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Jennifer K. Ishaq
Cleveland State University

SCHOOL-BASED YOGA INTERVENTION PROGRAMS:

PROMOTING SELF-REGULATION AND ADAPTIVE FUNCTIONING OUTCOMES

JENNIFER K. ISHAQ

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We hereby approve this thesis for

JENNIFER K. ISHAQ

Candidate for the Master of Arts in Clinical Psychology degree

for the Department of Psychology

And

CLEVELAND STATE UNIVERSITY'S

College of Graduate Studies by

Thesis Chairperson, Elizabeth Goncy, Ph.D.

Psychology, 5/6/2021
Department & Date

Methodologist, Shereen Naser, Ph.D.

Psychology, 5/6/2021
Department & Date

Thesis Committee Member, Colleen McMahon, Ph.D.

Psychology, 5/6/2021
Department & Date

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ABSTRACT

Self-regulation deficits in childhood are related to difficulty focusing, aggressive behavior, and poor communication and coping skills. In contrast, strong self-regulation skills are associated with better adaptive functioning outcomes including stronger academic performance, social competence, and stress management, which may act as a protective factor for adverse outcomes in adulthood. A promising intervention to address self-regulatory deficits is school-based mindfulness and yoga programs. Mindful yoga practice can promote the ability to focus better, avoid fights, and calm down.

With use of archival data, the present study aimed to analyze changes in student's self-regulation and adaptive functioning outcomes post school-based yoga intervention. Adaptive functioning outcomes were measured by student reported benefits in the abilities to focus or pay attention better, avoid fights, and calm down when upset. The study explored whether student use of yoga at home influenced self-regulation changes.

Results did not support positive changes overall in self-regulation after a school-based yoga program or the influence of self-regulation change scores on adaptive functioning outcomes. Our study did support the influence of yoga at home and higher changes in self-regulation and self-reported benefits to adaptive functioning outcomes. Younger children were more likely to report greater benefits in adaptive functioning outcomes. No gender differences were found in self-regulation or adaptive functioning outcomes.

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CHAPTER I

INTRODUCTION

Deficits in self-regulation may lead to difficulty focusing, poor communication and coping skills, and aggressive behavior. Lower self-regulation in childhood is related to greater adverse outcomes in adulthood including health problems, substance abuse, criminal convictions, and lower income (Montroy et al., 2016; Moffitt et al., 2011). Self-regulation skills cultivated in early childhood may lead to less adverse outcomes in adulthood. Strong self-regulation skills during childhood are additionally associated with better adaptive functioning outcomes including stronger academic performance, social competence, and stress management skills (Buckner et al., 2009; Vohs & Ciarocco, 2004). A promising intervention to promote self-regulation and address deficits involve mindfulness and yoga practice.

Yoga practice may strengthen the mechanisms of self-regulation that promote positive change and adaptive functioning in children (Shapiro et al., 2006; Zelazo & Lyons, 2012); specifically, one's ability to focus or pay attention, avoid fights, and calm down when upset, (Bergen-Cico et al., 2015; Buckner et al., 2009). Mindful yoga is "quieting the mind through physical activity" (Gordon, 2013) and has an additional advantage of hands-on and interactive involvement. Teaching children yoga practice can

be engaging and provide long-term improvements in self-regulatory abilities. Schools serve as an advantageous setting for program implementation of yoga to promote self-regulation and adaptive functioning. School-based implementation allows all children—with no discrimination based on intelligence, age, gender, or SES—to receive potential benefits associated with such programs.

Existing interventions, such as social-emotional learning programs (SEL), have been effective at promoting positive social behaviors and better management of conduct problems among children and adolescents (Durlak et al., 2011). Students who participated in a yoga program involving one to two weekly practices reported benefits of yoga including increased self-regulation, mindfulness, self-esteem, physical conditioning, academic performance, and stress reduction (Wang & Higgins, 2016). Yoga provides an additional benefit of physical activity and skills that students can continue to use at home and throughout their lives to cultivate self-regulation and adaptive functioning. Community organizations are working to adapt yoga into a secular SEL program for school implementation as a response to opposition from religious communities (Brown, 2019) and arguments that yoga promotes Eastern culture and religion (Gordon, 2013).

Using archival data, the present study analyzed significant changes in students' self-regulation and adaptive functioning outcomes after participation in a school-based yoga program. Adaptive functioning outcomes were assessed through student's self-reported improvements in abilities to focus better, avoid fights, and calm down. The study explored whether changes in adaptive functioning outcomes are related to changes in self-regulation. Furthermore, analyses investigated whether additional use of yoga at home influences changes in self-regulation.

1.1 Self-Regulation

Theoretical orientations in psychology have differing conceptualizations of specific mechanisms involved in self-regulation. Social-cognitive theory proposes self-regulation as a function of self-monitoring, affective self-reaction, and self-judgement through social and personal standards (Bandura, 1991). Personality theorists suggest self-regulation reflects specific personality traits including temperament, conscientiousness, and impulsivity (Hoyle, 2006). In contrast, neuropsychology views self-regulation as a higher-order function based on prefrontal cortex activity involving the planning and action of certain behaviors (Banfield et al., 2016). Despite the various existing theories, no universally accepted conceptualization of the construct or definitive cause of diminished self-regulation skills exists (Daly & Perez, 2009). For the present study, self-regulation is broadly defined as voluntary control of attentional, behavioral, and emotional impulses to develop, implement, and maintain specific habits or behaviors (Berger et al., 2007; Duckworth & Carlson, 2013: Raffaeli et al., 2005).

Although there is argument on whether self-regulation is a uni- or multi-dimensional construct (Edossa et al., 2018), self-regulation is commonly measured through three subconstructs; attentional/cognitive, behavioral, and emotional (Berger et al., 2007; Raffaeli et al., 2005). Each construct is related to varying domains of adaptive functioning in one's life including academic performance (cognitive), social skills (behavioral), and stress management (emotional). Self-regulation skills are essential for adaptive functioning (Hoyle, 2006). Buckner et al. (2009) sampled youth (M= 12 years old; N=156) from low-income communities on self-regulation and adaptive functioning measures as well as various mental health measures. Results indicated higher levels of

self-regulation were related to better adaptive functioning outcomes as well as higher ratings for academic achievement and grades, social competence, and problem behaviors. Further, self-regulation was related to higher psychological well-being (i.e., lower scores on depression and anxiety measures).

Cognitive self-regulation, specifically in children, predicts stronger academic performance (Duckworth & Carlson, 2013; Pintrich & DeGroot, 1990). In a sample of 173 seventh graders, researchers collected students' self-reported self-regulation and performance data on science and English class assignments. Self-regulation levels were the best predictor of academic performance, compared to self-efficacy, intrinsic value, and test anxiety (Pintrich & DeGroot, 1990). Further, behavioral self-regulation greatly influences one's social skills and relations with peers (Wyman et al., 2010). Previous research analyzed self-regulation, prosocial behavior, and aggressive behavior in a sample of 70 preschoolers. Higher self-regulation was associated with prosocial behavior, while lower self-regulation strongly predicted overall aggression with other students (Daly & Perez, 2009). Lastly, emotional self-regulation is often quantified through stress coping measures, as the two constructs are closely related (Wang & Saudino, 2011). Implementation of emotion regulation strategies in maladaptive ways is identified as emotion dysregulation (D'Agostino et al., 2017), and can be a significant risk factor for child psychopathology (Keenan, 2000). Children growing up in low-SES communities displayed greater deficits in emotion regulation and stress coping. Kim et al. (2013) conducted a longitudinal study with 54 nine-year-old children. At the age of 24, an fMRI on the prefrontal cortex functioning was conducted as a measure of emotion regulation ability in addition to a stress coping questionnaire. Results posited children raised in low-

SES communities had reduced prefrontal cortex functioning as adults, lower stress coping, and more emotion dysregulation.

