evaluate children's abilities because they encounter with many children. Second

they observe children in many situations that require high EF (Thorell & Nyberg, 2008). Accordingly, children may act differently in school and home contexts. That is, home context may not elicit as much executive functioning from children because their parents are providing much of the EF scaffolding that would normally be need by children functioning more independently in the preschool context.

In addition to these main analyses, we conducted analyses on some variables that were included in the study for strictly exploratory purposes. These 5 subscales were part of the CBQ that was filled out by mothers to measure effortful control. Of these 5 subscales, the smiling and laughter one revealed an intervention effect. This subscale taps into the children's experience of positive effect in response to the changes in their daily life. Our interpretation of this result might be that yoga was an enjoyable activity for preschool aged children which effected their behavior which made parent-child interactions more pleasant. As a result, children felt happier and this might have resulted in experiencing higher positive affect. However, we should approach to this result cautiously because of the fact that the cross-over interaction was a result of intervention and control groups switching scores between pre- and post-test. That is, the control group's absolute mean score at post-test decreased to the pre-test yoga group's score; whereas, the yoga group's absolute mean score at post-test increased to the score that the control group had in pre-test. Therefore, it is likely that these changes reflect normal variability in this measure and that the significant effect is an artifact of measurement variability.

The discussion up to this point has concerned results that compared the yoga and control groups. However, we also had hypotheses and results for just the yoga group.

The first one is our expectation that children who had higher engagement levels during the yoga activity, would benefit more from the intervention. However, this hypothesis was not confirmed by our analyses. However, we conducted our analysis 22 children. This also suggests that even there are meaningful differences for level of engagement we had insufficient power to detect it. Having a larger sample size would have provided more power in order to make more definitive conclusions about how engagement relates to intervention effects.

Another hypothesis was that children who enjoyed the yoga activity more would benefit more from the intervention; however, since there were only 3 children who reported that they did not enjoy the yoga activity we could not conduct any analysis. In addition to having a larger sample, future research could also use a child friendly Likert-scale with more options than 'yes' and 'no'. The last hypothesis was to see the effect of pre-test EF performance on the intervention. Specifically, we expected to see those children who were least developed on EF tasks to benefit the most from the intervention. However, this expectation was not confirmed by our results eventhough another preschool yoga study has revealed evidence for that hypothesis (Razza et al., 2015)

Besides the balloon task we did not have any other intervention effects for our target measures. There are two general possibilities for this lack of intervention effects. The first one is that there were problems with the methodology of the study which includes intervention design and testing aspects. The second reason is that the duration and intensity of the intervention was insufficient
to elicit effects. We argue below that it is the latter possibility that is most likely.

4.3 Strengths of the Intervention

We argue that the current study has a strong methodology both in terms of intervention design and testing aspects. One of the most important aspects of the study is that it was conducted by a certified adult and kids yoga instructor whom also had a certification in mindfulness. Also, the yoga instructor was not a teacher from the preschool which means she had no prior knowledge of the children and did not evaluate them. One study conducted a yoga intervention on preschoolers using a curriculum designed by an occupational therapist (Lawson & Blackwell, 2012); and another one conducted a study with the existing preschool teacher who also had a certification on yoga (Razza et al., 2015). In addition to this, the intervention was conducted with age specific classes in which every class included an equal number of children.

A third strength of the intervention is that it had a structured curriculum that was created by the instructor and applied in the same way for every group of children. The curriculum emphasized the mindfulness aspect of yoga as mindful movement and included all aspects of yoga including: sun salutations, yoga asanas, short meditations, breathing activities, and savasana. Thus, both the mindfulness and the yoga were applied at the same time using different kinds of themes for each week. This gives a strength to the present study by making it replicable and by maintaining fidelity. For all of these reasons, we argue that the methodology of the current study included a strong intervention design and, therefore, that the lack of intervention effects was not due to the design of the intervention.

4.4 Strengths of the Testing

The second aspect of methodology is the testing part. The first reason for why we argue that the testing contributed to a strong methodology is because we had blind testers. That is, the yoga instructor that conducted the intervention did not do the testing. Thus, testers were not included in the intervention program and did not have specific knowledge about the children or which group they were in. Further, the testers underwent extensive training by the main researcher prior to data collection. The training included how to administer all of direct child measures (DCCS, day-night, balloon, statue, HTKS and marsmallow tasks) and all of the relevant information about how to test preschoolers. In addition to testing, children's engagement levels were coded by additional independent research assistants who were not included in the testing of children.