Developmental differences in self-regulation skills are evident, with significant growth between early to middle childhood and minimal change from middle childhood to adolescence (Raffaeli et al., 2005; Raver, 2004). Female children and adolescents are often rated higher on self-regulation measures compared to male counterparts (Daly & Perez, 2009; Buckner et al., 2009). The presence of stronger self-regulation in childhood may give rise to related adaptive functioning outcomes, including better academic performance, prosocial behaviors, and stress management. Children able to self-regulate cognitively, behaviorally, and emotionally have decreased risk to adverse outcomes and a greater chance of becoming healthy, functional adolescents and adults. Specific adaptive functioning outcomes which measure attentional and cognitive skills involve one's ability to focus and pay attention. Behavioral skills are assessed through the ability to avoid fights. Emotional skills include being able to calm down when upset. Deficits in self-regulation abilities are evident through such cognitive, behavioral, and emotional skills.

Cognitive Processes

One mechanism of self-regulation involves cognitive and attention regulation. Cognitive self-regulation is defined as "regulation of attention and selective strategy use in the execution of cognitive tasks" (Matthews et al., 2014) and requires mental flexibility, verbal working memory, and inhibitory control of overt actions (Hubert et al., 2017; Kaunhoven & Dorjee, 2017). Such skills encourage behaviors advantageous for academic success in school-aged children, such as paying attention during class, following directions, and listening fully and attentively (McClelland & Cameron, 2011;

Tangney et al., 2004). Significant impairments in cognitive self-regulation, evident by inattentiveness, are a core symptom of attention-deficit/hyperactivity disorder (ADHD) (Graziano et al., 2011).

Early cognitive regulation in childhood and the ability to sustain attention are beneficial for academic success (Buckner et al., 2009; Howse et al., 2003). Self-regulation in preschoolers is often measured through the delay of gratification task, which involves making a child wait a specified amount of time before receiving a salient reward (Edossa et al., 2018; i.e., Marshmallow Task). For example, a marshmallow is often used as a desired stimuli and potential reward. The marshmallow is placed in front of the child. If the child waits the entire duration of the designated time to eat the marshmallow, the reward is doubled. If the child is unable to wait, they only receive the already eaten marshmallow. In a 10-year longitudinal study, Mischel et al. (1988) posited that preschoolers with stronger self-regulation skills in the Marshmallow Task showed greater academic success and higher self-regulation in adolescence. Parental reports indicated self-regulating preschoolers were more attentive and academically competent in adolescence. Mischel & Ayduk (2004) found that preschoolers able to self-regulate grew to obtain higher SAT scores. Early self-regulation skills may promote stronger attentional and concentration skills to focus on class and therefore, excel academically.

Behavioral Processes

Behavioral regulation is conceptualized as the ability to monitor and inhibit behavior towards a goal. Longitudinal research suggests behavioral self-regulation is stable throughout childhood (Edossa et al., 2018). Examples of behavioral self-regulation include stopping to think before acting as well as persistence through and completion of

difficult tasks. Behavioral self-regulation in childhood is vital for promoting social competence and prosocial behaviors, and diminishing anger and violence. Deficits in behavioral self-regulation are associated with difficulty controlling violent impulses and aggressive behaviors (Dewall et al., 2007). Students with lower rated self-regulation were more likely to respond impulsivity and anger to situations (Buckner et al., 2009) and have difficulty with peer relationships (Lopes et al., 2005). Preschoolers rated lower on self-regulation behaved in more aggressive manners (e.g., teasing, taking objects from another child, and bullying with physical force; Daly & Perez, 2009).

Conversely, higher levels of self-regulation in children has been found to be associated with more prosocial behavior and interpersonal sensitivity through both self- and peer-ratings (Hoza et al., 2005). Further, children obtaining higher scores on the Marshmallow Task are often described as more socially competent (Mischel & Ayduk, 2004; Mischel et al., 1988). Positive self-regulatory behaviors, such as controlling the impulse to say hurtful things, may help cultivate stronger social relationships (Tangney et al., 2004). Early behavioral self-regulation may mitigate risk factors in children by promoting prosocial behaviors and reducing violence in children and adolescents.

Emotional Processes

Emotion regulation is an important component of overall self-regulation (Kaunhoven & Dorjee, 2017; Raver, 2004) and is conceptualized as a mechanism allowing for socially acceptable and flexible emotional responses in order to meet external demands and personal goals (D'Agostino et al., 2007). Emotion regulation skills may include acceptance of emotions, stress management, and self-soothing. The ability to regulate emotions is closely tied to mental health outcomes such as anxiety and

depression (Buckner et al., 2009; Kim et al., 2013). Specifically, children with anxiety disorders use unhelpful coping skills more frequently and have difficulty managing uncomfortable or extreme emotions (Carthy et al., 2010; Suveg & Zeman, 2004). Severe deficits of emotion regulation can be a sign of emotional dysregulation, defined as the maladaptive or inappropriate use of emotion regulation strategies as opposed to a mere lack of regulatory skills (D'Agostino et al., 2007). Emotion dysregulation can manifest as decreased emotional awareness, inappropriate emotional reactivity, and emotional rigidity. Deficits and dysregulation of emotional regulation in childhood may be related to difficulty managing stress and calming down after intense emotions, and greater risk for psychopathology.

In contrast, adaptive emotional regulation is associated with psychological well-being, such as positive affect and life satisfaction. A study conducted in Italy measured adolescent's emotion regulation strategies, well-being, positive affect, and life satisfaction through self-report questionnaires. Emotion regulation was analyzed through cognitive reappraisal versus emotional suppression strategies. More frequent use of cognitive reappraisal than emotional suppression was associated with greater psychological well-being, including self-reported life satisfaction and positive affect (Verzeletti et al., 2016). Research conducted with preschoolers suggests stronger self-regulation skills may facilitate stress management (Mischel & Ayduk, 2004; Mischel et al., 1988). Preschoolers who were able to self-regulate in the Marshmallow Task were rated by their parents as better able to cope with frustration and stress. Fostering emotional self-regulation in children may act as a protective factor for anxiety, depression, and harmful impacts of stress (Troy & Mauss, 2011), all of which have been

globally exacerbated with the COVID-19 pandemic (Bäuerle et al., 2020; Salari et al., 2020).

Development and Gender Differences

Existing literature suggests developmental differences are present in self-regulation skills (Raver, 2004). Self-regulation skills can be observed immediately after birth through self-soothing activities, such as sucking and orienting of attention (Berger et al., 2007; Rothbart et al., 2011). A significant growth in self-regulation typically occurs between early childhood (4-5 years of age) and middle childhood (8-9 years), with little development observed between middle childhood and early adolescence (12-13 years) (Raffaeli et al., 2005). Lower self-regulation in early childhood and adolescence is associated with greater adult health problems, substance abuse, criminal convictions, and lower income (Kim et al., 2013; Montroy et al., 2016; Moffitt et al., 2011). Self-regulation is a vital skill to foster in early childhood.

Interestingly, gender differences in self-regulation are evident as an individual develops. Gender differences have not been found in early infancy (Keenan, 2000), but generally appear during early childhood. The literature is mixed, with some studies suggesting no significant differences on self-reported self-regulation in middle school students (Pintrich & DeGroot, 1990) or on self-regulation tasks in early elementary school students (Hubert et al., 2017). However, ample research has found male children and adolescents score lower on self-regulation measures compared to same-aged females (Duckworth & Carlson, 2013). Daly & Perez (2009) found preschool boys displayed lower self-regulation skills and greater levels of aggression than females in the same classroom. Buckner et al. (2009) found early adolescent females had higher levels of self-

regulation than males. Despite inconsistency in the literature, self-regulation skills are generally found to be better developed in female students.

In summary, self-regulation is the employment of goal-directed habits or behaviors attained through cognitive, behavioral, and emotional processes. Self-regulation can be assessed through adaptive functioning outcomes; including, a.) academic performance and one's ability to focus and sustain attention, b.) prosocial behavior and one's ability to avoid fights, and c.) stress management and one's ability to calm down when upset. Self-regulation skills are observable immediately after birth. Developmental differences are evident with a significant increase in self-regulation skills occurring between early and middle childhood. Gender differences are often found with males attaining lower levels on self-regulation measures, although the literature is inconclusive. Deficits in self-regulation in early life can lead to maladaptive behaviors and adverse consequences into adulthood. One way to alleviate and strengthen self-regulation deficits and adaptive functioning outcomes may be through participation in mindful yoga (Razza et al., 2013).

1.2 Mindful Yoga

Mindfulness is a newly expanding topic of research found to be advantageous for promoting self-regulation. The conceptualization of mindfulness varies among scientific domains because of the many forms in both Western and Eastern cultures, each varying in mental and behavioral activities, e.g., Hatha yoga, *Vipassana*, or mindfulness based cognitive therapy (Schmidt, 2014). Despite conflicting schools of thought, a common conceptualization of mindfulness is "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience

moment by moment" (Kabat-Zinn, 2003). Existing literature has categorized mindfulness, physical yoga, and breath work as overlapping and indistinct constructs (Gordon, 2013; Sreekuman et al., 2020). The present study will conceptualize mindful yoga as "quieting the mind through physical activity" under the overarching practice of mindfulness (Gordon, 2013).

Yoga involves a series of physical postures combined with deep, controlled breathing intended to link body movements and breath to induce a meditative state (Gordon, 2013; Smith et al., 2020). The term "yoga" closely translates to "union" (Chopra & Simon, 2003), and has been thought to join the mind and body (Butzer et al., 2017; Smith et al., 2020). Yoga is commonly associated with religious contexts (e.g., Hinduism, Sikhism, and Buddhism), but practicing yoga does not require allegiance to a religion or its beliefs (Gordon, 2013; Smith et al., 2020). Recent school-based yoga programs have confronted the challenge of implementing non-religious forms of yoga which allow students to experience potential benefits of yoga while remaining a secular practice (Brown, 2019).

In recent decades, mind-body medicine and benefits from yoga have gained popularity for psychopathological, cardiovascular, and respiratory conditions (Gard et al., 2016; Khalsa, 2004). Yoga participation has been shown to benefit self-regulation in children by promoting attentional and cognitive processing, prosocial behaviors, and effective emotion regulation. Case-Smith et al. (2010) conducted a study using a school-based yoga intervention with third graders in a low-income, urban community. The intervention involved a 45-minute yoga practice once a week and a 15-minute session four times a week for eight weeks. Through qualitative focus groups, students reported

yoga aided in adaptive functioning outcomes including enhanced focus, control of behavior, and feelings of calmness. Such skills may facilitate benefits found in self-regulation after recurrent yoga practice.

Cognitive Processes

Meditation is shown to increase regulation, accuracy, and efficiency of attentional and cognitive processing (Villate, 2015). To compare cognitive abilities in meditators versus non-meditators, Kozasa et al. (2012) and Moore and Malinowski (2009) used the Stroop Task and an fMRI. Higher levels of mindfulness were correlated with higher scores on the Stroop Task. Participants with higher mindfulness completed the task with greater inhibitory control and processing speed, while performing fewer errors overall. Further, meditators had fewer errors during the incongruent responses portion (i.e., reading the word 'red' in blue font), suggesting a greater ability to inhibit and shift attention. Results from fMRIs showed meditators had lower neural activity in attentional brain areas compared to non-meditators, suggesting increased mental efficiency.

Telles et al. (2013) reported similar findings utilizing the Stroop Task with children aged eight to 13. The school-based program compared yoga to physical exercise (PE) over three months involving 45 minutes of activity every weekday. Participation in both yoga and PE showed improvements in all portions of the Stroop Task; however, PE exhibited higher interference scores, suggesting lower cognitive flexibility than yoga participants. Research suggests yoga is associated with greater cognitive regulation, attentional control, and performance quality. Yoga practice may be beneficial in childhood (Gulati et al., 2019; Telles et al., 2019) by providing regulatory techniques for managing school-related stressors and academic performance (Wang & Hagins, 2016).

Behavioral Processes

Yoga practice has been associated with prosocial behaviors, including being better able to avoid fights and develop social connections. After yoga participation, third grade students reported feeling more in control of their behaviors and management of anger responses. Many children reported feeling better able to stop anger problems and "not fight in school" or at home with siblings (Case-Smith et al., 2010). Similar findings using focus groups were evident in a sample of seventh graders who meditated in a school-based program for 35 minutes, one to two times a week for a total of 32 sessions (Butzer et al., 2017). In both studies, students were observed to have greater behavioral self-regulation post-intervention (e.g., take deep breathes and communicate instead of using violence or aggression towards others).

In addition, Butzer et al. (2017) found seventh grade students reported feeling more connected to classmates after participating in the yoga practices. Dariotis et al. (2016) analyzed fifth and sixth graders after in-person yoga instruction through a non-profit 16-week yoga intervention program. In focus groups, the students claimed to have better anger identification in self and others. Students also reported more positive social interactions. Yoga may strengthen behavioral regulation in children and prosocial behaviors including avoidance of violent conflict and strengthened peer connections.

Emotional Processes

Mindfulness practices have been used to promote emotional self-regulation and management of psychological distress. In recent years, mindfulness has become incorporated into a variety of psychotherapy approaches (Gordon 2013; Hayes & Feldman, 2004; Kabat-Zinn, 2003). Elevated mindfulness is associated with less

emotional dysregulation and a greater ability to differentiate emotions (Hill & Updegraff, 2012). Mindful yoga practice may help children manage emotional and stress-related changes in the mind and body, specifically with anxiety and depression (Khalsa, 2004; Smith et al., 2020; Streeter et al., 2010). School-based yoga programs measures post-intervention found students reported a heightened ability returning to a calm mental state and feeling more relaxed. This was evident in all age cohorts including children (Case-Smith et al., 2010), adolescents (Butzer et al., 2017), and college students (Villate, 2015).