Another aspect of the testing that contributed to a strong methodology was having both indirect and direct measures. The indirect teacher reported measures focused on EF. These measures were completed by children's preschool teachers but not by the yoga instructor which excluded any experimenter bias on these evaluations. Indirect mother reported measures were focused on EF and effortful control. Also, the direct child measures included both cool EF (i.e., cognitive flexibility, inhibitory control, working memory, and motor control) and hot EF measures (i.e., delay of gratification). Because of these advantages for the testing aspects of the methodology we argue that the lack of intervention effects was not due to how the testing was conducted.

4.5 Limitations and Future Directions

Other than the working memory aspect of EF and positive affect we could not find any intervention effects on children's self-regulatory abilities. There might be several limitations behind this result. For this section, I will focus on the low sample size, short duration, and low intensity of the intervention as major limitations for the current study and focus on how future studies can develop these.

The first limitation is common for many interventions that are conducted in early childhood (Emerson et al., 2017; Razza et al., 2015; Wood et al., 2018). We had a limited sample of participants which might mean that we were unable to detect effects from the intervention. A larger sample size, especially for 36-60 month old children, would be helpful to draw more reliable conclusions about the potential effects of a yoga intervention on self-regulation.

Second, the literature puts an emphasis on the duration of interventions as another common limitation (Lawson & Blackwell, 2012; Thanasetkorna et al., 2015; Wood et al., 2018) Duration has two aspects for the current study; duration of the intervention itself and the duration between pre and post-testing times. For the current study, the duration of the intervention was 3 months (12 weeks). Within the literature, there are studies conducted with preschoolers that are less than 12 weeks; Lawson and Blackwell's study lasted for 6 weeks; Thanasetkorna et al.'s (2015) study lasted for 9 weeks; and Wood et al.'s study lasted for 6 weeks as well as those that are more than 12 weeks; Razza et al.'s (2015) study lasted for 6 months. Because of the practical demands, we could not make our intervention longer (i.e. 6 months or a full school

year for just yoga group); whereas, our results are supporting the idea that 3 months is not enough to produce developments in EF.

In addition to this, duration was also problem for us because of the school in which the intervention was conducted. The school included low to middle SES households and teacher participants. The average age of the teachers was 50 and average education level was open university. This effected the day-to-day activities in the school and meant that it took a while to get children used to a structured yoga activity. The extra time need for this also supports the idea of having a longer duration.

The second aspect of duration was the time between when pre- and post-testing were conducted. Yoga is a discipline which works on the integrity of body and mind and it directs attention on the body and breathing so that it can improve self-regulation abilities in the long run (Gothe et al., 2013). The 3 month duration between pre- and post-test may not have been long enough for preschoolers. Given the longer-term changes yoga is supposed to produce on self-regulation, there may be *sleeper effects* that would be revealed if follow-up testing was conducted again after the intervention was over (i.e., sometime after the intervention had been conducted or later in life Seitz, 1981; Barnett, 2011). Some studies from various intervention programs have revealed *sleeper effects*; one meta-analytical review revealed long-term effects of school-based social, emotional, and behavioral programs on children's academic performances, antisocial behavior, and substance abuse (Sklad, Diekstra, Ritter, Ben, & Gravesteijn, 2012). Another study which included both children and their mothers revealed better narrative skills one year after the intervention was conducted

(Peterson, Jesso, & Mccabe, 1999). Finally, a Head Start program oriented article mentioned the possible long-term effects of the program via having the evidence of short-term effects (Ludwig & Phillips, 2008). However, since we did not have the chance to conduct follow-up analysis, we were not able to test for such effects.

Third, the intensity of an intervention can make a difference in terms of its effectiveness. Intensity concern the amount of time that we conducted yoga over the intervention duration of 3 months. For the current study, this was 75 minutes in total every week for each age group. It may be that 75 minutes of yoga per week is insufficient to observe the effect of yoga on EF. Other yoga intervention studies have been conducted in various ways. Lawson and Blackwell's (2015) study was lasted for 6 weeks; 10 minutes of a video; *Yoga Reflex Integration,* for four days in a week followed by a motor activity. Results of this study revealed limited effects of this program on preschoolers' fine motor activities. Razza et al.'s (2015) study lasted for 6 months; increasing the amount of yoga within each day as the intervention proceeded such that they started with 10 minutes per day, each day of the week in fall semester and increased it to 30 minutes in spring semester. Results of this study revealed that the yoga group developed in terms of attention and inhibition aspects of self-regulation. Another pilot study which was mainly about mindfulness activities conducted on preschoolers lasted for 6 weeks; twelve lessons in total (2 per week) and each class lasted for 25 minutes. Indirect measures that were collected from parents and teachers revealed mostly nonsignificant results as well. Thus, relative to the literature, our intervention was not shorter per day/week than some other but the longer interventions had more robust results.

Shorter but more intense interventions were also conducted on school-aged children. One study conducted yoga for 10 days 8 hours of yoga was conducted by Manjuanth and Telles, 2004; another one conducted yoga for 8 weeks 60 minutes yoga per week with 10 minutes of yoga homeworks for the other 6 days of the week (White, 2012); and another one conducted yoga for 1 week 75 minutes of yoga per day (Manjuanth & Telles, 2001). Thus, we might also have more intense studies on preschoolers' to see the effect for yoga. In this way, children could get both longer yoga sessions (more intense) for a longer duration (length of the intervention). For the current study, because of the practical demands (i.e., not being able to change the school program according to the intervention) we could not have more yoga sessions in a week.

In sum, there is the possibility that a 3 month yoga intervention done for 75 minutes per week is not enough to see the effects on self-regulation. Thus, a longer and more intense intervention should probably be done to better evaluate the effect of mindful yoga on preschoolers' self-regulation. As a way to increase intensity, the intervention could be integrated into the school curriculum. This could also have a home component which might work better to integrate mindfulness and yoga into children's lives. Aspects of the curriculum could include savasana sessions, guided imagery depending on the age of the child, and breathing activities before sleeping time, mindful tasting in lunch time, mindful listening in music lessons or guided short mediatations in the times that children can attend on certain objects, and yoga asanas in the morning with mindful commands etc. Having these activities throughout the day will help us to nurture mindfulness in childhood considering the fact that they need different kind of activities to understand mindfulness and yoga anyways (Greenberg & Harris, 2012).

Although we measured many aspects of EF (cognitive flexibility, interference control, working memory, motor control as well as inhibitory motor control, delay of gratification, planning, regulation, and social ability) we had no direct measure of attention. Mindfulness and yoga involve focusing on the moment via movement, breathing, and meditation; and, attention is a central component of such practices. Yoga has been shown to improve the attention and concentration of 18-22 year old medical students after doing 12 weeks of yoga (Joice, Manik & Sudhir, 2018). Thus, yoga might show benefits on attention and concentration of children too and having an attention task may benefit future studies.

4.6. Conclusions

Despite these limitations, to our knowledge, preschool yoga studies have not been conducted in a structured way that involves a curriculum designed by a certified mindfulness and yoga instructor (for the general structure of the current study see Table 1). In addition to being structured, the content of mindfulness and yoga changed every week in terms of theme which included nature and emotions. These themes were added to have a comprehensive mindfulness intervention. Thus, we argue that having a structured curriculum that is applied on all participants increases the fidelity and replicability of the intervention.

In addition to its structured design, this study is the first mindfulness based yoga study on preschoolers in Turkey. Most of the literature is dominated by studies that are done in India. Since yoga and meditation has a special meaning and history for Indian culture at large, the results of their studies might differ from the ones that are done with different cultures (Greenberg & Harris, 2012). While other studies have

been done in Western cultures, it is important to conduct a study in a culture that has both Eastern and Western aspects. Having the intervention in Turkey allowed us to see the effects of yoga on preschoolers in a different culture and context. More studies are needed to see if the effects in the current study are robust and how mindfulness based yoga effects self-regulation in a diversity of cultures.

Since self-regulation has an important effect on the academic and social developments of children, the current study is important. It is important to know if self-regulation can be promoted through a mindfulness based yoga program with preschoolers. Further studies are needed to see whether the effect that is present in early childhood extends into the preschool years. Ultimately, longitudinal studies with interventions that are integrated into the school-day and that last for longer durations will be needed to see the full potential of mindful yoga in the long run.

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APPENDICES

APPENDIX A: DEMOGRAPHIC FORM

Ebeveyn Demografik Bilgi Formu Tarih:

Araştırmamıza destek verdiğiniz için teşekkür ederiz. Lütfen soruları verilen sıraya göre cevaplayınız.

1. Adınız ve soyadınız:
2. Yaşınız:
3. Çalışmaya katılan çocuğunuzun adı:
4. Çocuğunuzla olan yakınlığınız :

   [ ] Anne

   [ ] Baba

   [ ] Diğer:

5. Çocuk sayısı:

6. Çocuğunuzun/çocuklarınızın ad(ları): Çocuğunuzun/çocuklarınızın Doğum tarihi:

   _____ _____

   _____ _____

   _____ _____

7. Çocuklarınızın bakımında destek aldığınız kişiler var mı? Evet [ ] Hayır [ ]

Cevabınız evet ise, bu kişi/kişiler kimdir?