Dariotis et al. (2016) implemented a school-based yoga program to analyze students' perceived benefits through qualitative measures. Fifth and sixth grade students participated in a 16-week program with in-person instruction and participated in a focus group post-intervention. Students reported positive outcomes including enhanced de-escalating negative emotions, calming down, and reducing stress. Similar findings are evident in elementary school children. Students reported decreased stress, a heightened ability to calm down from 'big emotions' such as anger and sadness, and overall higher positive affect (Geldert, 2017; Streeter et al., 2010; Telles et al., 2013). Yoga may be advantageous for facilitating emotion regulation outcomes of managing stress, returning, and remaining a relaxed or calm state, as well as experiencing more positive affect.

In summary, mindful yoga has been shown to facilitate the development of self-regulation abilities in children through cognitive, behavioral, and emotional processes. Yoga interventions are associated with 1.) greater cognitive regulation, accuracy, and efficiency which may foster positive academic performance in children, 2.) greater behavioral regulation and prosocial behaviors such as decreased violence and stronger

peer relationships, and 3.) greater emotional regulation including feeling better able to manage stress, return to a calming state, and greater positive affect.

Specifically, school-based yoga intervention programs have been shown to be effective at fostering self-regulation skills and adaptive functioning outcomes. Improvements in overall self-regulation may facilitate benefits found in related adaptive functioning outcomes. Common adaptive functioning outcomes students report include enhanced abilities to focus better and pay attention more, avoid violent conflict, and calm down from strong emotions. The opportunity to cultivate such skills should be available to all children and is one such benefit of school-based implementation.

1.3 School-Based Implementation

School-based programs are advantageous for providing benefits to all students, children, and adolescence in the public system without discrimination based on demographic characteristics. School-aged children are a vital developmental group to implement educational programs, as their brains have greater neuroplasticity and flexibility to grow (Kolb & Gibb, 2011; Smith et al., 2020). Specifically, existing school-based programs are effective in improving overall well-being, adaptive functioning, and deficits in children (Pandey et al., 2018). One example of school-based programs includes SEL curriculums, which are shown to be advantageous for promoting prosocial behaviors and decreasing conduct difficulties (Durlak et al., 2011; Kragg et al., 2006). An additional example is mindfulness-based kindness programs and have supported benefits to social competence and executive functioning (Flook et al., 2015). Although such programs have been effective, mindful yoga programs have an additional component involving physical activity and movement.

School-based yoga intervention programs have been shown to be an effective way to promote self-regulation and related adaptive functioning outcomes including academic performance, prosocial behaviors, and stress management (Flook et al., 2010; Gulati et al., 2019; Kaunhoven & Dorjee, 2017; Razza et al., 2013; Schonert-Reichl & Hyme, 2007). School-based yoga has been shown to mitigate adverse effects of stress, anxiety, and aggression while improving physical and mental well-being (Smith et al., 2020; Velásquez et al., 2015). In addition to the benefits students receive, teachers also report classroom improvements, more positive dynamics with students, and personal benefits from yoga practices (Dariotis et al., 2016; Gulati et al., 2019).

Several programs have been implemented in schools to analyze the impact of yoga programs on children's related skills. One program implemented with preschool children involved 10 to 30 minutes of yoga each school day for 25 weeks (Razza et al., 2013). Post-intervention, researchers found significant increases in cognitive self-regulation. The intervention was found to be most beneficial for students whose scores fell in the at-risk range for self-regulation dysfunction. In another example, a program was introduced with second and third graders by Flook et al. (2010). The program consisted of 30-minute yoga practices, twice a week for 8 weeks. Executive functioning teacher and parent reports were collected pre- and post-intervention. Results found improvements in children's behavioral regulation reported by both teachers and parents. An additional study of varying implementation involved boys aged 9 to 12 (Gullati et al., 2019). Yoga intervention involved 60 minutes of yoga every day for 4 ½ months. Children had improvements in attention, concentration, memory, motor speed, and self-esteem post-intervention.

In the final example, Bergen-Cico et al. (2015) implemented a yoga program with sixth graders which involved a brief, four-minute yoga practice three times a week. Students showed significant changes in self-regulation compared to a control group. Post-intervention, students reported yoga helped them with adaptive functioning outcomes of greater ability to focus and concentration during class, and to feel calmer. Parental reports suggested children were better able to manage stress and conflict in daily life. Further, several students began practicing yoga outside of the school program.

Limitations of school-based yoga programs are the diverse implementation strategies and understudied impact of students' use of yoga at home during the duration of programs. There remains a high degree of variability and lack of standardization within methodology, including heterogeneity of setting, duration and frequency of yoga practice, whether at-home practice is assigned, and the specific principles incorporated in yoga instruction (Harper, 2010; Khalsa & Butzer, 2016; Smith et al., 2020; White, 2012). Additionally, challenges exist with measurements of self-regulation in children and in school-based settings, specifically with reliability and ecological validity (McClelland & Cameron, 2012). Therefore, the present study will address the methodology limitations through a 20-week standardized school-based yoga intervention program, with practice once a week for 30-45 minutes, and explore significant changes in self-regulation as well as adaptive functioning skills.

Additionally, information on student's use of yoga at home was collected from the school-based intervention and was analyzed in relation to changes in self-regulation. The influence of independent use of yoga is an understudied area of school-based yoga implementation with minimal existing research. Independent use of yoga would provide

greater exposure and practice for students. Greater experience of yoga and mindfulness techniques may yield more significant changes in self-regulation skills (Kozasa et al., 2012; Moore & Malinowski, 2009). Student's participation of yoga on their own may contribute above and beyond the effects of in-class yoga participation on self-regulation skills. Further, use of yoga at home shows children's interest and application of novel coping skills and can lead to continued practice and experienced benefits beyond the duration of the school program. Unprompted use of yoga at home could provide long-term benefits which continue to function as protective factors to children and adolescent's overall well-being.

In this study, some of the schools chosen for the yoga program are in low-SES communities. School-based yoga programs have the advantage of providing care and attention to children in low-SES areas who may not otherwise learn additional coping or relaxation skills. Children who grow up in poverty and high stress environments typically grow to have decreased functioning in brain areas associated with self-regulation (Kim et al., 2013). Kindergarten students living in low-SES areas showed deficits in self-regulation skills by becoming distracted more often on attentional self-regulation tasks and earned lower scores on reading ability tests (Howse et al., 2003). Fostering self-regulation in students raised in low-SES areas may negate negative individual-level outcomes associated with diminished self-regulation such as involvement in crime, substance abuse, and cyclical poverty among low-SES communities (Causadias et al., 2012; Harper, 2010; Moffitt et al., 2011).

1.4 Archival Data Use

The present project utilized an archival dataset primarily collected for program evaluation purposes. ZenWorks is a community-based non-profit organization that implements yoga and mindfulness-based programs in surrounding schools. Community-based school intervention programs are not commonplace but can provide greater reach and availability to populations that may otherwise not be exposed to beneficial skills such as yoga and mindfulness. The founder of the ZenWorks organization previously worked as a schoolteacher in Brooklyn, New York. In her role, she noticed her students were over-stimulated and stressed and began incorporating yoga poses and breathing exercises throughout the day. She observed significant changes in their abilities to focus during class and became motivated to provide access to yoga and mindfulness to those in under-served communities (ZenWorks, n.d.). During COVID-19, the organization began providing free virtual programs and YouTube videos online to the public. ZenWorks has continued to play an active role in fostering growth in the students they work with. Cleveland State University joined with ZenWorks to systematically assess the effects of school-based yoga on various outcomes.

Several benefits exist when utilizing archival data. First, archival data allows exploration of community-based implementation programs and provides empirical evidence for the efficacy of existing programs. Partnering with established organizations such as ZenWorks can be advantageous and allow greater reach to unique populations and cultivation of community relations (Wilson et al., 2008). Yoga and mindfulness programs have become more widespread but lack strong and cohesive scientific evidence on the efficacy and standardization of implementation. Collaboration between academia

and community organizations allows for the assessment, improvement, and monitoring of such programs. Specific to the present study, the use of archival data allows for the continued investigation of previous programs no longer implemented due to the COVID-19 pandemic. The present study maximizes archival data and provides a contribution of novel programs to the existing literature through novel secondary data analysis.

Although benefits exist, use of archival data produce limitations, particularly when implementation and data collection are intended for program evaluation as opposed to research. In this case, these limitations include a lack of quantitative data on specific hours or days of student participation and pre-selected measurement scales. Additionally, attendance was not recorded, and yoga experience could not be controlled for. The lack of a quantitative attendance variable is a limitation evident in existing yoga research utilizing archival data (Wilson et al., 2008). The dataset did not collect measures for individual students from parents, teachers, or additional informants. Only self-report measures were collected which do not allow for score comparisons or reduction of biases commonly associated with self-report measures (Van de Mortel, 2008). Further, the self-regulation measure was intended for a program evaluation and was not designed for the purpose of the present study. Measurement of self-regulation in school-based populations in general can be unreliable and ungeneralizable to other settings (McClelland & Cameron, 2012) and the self-regulation measure utilized in the archival dataset may be lacking in similar ways (Raffaeli et al., 2005). Lastly, video-based instruction creates greater standardization and replicability of programs to communities who may not have access to such beneficial programs; however, in-person can provide individual feedback

or assistance with challenging postures. Literature is lacking in the analysis of differences between in-person versus video-based instruction of yoga and outcomes.

1.5 Objective

The objective of the present research was to analyze significant changes in self-regulation skills and related adaptive functioning outcomes for children aged 7-15 before and after implementation of school-based yoga intervention programs. Adaptive functioning outcomes include being able to focus more or pay attention better, avoid fights or arguments, and calm down when upset. Further, student use of yoga at home was analyzed in relation to changes in overall self-regulation. Additionally, the present study aimed to control for potential differences between nested data in schools.

1.6 Hypotheses

Hypothesis 1a. After yoga, student self-reported self-regulation will improve.

Hypothesis 1b. After yoga, students will report benefits from yoga including the abilities to a) focus more or pay attention better during activities, b.) calm down when upset, and c.) avoid fights. Further, potential gender differences in endorsement of benefits from yoga will be analyzed for exploratory purposes.

Hypothesis 2. Greater changes in self-regulation will be associated with more self-reported benefits on related outcomes.

Hypothesis 3. Students who report use of yoga at home will report a greater change in self-reported self-regulation.

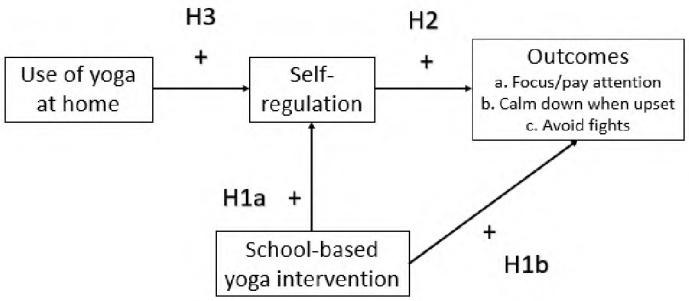

Figure 1: Conceptual model of hypothesis for school-based yoga intervention. Adapted from Dariotis et al (2016).

CHAPTER II

METHODOLOGY

2.1 Participants and Procedures

The present project involves secondary data analysis of an archival dataset. Archival data was collected during the 2018-2019 school year on a yoga and mindfulness intervention program. The primary purpose of data collection was to serve as a program evaluation for ZenWorks. Analysis of archival data creates limitations in the way a researcher can use the data due to constraints in the type of data available. Limitations of archival data and measure adaptations for the purpose of the present study will be further addressed throughout the methodology.

ZenWorks is a non-profit school-based yoga and mindfulness program that collaborates with schools to provide no cost interventions. The school-based intervention implemented by ZenWorks provided a 20-week yoga and mindfulness curriculum for 10 schools in the surrounding Cleveland metropolitan area. Yoga sessions took place once a week during classroom time with yoga mats provided. Certified instructors provided in-person, 30-45-minute lessons with students during designated class breaks.

The sample included students aged 7-15 with diverse ethnic backgrounds and socioeconomic status. For the present study and analyses, inclusion criteria required that

all participant demographic data be collected including school of attendance, age, and gender. Further, participants were required to have completed 85% of questions to ensure data collection both pre- and post-intervention. In the truncated analytic sample, I proposed to include at least 308 participants based on a power analysis conducted through GPower program [$(1-\beta) = .80$, $\alpha = .05$, and predicted small effect size (OR = 1.5)] (Chen et al., 2010).

All measures in the archival dataset were collected through self-report, paper-and-pencil questionnaires. Items were read aloud to young students, those with cognitive impairments or developmental delays, or others who may have had difficulties completing questionnaires. Students completed a questionnaire pre- and post-intervention. Pre-assessment occurred near the beginning of the school year in October. Post-assessment was collected near the end of the school year in April. Due to the primary purposes of the dataset, measures were collected during different time periods (Table 1). There was no monetary compensation for involvement in the intervention.

Table I. *Archival data measures and collection period.*

Measure	Collected Pre- (Oct. 2018)	Collected Post- (Apr. 2019)
Demographics	X	
Self-Regulation Questionnaire	X	X
Yoga Involvement & Impact	X	X
Adaptive Functioning Outcomes		X

2.2 Measures

2.2a Demographics

De-identified student demographics were collected from the school. Information included the school of attendance, student's date of birth, gender, and race or ethnicity.

2.2b Self-Regulation Questionnaire

Overall self-regulation was assessed through a 15-item, self-report questionnaire designed for the present study and demonstrated face validity (Appendix A). Students answered questions on a 4-point Likert scale such as "*I can pay attention to one thing at a time,*" "*I can manage my behaviors and actions,*" and "*I can express my thoughts, feelings and needs appropriately.*" Items in the archival dataset were selected for the purpose of a program evaluation and may not be akin to existing self-regulation measures in the literature. As a result, some overlap may exist between the self-regulation questionnaire and adaptive functioning outcomes selected for the present project.

Existing measures commonly analyze self-regulation through various subconstructs: cognitive/attentional, behavioral, and emotional. As a result, preliminary analyses were conducted to ensure reliability and validity of the self-regulation measure for the purpose of the present study. Preliminary Cronbach's alpha analyses on both pre- and post-intervention data were strong with $\alpha = .859$-$.935$. Preliminary latent factor analysis of the 15-item self-regulation measure was evaluated using the pre-intervention data. An exploratory factor analysis was conducted on one half of the participants, and confirmatory factor analysis was conducted for the second half. Compared to a three-factor model and a two-factor model, a one-factor model of self-regulation best fit the pre-intervention data with strong construct validity [CFI = 0.940, TLI = 0.930, RMSEA = 0.048]. Strong, but not strict, factorial invariance was found for gender and race (Ishaq et al., 2020). The self-regulation measure utilized in the dataset provided a strong measure of overall self-regulation, while the adaptive functioning outcomes may assess changes in the identified subconstructs of self-regulation.