[ ] Eşiniz

[ ] Anneniz/Kayınvalideniz

[ ] Bakıcı

[ ] Diğer:

8. Eğitim durumunuz nedir?

[ ]Okuryazar değil

[ ] İlköğretim

[ ] Ortaokul

[ ] Lise

[ ] Üniversite

[ ] Yüksek Lisans

[ ] Doktora

[ ] Diğer:

9. İş durumunuz:

[ ] Tam zamanlı çalışmaktayım

[ ] Yarı zamanlı çalışmaktayım

[ ] Evden yürütmekteyim

[ ] Şu anda çalışmamaktayım

[ ] Okula devam etmekteyim

10. Eşiniz ile birlikte mi yaşıyorsunuz? Evet [ ] Hayır [ ]

Cevabınız evet ise, ne kadar süredir birlikte yaşıyorsunuz?

[ ] 0-2 yıl

[ ] 3-5 yıl

[ ] 6-10 yıl

[ ] 11-20 yıl

[ ] 21 ve üzeri

11. Eşinizin yaşı:

12. Eşinizin eğitim durumu nedir?

[ ] Okuryazar değil
[ ] İlköğretim
[ ] Ortaokul
[ ] Lise
[ ] Üniversite
[ ] Yüksek Lisans
[ ] Doktora
[ ] Diğer:

13. Eşinizin işi:

[ ] Tam zamanlı çalışmakta
[ ] Yarı zamanlı çalışmakta
[ ] İslerini evden yürütmekte
[ ] Şu anda çalışmamakta
[ ] Okula devam etmekte

14. Evinizin aylık gelir düzeyi:

[ ] 1.600 TL`den az
[ ] 1.601 TL - 3.500 TL
[ ] 3.501 TL - 5.500 TL
[ ] 5.501 TL - 7.500 TL
[ ] 7.501 TL`den fazla

15. Evinizin aylık gelir düzeyini nasıl değerlendirirsiniz?

[ ] Düşük
[ ] Orta seviyede
[ ] İyi seviyede
[ ] Çok iyi seviyede

16. Çocuğunuzun alerjik olduğu herhangi bir madde/ürün/yiyecek var mıdır?

    [ ] Evet

    [ ] Hayır

    Eğer cevabınız evet ise, alerjik olduğu madde/maddeleri yazınız:

17. Bilinçli farkındalık (mindfulness) kavramını önceden duymuş muydunuz?

    [ ] Evet

    [ ] Hayır

Bu sorudaki cevabınız evet ise, 18., 19. ve 20. soruları yanıtlayınız, değilse 21. sorudan devam ediniz

18. Bilinçli farkındalık (mindfulness) kavramı sizin için bir şey ifade ediyor mu? Ediyorsa, lütfen ne ifade ettiğini açıklayınız.

    [ ] Evet

    [ ] Hayır

19. Bilinçli farkındalık (mindfulness) kavramını günlük yaşantınızda uyguluyor musunuz?

    [ ] Hiç uygulamıyorum

    [ ] Biraz uyguluyorum

    [ ] Bazen uyguluyorum

    [ ] Çoğunlukla uyguluyorum

    [ ] Herzaman uyguluyorum

20. Çocuğunuzla olan iletişiminizde mindful (bilinçli farkındalıklı) olduğunuzu düşündüğünüz zamanı/zamanları işaretleyiniz.

    [ ] Birlikte oyun oynarken
    [ ] Birlikte yemek yerken/ ya da çocuğunuza yemek yedirirken
    [ ] Çocuğunuzla sohbet ederken
    [ ] Birlikte anaokuluna giderken/dönerken
    [ ] Diğer:

21. Kendi yaşantınızda herhangi bir spora yer veriyor musunuz?

    [ ] Evet
    [ ] Hayır

Eğer bu soruya cevabınız evet ise 22. ve 23. Soruları yanıtlayınız.

22. Haftalık spor sürenizi değerlendirecek olursanız aşağıdaki seçeneklerden hangisi sizin için uygun olur?

    [ ] 1 saatten az
    [ ] 1-3 saat
    [ ] 3-5 saat
    [ ] 5-7 saat
    [ ] 7 saat ve üzeri

23. Lütfen aşağıdaki spor seçeneklerinden uyguladığınızı/uyguladıklarınızı işaretleyiniz.

    [ ] Tempolu yürüyüş
    [ ] Fitness
    [ ] Futbol
    [ ] Basketbol/Voleybol
    [ ] Tenis/Squash
    [ ] Pilates
    [ ] Yoga
    [ ] Diğer:

Eğer 23. Soruya cevabınız/cevaplarınızdan biri yoga ise, 24. soruyu yanıtlayınız, değilse 25. sorudan devam ediniz.

24. Yoga pratiğinizde aşağıdakilerden hangisi/hangilerine yer veriyorsunuz?

[ ] Yoga pozları
[ ] Nefes çalışmaları
[ ] Meditasyon

25. Yoganın çocuklar üzerinde uygulanabileceğini düşünüyor musunuz?

[ ] Evet
[ ] Hayır

26. Yoga çocuklar üzerinde uygulandığında faydalı olacağını düşünüyor musunuz?

[ ] Evet
[ ] Hayır

Eğer 26. soruya cevabınız evet ise 27. soruyu yanıtlayınız.

Yoganın çocuklar üzerinde ne gibi faydası/faydaları olabileceğini düşünüyorsunuz?
[ ] Hareket etmelerini sağlar
[ ] Sakinleşmelerini sağlar
[ ] Stres seviyelerini azaltır
[ ] Hayalgüçlerini genişletir
[ ] Farkındalıklarını arttırır
[ ] Dikkat seviyelerini arttırır
[ ] Enerjilerini atmalarını sağlar
[ ] Diğer:

Lütfen tüm soruları cevapladığınıza emin olunuz. Yardımlarınız için çok teşekkür ederiz!

APPENDIX B: CHILDREN'S BEHAVIOUR QUESTIONNAIRE

Lütfen başlamadan önce dikkatlice okuyunuz.

Sonraki sayfalarda çocuğunuzun çeşitli durumlardaki tepkilerini tanımlayan çeşitli ifadelerle karşılaşacaksınız. Bu durumlar karşısında sizin çocuğunuzun tepkisinin nasıl olacağını belirtmenizi istiyoruz. Elbette, "doğru" tepki diye bir şey yoktur, çocuklar çok farklı şekilde tepki gösterebilirler ve biz de bu farklılıkların neler olduğunu öğrenmeye çalışıyoruz. Lütfen her ifadeyi okuyup onun, çocuğunuzun "geçtiğimiz altı ay içinde" benzer durumlardaki tepkisini "doğru" mu "yanlış" mı ifade ettiğine karar veriniz.

Eğer bu ifade;

çocuğunuz için tamamıyla yanlışsa 1'i

çocuğunuz için çoğunlukla yanlışsa 2'yi

çocuğunuz için kısmen yanlışsa 3'ü

çocuğunuz için ne doğru ne yanlışsa 4'ü

çocuğunuz için kısmen doğruysa 5'i

çocuğunuz için çoğunlukla doğruysa 6'yı

çocuğunuz için tamamıyla doğruysa 7'yi

daire içine alınız.

Eğer çocuğunuzda böyle bir durumla karşılaşmamışsanız ve bu nedenle o maddeyi yanıtlayamıyorsanız uygun değil (UD) şıkkını daire içine alınız.

Lütfen <u>her durum</u> için bir rakamı ya da uygun değil şıkkını daire içine aldığınızdan emin olunuz.

1. Bir yerden başka bir yere giderken her zaman çok aceleci ve telaşlıdır.

   l 2 3 4 5 6 7 UD

2. Yatağa gitmesi gerektiği söylendiğinde sinirlenir.

   l 2 3 4 5 6 7 UD

3. Canı kolay yanmaz.

   l 2 3 4 5 6 7 UD

4. Yüksek kaydıraklardan kaymak gibi maceralı etkinliklerden hoşlanır.

   l 2 3 4 5 6 7 UD

5. Dokunduğu nesnelerin düzgün veya pürüzlü olduğunun farkına varır.

   l 2 3 4 5 6 7 UD

6. Heyecanlı bir olaydan önce öylesine telaşlanır ki yerinde duramaz.

   l 2 3 4 5 6 7 UD

7. Genellikle düşünmeden hemen harekete geçer.

   l 2 3 4 5 6 7 UD

8. En sevdiği oyuncak kaybolduğunda veya kırıldığında içli içli ağlar.

   l 2 3 4 5 6 7 UD

9. Hava soğuk veya nemli olduğunda biraz rahatsız olur.

   l 2 3 4 5 6 7 UD

10. O kadar çılgınca ve dikkatsizce oynamayı sever ki yaralanabilir.

l 2 3 4 5 6 7 UD

11. Hemen hemen herkesin yanında rahattır.

l 2 3 4 5 6 7 UD

12. Odadan odaya yürümek yerine koşmayı tercih eder.

l 2 3 4 5 6 7 UD

13. Ebeveynleri yeni kıyafet giydiklerinde farkına varır.

l 2 3 4 5 6 7 UD

14. İstediği bir şey olmadığında öfke nöbeti geçirir.