2.2c Yoga Involvement and Impact

Yoga involvement consisted of participation in a 20-week program with sessions taking place once a week during classroom time with yoga mats provided. Sessions took place for approximately 30-45-minutes with a trained yoga instructor who guided students through the yoga poses and routine. Student attendance was collected through teacher's daily logs; however, teacher attendance logs did not specify the number of yoga sessions attended by each student. Due to these limitations, quantitative yoga participation was not available for the present study.

Pre-assessment questions inquired about students' previous yoga experience, whether they enjoyed the previous yoga experiences, and whether they have ever engaged in "calming strategies" in the past. Post-assessment questions reassessed students on the three questions from pre-assessment in addition to five novel questions (Appendix B). Post-assessment questions evaluated whether students enjoyed the yoga classes in school and whether they felt yoga was beneficial. The remaining post-assessment questions assessed whether students used yoga on their own, plan to use yoga in the future, or had taught others yoga. Whether students used yoga on their own will be included in the analyses.

2.2d Adaptive Functioning Outcomes

Post-assessment questions determined specific adaptive functioning skills and outcomes students felt were strengthened through yoga (Appendix C); including, (a) focus more or pay attention better during activities, (b) avoid fights or arguments, and (c) calm down when I am upset. Existing literature focuses on the three identified adaptive functioning outcomes in relation to self-regulation (Bergen-Cico et al., 2015). Based on

the literature, each adaptive functioning outcome was selected to correspond with one of three subconstructs of self-regulation: (a) cognitive, (b) behavioral, and (c) emotional. With measures being created for the purpose of ZenWorks' program evaluation, intersection may exist between the adaptive functioning outcomes selected and the self-regulation measure. While the self-regulation questionnaire utilized in the archival dataset is shown to have strong construct validity for one-factor (Ishaq et al., 2020), the three adaptive functioning outcomes may provide greater insight into the specific mechanisms and subconstructs of self-regulation strengthened through school-based yoga interventions.

CHAPTER III

RESULTS

3.1 Data Truncation

The data was truncated based on requirements for each individual student to have all demographic information (i.e., date of birth, gender, school pre- and post-intervention) and answered at least 85% of all questions to ensure completion of both pre- and post-assessments. The original sample included 1,540 participants. Exclusion based on lack of demographic information reduced the sample by 566 for date of birth and gender. The missing participants appeared to be systematic, missing from five specific schools. Only 20 participants were missing DOB and gender at random and were still included in the final dataset because both pre- and post-intervention data was collected. Exclusion criteria based on the 85% completion of questions eliminated 467 additional participants from the original dataset. The incompletion of both pre- and post-intervention data were missing at random and likely related to students' absence during data collection periods. The final truncated dataset contained 507 participants (Table 2), which provided adequate power.

Table II. *Participant elimination per exclusion criteria*

Exclusion Criteria	# of Participants Excluded
Demographics	566
85% Completion of Questionnaires	467
-missing both pre/post (0%)	7
-missing only pre (35%)	191
-missing only post (65%)	269
Final Sample	**N=507**

Following completion of the proposed data truncation, a variable was created to calculate participant age based on the date of birth by subtracting participant's provided data of birth from an approximate initial collection date of October 1st, 2018. The initial age variable provided participant age in seconds. This was then converted into years through the following formula: [age / (365*24*60*60) = age year]. To calculate self-regulation change scores from pre- to post-data, separate mean scores from both the pre- and post-self-regulation measures were calculated, and then post-self-regulation mean scores were subtracted from the pre-self-regulation.

3.2 Preliminary Analyses

The sample contains clustered data and violates the assumption of independence. To address nonindependence and account for increased probability of Type I errors, preliminary analyses were conducted to determine whether significant variance exists between schools and whether a multilevel modeling (MLM) analysis would be necessary (Hahs-Vaughn, 2017). An MLM analysis controls for contextual factors between schools (e.g., classroom, classmates, teacher) that may impact children's participation during yoga across levels.

A preliminary analysis was conducted to calculate the intraclass correlation coefficient (ICC) of each proposed independent variable to confirm a significant amount of variance between schools is present. In an educational setting, the ICC should be

between .05 to .15 for MLM to be a beneficial analysis (Hedges & Hedberg, 2007). All ICC scores were at or below .05, supporting no significant differences evident between schools and does not necessitate MLM. General linear model analyses were used for hypothesis testing. Therefore, school is not included in the analyses with the evidence of insignificant variance existing between schools.

3.3 Testing of Assumptions

Next the data was analyzed for assumptions of normality and significant outliers. Normality met assumptions for all self-regulation measures (i.e., pre-intervention, post-intervention, and change scores). Pre- and post-measures were slightly negatively skewed and change scores were slightly leptokurtic, based on the criteria of skewness equal to or less than two and kurtosis at or below seven (Hahs-Vaughn, 2017); however, no transformations for normality were required. Significant outliers with an absolute value of three standard deviations from the mean were found for self-regulation change scores. With concern of questionable data for change self-regulation scores, nine outliers were excluded from the dataset.

3.4 Descriptive Statistics

Pearson correlations were conducted to analyze relationships between all variables in the model (Table 3). Self-regulation change scores were significantly associated with endorsement of use of yoga at home (r = -.116, p = .010); however, no significant correlations with age, gender, or adaptive functioning outcomes of focus and pay attention more, calm down when upset, or avoid fights. Age was significantly correlated with endorsed improvements in abilities to focus (r = .099, p = .031) and to avoid fights (r = .156, p = .001), as well as whether students used yoga at home (r = .117,

$p = .011$). Gender was correlated only with use of yoga at home ($r = .102$, $p = .026$). Use of yoga at home was not correlated with any of the three adaptive functioning outcomes (p's > .05). Significant correlations existed between all adaptive functioning outcomes; (a) focus more and calm down ($r = .570$, $p < .001$,), (b) focus more and avoid fights ($r = .471$, $p < .001$), and (c) calm down and avoid fights ($r = .542$, $p < .001$).

Table III. *Descriptive statistics and correlations among study variables*

	1	2	3	4	5	6	7
1. Age	-						
2. Gender	.053	-					
3. SR: Change	.030	.005	-				
4. AdF: Focus more	.099*	-.011	-.022	-			
5. AdF: Calm down	.069	.030	-.039	.570**	-		
6. AdF: Avoid fights	.156**	-.033	-.050	.471**	.542**	-	
7. Use at home	.117*	.102*	-.116**	.067	.067	.067	-
M	10.77	1.36	-.03	1.33	1.25	1.42	1.35
(SD)	1.79	.48	.56	.48	.43	.50	.55

Note. SR = Self-regulation, AdF= Adaptive functioning outcome. * $p < .05$; **$p < .001$

3.5 Hypothesis Testing

Hypothesis 1a. After yoga, student self-reported self-regulation was expected to improve. A repeated-measures ANCOVA determined no main effect or significant difference in mean self-regulation scores across pre- (M=3.11) and post-intervention (M=3.09) time points, $F(1, 475) = .603$, $p = .438$. No interaction effects were present between self-regulation scores and age, $F(1, 475) = .449$, $p = .503$, or gender, $F(1, 475) = .032$, $p = .859$.