l 2 3 4 5 6 7 UD

15. Yaptığı şeylere büyük hayranlık duyar.

l 2 3 4 5 6 7 UD

16. Bir işle uğraşırken zihnini o iş üzerinde tutmakta zorlanır.

l 2 3 4 5 6 7 UD

17. Hırsız veya "öcü"lerden korkar.

l 2 3 4 5 6 7 UD

18. Dışarıdayken, çoğunlukla sessizce oturur.

l 2 3 4 5 6 7 UD

19. Komik öykülerden hoşlanır fakat genelde onlara gülmez.

l 2 3 4 5 6 7 UD

20. Ailesinin planları yolunda gitmezse üzülür.

l 2 3 4 5 6 7 UD

21. Bir işi bitirmeden diğer işe geçer.

l 2 3 4 5 6 7 UD

22. Evde oynarken yerinde duramaz (koşar, zıplar, tırmanır).

l 2 3 4 5 6 7 UD

23. Yüksek sesten korkar.

l 2 3 4 5 6 7 UD

24. Alçak sesleri bile dinler.

l 2 3 4 5 6 7 UD

25. Heyecan verici bir etkinlikten sonra sakinleşmekte güçlük çeker.

l 2 3 4 5 6 7 UD

26. Ilık banyo yapmaktan hoşlanır.

l 2 3 4 5 6 7 UD

27. Bazı görevleri başaramadığında üzülür.

l 2 3 4 5 6 7 UD

28. Sıklıkla yeni ortamlara atılır.

l 2 3 4 5 6 7 UD

29. Ufak bir kesik ya da yaralanmada bir hayli üzülür.

l 2 3 4 5 6 7 UD

30. Yapmak istediği bir şeyden alıkonulduğunda hayal kırıklığı yaşar.

l 2 3 4 5 6 7 UD

31. Ziyarete gelen sevdiği akrabalarının veya arkadaşlarının gitmeye hazırlanmaları, onu mutsuz eder.

l 2 3 4 5 6 7 UD

32. Ebeveyni dış görünümünü değiştirdiğinde, yorum getirir.

l 2 3 4 5 6 7 UD

33. Kovalamacılık gibi hareketli oyunlardan hoşlanır.

l 2 3 4 5 6 7 UD

34. Bir şeye sinirlendiğinde en az 10 dakika kızgın olur.

l 2 3 4 5 6 7 UD

35. Karanlıktan korkmaz.

l 2 3 4 5 6 7 UD

36. Yeni durumlara alışması uzun zaman alır.

l 2 3 4 5 6 7 UD

37. Uzun zamandır tanıdığı insanlar arasında bile bazen çekingendir.

l 2 3 4 5 6 7 UD

38. İstenirse, yeni etkinliklere geçmeden önce bekleyebilir.

l 2 3 4 5 6 7 UD

39. Ebeveyninin veya bakıcısının yanına sokulmaktan hoşlanır.

l 2 3 4 5 6 7 UD

40. Oynamak istediği şeyi bulamazsa kızar.

I 2 3 4 5 6 7 UD

41. Ateşten korkar.

l 2 3 4 5 6 7 UD

42. Bazen yeni tanıştığı yetişkinlerle konuşurken huzursuz görünür.

l 2 3 4 5 6 7 UD

43. Ne yapacağına karar verirken yavaştır ve acele etmez.

l 2 3 4 5 6 7 UD

44. Üzgünken, birkaç dakika içinde daha iyi hissetmeye başlayabilir.

l 2 3 4 5 6 7 UD

45. Gezmeye gitmeden önce ihtiyaçlarını hazırlar.

l 2 3 4 5 6 7 UD

46. Gezi planı yaparken çok heyecanlanır.

L 2 3 4 5 6 7 UD

47. Oturma odasındaki bazı yeni nesneleri hemen farkeder.

l 2 3 4 5 6 7 UD

48. Diğer çocuklarla oynarken neredeyse hiç kahkaha atmaz.

l 2 3 4 5 6 7 UD

49. Küçük kesik ve yaralara çok üzülmez.

l 2 3 4 5 6 7 UD

50. Hareketli oyunlara kıyasla sakin etkinlikleri tercih eder.

l 2 3 4 5 6 7 UD

51. Aklına gelen ilk şeyi durup düşünmeden hemen söyler.

l 2 3 4 5 6 7 UD

52. Yeni tanıdığı insanların yanında utangaçtır.

l 2 3 4 5 6 7 UD

53. İstendiğinde, sakince oturmakta zorlanır (Sinemada, otobüste vs.).

l 2 3 4 5 6 7 UD

54. Üzücü bir öykü duyduğunda pek ağlamaz.

l 2 3 4 5 6 7 UD

55. Bazen kendi kendine oynarken gülümser veya kıkırdar.

l 2 3 4 5 6 7 UD

56. Televizyondaki üzücü bir olaydan pek etkilenmez.

l 2 3 4 5 6 7 UD

57. Kendisiyle sadece konuşulması bile hoşuna gider.

l 2 3 4 5 6 7 UD

58. Gezmeye gitmeden önce çok heyecanlanır (Piknik, parti).

l 2 3 4 5 6 7 UD

59. Üzgün olduğunda, başka bir şey düşünerek çabucak neşelenir.

l 2 3 4 5 6 7 UD

60. Çocuklara oyun oynamayı rahatça teklif eder.

l 2 3 4 5 6 7 UD

61. Yatağa gitmesi gerektiği söylendiğinde pek olumsuz tepki vermez.

l 2 3 4 5 6 7 UD

62. Resim yada boyama yaparken çok iyi yoğunlaşır.

l 2 3 4 5 6 7 UD

63. Karanlıktan korkar.

l 2 3 4 5 6 7 UD

64. Küçücük bir incinmede bile ağlamaya yatkındır.

l 2 3 4 5 6 7 UD

65. Resimli kitaplara bakmaktan hoşlanır.

l 2 3 4 5 6 7 UD

66. Üzüldüğünde, kolaylıkla yatıştırılır.

l 2 3 4 5 6 7 UD

67. Yönergeleri (Dur!, Geri gön!, Sağa dön! vs. gibi) takip etmede iyidir.

I 2 3 4 5 6 7 UD

68. Televizyondaki veya sinemadaki "canavarlardan" pek korkmaz.

l 2 3 4 5 6 7 UD

69. Salıncakta sallanırken yükseğe çıkmayı ve hızı sever.

l 2 3 4 5 6 7 UD

70. Bazen yeni girdiği ortamlardan utangaççа ayrılır.

l 2 3 4 5 6 7 UD

71. Bir şey oluştururken veya bir şeyleri bir araya getirirken yaptığı işe odaklanır ve uzun süre ilgilenir.

l 2 3 4 5 6 7 UD

72. Kendisine şarkı söylenilmesini sever.

l 2 3 4 5 6 7 UD

73. Tehlikeli olduğu söylenen yerlere yavaş ve dikkatlice yaklaşır.

l 2 3 4 5 6 7 UD

74. Bir şeyi çalıştırmakta zorlansa da cesareti pek kırılmaz.

I 2 3 4 5 6 7 UD

75. Kızdığında sakinleştirilmesi çok zordur.

l 2 3 4 5 6 7 UD

76. Tekerlemelerde olduğu gibi ahenkli sesleri sever.

l 2 3 4 5 6 7 UD

77. Sevdiği insanlara hep gülümser.

l 2 3 4 5 6 7 UD

78. Kaba ve gürültülü oyunları sevmez.

l 2 3 4 5 6 7 UD

79. Diğer çocuklarla oynarken genelde yüksek sesli kahkahalar atar.

l 2 3 4 5 6 7 UD

80. Televizyon ya da sinema komedileri seyrederken pek kahkaha atmaz.

l 2 3 4 5 6 7 UD

81. Hayır dendiğinde yaptığı şeyi kolayca bırakabilir.

l 2 3 4 5 6 7 UD

82. Yeni bir etkinliği neredeyse en son deneyen çocuktur.

l 2 3 4 5 6 7 UD

83. Parfüm, sigara ya da yemek kokusu gibi kokuları genelde farketmez.

l 2 3 4 5 6 7 UD

84. Bir öykü dinlerken dikkati kolayca dağılır.

l 2 3 4 5 6 7 UD

85. Akşamları bile enerji doludur.

l 2 3 4 5 6 7 UD

86. Ebeveyninin kucağında oturmaktan hoşlanır.

l 2 3 4 5 6 7 UD

87. Oyun oynamayı bırakması istendiğinde sinirlenir.

l 2 3 4 5 6 7 UD

88. Hızlı ve korkusuzca bisiklete binmekten hoşlanır.

l 2 3 4 5 6 7 UD

89. Bazen resimli kitaplara dalıp gider ve uzun süre onlara bakar.

l 2 3 4 5 6 7 UD

90. Dondurma gibi bir tatlı teklif edildiğinde sakinliğini korur.

l 2 3 4 5 6 7 UD

91. Soğuk algınlığı geçirirken çok zor şikayet eder.

l 2 3 4 5 6 7 UD

92. Ailesiyle dışarı çıkmayı ister ama buna pek heyecanlanmaz.

l 2 3 4 5 6 7 UD

93. Sessizce oturup insanların yaptıklarını seyretmeyi sever.

l 2 3 4 5 6 7 UD

94. Sallanmak gibi sakin ritmik etkinliklerden hoşlanır.

l 2 3 4 5 6 7 UD

Lütfen tüm soruları cevapladığınıza emin olunuz. Yardımlarınız için çok teşekkür ederiz.