Hypothesis 1b. After yoga, students were hypothesized to report benefits in the abilities to a) focus more or pay attention better during activities, b.) calm down when upset, and c.) avoid fights. Further, potential gender differences were analyzed for

exploratory purposes. Multiple two-by-two chi-square analyses were conducted by gender and endorsement of experienced benefits from each adaptive functioning outcome; (a) focus and pay attention better, (b) avoid fights, and (c) calm down when upset. Of the students in the sample, 66% of both females and males equally endorsed yoga as beneficial to their ability to focus more and pay attention better. No significant differences were evidenced by gender, χ^2 (1) = .005, φ = .003, p = .946. In relation to the ability to calm down when upset, 76% of females and 72% of males endorsed experiencing benefits after participation in the yoga intervention with no significant differences observed by gender, χ^2 (1) = .721, φ = -.039, p = .396. For changes in one's ability to avoid fights, females and males did not significantly differ with 57% and 60% endorsing experiencing benefits, respectively, χ^2 (1) = .308, φ = .025, p = .579. Overall, the majority of students endorsed experiencing benefits in adaptive functioning outcomes of better focus, greater ease calming down when upset, and ability to avoid fights, although no outcomes differed by gender.

Hypothesis 2. Greater changes in self-regulation were expected to be associated with a greater likelihood of endorsing benefits with adaptive functioning outcomes. Using a multivariate logistic regression, the three adaptive functioning outcomes were regressed onto self-regulation scores while covarying for age and gender. Overall, demographics and self-regulation accounted for 1.7% of the total variance in the positive endorsement of focus and pay attention better. Endorsement of experiencing benefits in students' abilities to focus and pay attention better was associated with age, OR = .877, p = .017. The likelihood of endorsing greater abilities to focus decreased as age increased. The ability to focus more after yoga was not significantly related to self-regulation change

scores or gender. No significant relationships existed between the endorsed improvements in one's ability to calm down when upset and age, gender, or changes in self-regulation (p's > .05). Demographics and self-regulation change scores accounted for 4.1% of the total variance of the final adaptive functioning outcome of the ability to avoid fights. The ability to avoid fights was found to have a significant relationship with age (OR = .824, $p < .001$) but not with gender or self-regulation change scores (p's > .05). As age increased, the likelihood of endorsing strengthened abilities to avoid fights decreased. With adaptive functioning outcomes, younger children were more likely to endorse benefits from yoga in focusing and avoiding fights than older children.

Table IV. *Multivariate logistic regression results*

	AdF: Focus more		AdF: Calm down		AdF: Avoid fights	
	OR [CIs]	*p*	OR [CIs]	*p*	OR [CIs]	*p*
Age	.877 [.79-.98]	.017*	.896 [.80-1.01]	.065	.824 [.74-.92]	<.001**
Gender	.968 [.65-1.45]	.874	.798 [.52-1.23]	.308	1.04 [.71-1.54]	.832
SR: Change	1.12 [.80-1.58]	.504	1.23 [.85-1.77]	.274	1.29 [.93-1.80]	.127

Note. SR = Self-regulation, AdF= Adaptive functioning outcome, OR = Odds Ratios, CI = 95% Confidence Intervals, * $p < .05$; ** $p < .001$.

Hypothesis 3. The final hypothesis is that students who report use of yoga at home will report a greater change in self-reported self-regulation. A one-way ANCOVA covarying for age and gender was employed for hypothesis 3 analyzing use of yoga at home and changes in students' self-regulation scores. After accounting for age and gender, those who used yoga at home had greater changes in self-regulation, $F(3,1) = 8.71$, $p = .003$, $\eta^2 = .019$.

CHAPTER IV

DISCUSSION

The present study served to analyze changes in children and adolescent's self-regulation and self-reported benefits in adaptive functioning skills (i.e., focus or pay attention better, avoid fights, and calm down when upset) after implementation of a school-based yoga program. Higher rated self-regulation skills during one's developing years is associated with adaptive functioning outcomes including higher academic performance, social competence, and stress management skills (Buckner et al., 2009; Vohs & Ciarocco, 2004). Conversely, the literature shows lower self-regulation in early life is related to greater adverse outcomes into adulthood including health problems, substance abuse, criminal convictions, and lower income (Montroy et al., 2016; Moffitt et al., 2011). Community-based organizations can serve as beneficial partners for effective implementation of school-based programs to children and adolescents and cultivating connections through existing community relationships. ZenWorks Yoga implemented a mindfulness and yoga school-based program to promote greater self-regulation and adaptive functioning outcomes in participating students (Buckner et al., 2009; Shapiro et al., 2006; Zelazo & Lyons, 2012). Implementation in schools has an additional benefit of allowing all children, with no discrimination based on intelligence, age, gender, or SES,

to receive benefits of yoga. Overall, the findings were somewhat supportive of the hypotheses with three key findings.

First, the analysis of self-regulation pre- and post-intervention scores did not support significant differences in self-reported self-regulation following yoga participation. The most compelling evidence for the lack of findings regarding self-regulation is the difficulty attaining an adequate measure of self-regulation in children and school-based settings (Boekaerts & Corno, 2005; McClelland & Cameron, 2012). From a previously conducted factor analysis, our measure had a strong one-factor solution (Ishaq et al., 2020); however, additional research needs to be conducted regarding content validity of the self-regulation measure. Another alternative explanation may be the difficulty measuring cognitive outcomes in mindfulness-based interventions (Vago et al., 2019). Self-report measures are more subjective than objective measures, such as academic grades or measures of brain changes through fMRIs that are more commonly utilized in mindfulness research (Kozasa et al., 2012).

Additionally, there is possibility that yoga is in fact not related to changes in self-regulation. Various mechanisms may exist within the construct of self-regulation. Yoga may be acting on different skills or mechanisms other than self-regulation. With the difficulties measuring self-regulation, the research between school-based yoga implementation and self-regulation are in its nascent stages and further research should be continued to analyze the potential relationship. Qualitative research may provide greater insight on the specific mechanisms or skills impacted by yoga and mindfulness practices (Butzer et al., 2017; Case-Smith et al., 2010).

Second, self-regulation change scores and gender were not significantly associated with the beneficial endorsement of adaptive functioning outcomes; however, the abilities to focus better and to avoid fights was associated with age. The initial finding was surprising as self-regulation and adaptive functioning outcomes of the abilities to focus, calm down, and avoid fights were expected to coincide with subconstructs of self-regulation; cognitive, emotional, and behavioral, respectively. With the one-factor model of self-regulation, the present study hypothesized self-regulation scores would be statistically similar to adaptive functioning outcomes. However, correlational and regression analyses suggested no significant overlap between adaptive functioning outcomes and changes in self-regulation. This finding may be explained by discrepancies in the conceptualization of self-regulation.