APPENDIX C: CHILDHOOD EXECUTIVE FUNCTIONING INVENTORY

Aşağıda, bir dizi ifadeler bulacaksınız. Lütfen, her ifadeyi dikkatlice okuyunuz ve sonra o ifadenin çocuğunuz için **ne kadar doğru** olduğunu belirtiniz. Cevabınızı, her ifadeden sonra yer alan sayılardan (1'den 5'e kadar) **birini** işaretleyerek gösteriniz. Lütfen **her soruya** yanıt verdiğinizden emin olunuz.

Katılımınız için teşekkür ederiz.

Kesinlikle doğru değil **1**	**Doğru değil** **2**	**Kısmen doğru** **3**	**Doğru** **4**	**Kesinlikle doğru** **5**

1. Uzun talimatları hatırlamakta zorluk yaşar.	1	2	3	4	5
2. Yapmak istemediği bir şeyi yapmak konusunda kendini **nadiren** motive edebilir.	1	2	3	4	5
3. Bir etkinliğin ortasındayken, ne yapıyor olduğunu hatırlamada zorluk yaşar.	1	2	3	4	5
4. Yapması için bir ödül vaat edilmezse, daha az ilgisini çeken görevleri tamamlamakta zorluk yaşar.	1	2	3	4	5
5. İlk olarak ne olabileceği hakkında düşünmeden bir şeyleri yapma eğilimi vardır.	1	2	3	4	5
6. Birkaç işi yapması istenildiğinde sadece ilk veya sonuncu olarak yapılması isteneni hatırlar.	1	2	3	4	5
7. Takıldığı zamanlarda, bir sorunu farklı yollarla çözmekte zorluk yaşar.	1	2	3	4	5
8. Bir işin yapılması gerektiğinde, sıklıkla, daha ilgi çekici bir şeyden dolayı dikkati dağılır.	1	2	3	4	5

9. Gidip alması istenen şeyi kolayca unutur.	1	2	3	4	5
10. Özel bir durum (örn; okul gezisine gitmek, bir eğlenceye gitmek vb.) olacağı zaman aşırı derecede heyecanlanır.	1	2	3	4	5
11. Sıkıcı bulduğu işleri yapmada belirgin zorluk yaşar.	1	2	3	4	5
12. Bir etkinliği planlamada zorluk yaşar (Örn; okul gezisi veya okul için gerekli olan malzemeleri getirmeyi hatırlamak gibi).	1	2	3	4	5
13. Söylenilmesine rağmen, kendini tutmakta veya zapt etmekte zorluk yaşar.	1	2	3	4	5
14. Birçok adımdan oluşan etkinlikleri devam ettirmekte zorluk yaşar (Örn; küçük çocuklar için, hatırlatılmadan tüm kıyafetlerini giyebilmek; büyük çocuklar için tüm ev ödevlerini kendi başına yapabilmek).	1	2	3	4	5
15. Konsantre olabilmesi (dikkatini verebilmesi) için verilen görevi ilgi çekici bulması gerekir.	1	2	3	4	5
16. Uygun olmayan durumlarda, gülümsememek veya gülmemek için kendini tutmakta zorlanır.	1	2	3	4	5
17. Başkalarının kolayca anlayacağı şekilde, olmuş bir olay hakkında hikaye anlatmakta zorlanır.	1	2	3	4	5
18. Durdurulması söylendikten **hemen sonra** bir etkinliği durdurmakta zorlanır. Örneğin durdurması istendikten sonra birkaç kez daha zıplar veya bilgisayarda bir süre daha oynar.	1	2	3	4	5
19. *Nasıl* yapıldığı ayrıca **gösterilmediği** sürece sözlü talimatları anlamakta zorlanır.	1	2	3	4	5
20. Birkaç adımı içeren işlerde ya da etkinliklerde zorluk yaşar.	1	2	3	4	5
	1	2	3	4	5

21. İleriyi düşünme veya deneyimlerinden ders çıkarmada zorluk yaşar.					
22. Bir grup içinde, diğer çocuklar ile karşılaştırıldığında daha haşarı şekilde davranır (Örn; Bir doğum günü partisinde veya grup etkinliği sırasında).	1	2	3	4	5
23. Geriye doğru sayma gibi zihinsel çaba gerektiren görevleri yapmakta zorlanır.	1	2	3	4	5
24. Bir işle uğraşırken başka şeyleri aklında tutmakta zorlanır.	1	2	3	4	5
25. Nispeten basit görevleri yerine getirirken dahi sesli düşünür.	1	2	3	4	5
26. Aynı yaştaki akranları ile karşılaştırıldığında, zaman kavramını anlamakta zorlanır.	1	2	3	4	5

Her soruyu cevapladığınızdan emin olunuz. Katılımınız için teşekkür ederiz.