Interestingly, the present study found that the likelihood of endorsing benefits in two of the three adaptive functioning outcomes decreased as age increased. Younger children were more likely than older children or adolescents to endorse experiencing benefits from the school-based yoga program in their ability to focus and avoid fights. There were no gender differences evident in the endorsement of experiencing benefits in the three adaptive functioning outcomes after yoga participation; however, regardless of gender, the majority of students did endorse experiencing benefits in their ability to focus or pay attention better, calm down when upset, and avoid fights. The findings may be explained by the hypothesis that adaptive functioning outcomes, although related to subconstructs of self-regulation, may not evince gender differences like self-regulation. The literature is lacking on analyzing gender differences in adaptive functioning outcomes. With use of archival data, measurement limitations were imposed. Findings

may have differed with a continuous scale as opposed to the dichotomous, all-or-nothing endorsement of adaptive functioning outcome benefits utilized in the present study.

Third, results show students who reported greater use of yoga at home had greater changes in self-regulation above and beyond age and gender. The present finding is consistent with previous literature (Kozasa et al., 2012; Moore & Malinowski, 2009) and provides evidence that greater exposure and practice of yoga can lead to greater reported improvements. Fundamentally, those who practiced yoga at home likely had greater interested in the program and experienced greater improvements. In clinical settings, clients who use skills outside of therapy sessions more often report better treatment outcomes than those who do not frequently reflect on or use suggested skills (Barnicot et al., 2016). In preliminary analyses, the use of yoga at home was also correlated with age and gender. The present study did not analyze the influence of age and gender on use of yoga at home. Future research should include such analyses into their study to better understand differences in age cohorts use of yoga at home. Additionally, students who endorsed use of yoga at home likely also experienced less questioning and greater acceptance of yoga from members of their home. Although research supports greater use at home can lead to greater changes in self-regulation, family context and other factors may limit students' abilities to practice yoga at home (Dariotis et al., 2016).

4.1 Limitations

Various limitations of the present study could be addressed in future research; for example, the inconsistency of yoga implementation among the literature and use of an archival dataset. Implementation of yoga was conducted in-person and is the common method used in existing literature. Video-based instruction has additional benefits of

greater standardization and wider reach of implementation; however, in-person instruction may facilitate greater student participation and involvement. In clinical settings, the client-clinician rapport is a strong determinant of therapy success (Lambert & Barley, 2001). A similar pattern may be evident with yoga instructors and students during in-person implementation. When given the ability to develop a relationship with the instructor, students may report and experience greater improvements. During yoga classes, instructors add unique components like different therapists implement various approaches or techniques in clinical settings. In conjunction with the posture and poses, yoga and instructors teach skills to practice gratitude, compassion, and acceptance (Brown, 2019). The educational component of yoga may dictate learning and changes in self-regulation skills above and beyond solely movement of the body.

The use of archival data limited the flexibility and selection of measures in the present study. There was no control or waitlisted group for comparison between yoga participation of study outcomes or a quantitative variable for the number of yoga sessions students were present. With the archival data, the self-regulation measure was designed for a program evaluation and not validated for the population, setting, or content validity. A previously validated school-based measure of self-regulation in children and adolescents would have been beneficial to utilize for the present purpose, such as the Adolescent Self-Regulatory Inventory (Bergen-Cico et al., 2015). For adaptive functioning outcomes, the design of dichotomous, back-to-back questioning during a single period may have led to measure effects. There were correlations between all adaptive functioning outcomes utilized in the present study.

The archival study utilized student self-reports, while existing literature only utilized parent and/or teacher measures (Telles et al., 2013). Use of parent and teacher measures may have provided additional information on externally perceived changes in self-regulation and adaptive functioning outcomes. Multiple informants may reduce biases associated with solely using external source reports or internal self-reports. General limitations to school-based programs have been the rebuke by parents and religious communities (Broyles, 2020). Parental involvement in outcome responses as well as acceptability can increase parental buy-in and student's likelihood to use yoga at home. Despite these limitations, the results suggest several theoretical and practical implications.

4.2 Implications

Continued work on standardization of yoga implementation and manipulation of confounding variables (e.g., self-regulation measure, in-person vs pre-recorded sessions, additional skills covered in yoga sessions, family/teacher context and attitudes towards yoga) is important to better understand their influence on the effects of yoga in relation to self-regulation and adaptive functioning outcomes. Further standardization and control of external variables can provide better understanding of specific mechanisms of self-regulation impacted by yoga participation, specifically in younger children where more significant changes in self-regulation or related skills have been observed. Several studies included an interval time and activity chart, providing in-depth knowledge on what yoga sessions consisted of (Yüce & Muz, 2020). Future research should include all skills and knowledge taught in school-based mindfulness and yoga intervention programs to allow better understanding of the mechanisms at work. Parent and teacher reported measures in

conjunction with self-report measures of self-regulation and related skills would be beneficial in future studies to reduce biases and consider extraneous variables.

There has not been consistency in fidelity of implementation or inclusion of related variables in existing research on school-based yoga and mindfulness programs (Espil et al., 2021). Schools are lively and hectic environments with limited resources, which can add difficulty to implementing standardized and structured programs. Identifying important components of yoga or mindfulness that improve students daily functioning and skills (e.g., focus, calm down, avoid fights) related to school success would further encourage school buy-in and incorporation of such programs. Although no significant improvements in self-regulation were found, students did endorse experiencing benefits in adaptive functioning outcomes which are related to overall success in schools. Whether student reported improvements are related to self-regulation or whether there is another mechanism impacting students' perceived benefits should be further investigated.

In recent studies, researchers have begun to analyze mindfulness and yoga in conjunction with clinical treatments. Cognitive Behavioral Therapy (CBT) is a commonly used therapeutic intervention that has been advantageous for anxiety disorders, general stress, and anger control problems, among others (Hofmann et al., 2012). Many CBT interventions incorporate deep breathing and muscle relaxation techniques commonly used in mindfulness or yoga practice, particularly the "third wave" approaches (e.g., dialectic behavioral therapy, acceptance and commitment therapy). Recent research has formulated a yoga-enhanced cognitive behavioral therapy (Y-CBT), specifically incorporating more mind-body awareness. The research has found significant

improvements in anxiety, depression, panic, sleep, and quality of life (Khalsa et al., 2015). Components of yoga and mindfulness have become more supported in the literature on a variety of beneficial outcomes across school and therapeutic settings.

Additional research on self-regulation psychometrics is needed for better reliability in the assessment of school-based programs. Previous literature has found that the subconstructs of attention, cognitive, and behavioral self-regulation are highly intercorrelated and self-regulation may be better conceptualized by a single concept (Raffaeli et al., 2005), which provides explanation as to why self-regulation was not related to adaptive functioning outcomes. The measure of self-regulation utilized in the present study was found to have a strong one-factor solution (Ishaq et al., 2020) and did not support the analysis of specific subconstructs of self-regulation. Continued research should investigate a unified conceptualization of self-regulation as a uni- or multi-dimensional construct. Further research is likely to benefit from distinctive definitions between self-regulation and related concepts such as self-control. Use of quantitative measures, such as academic achievement or behavioral incidents, will likely be more reliable than self-reported measures in analyzing significant changes in performance during yoga intervention (Boekaerts & Corno, 2005). Additionally, use of objective as opposed to subjective measures of adaptive functioning outcomes may be beneficial for collaboration with other fields (i.e., fMRI, neuroimaging measures of attention; Kozasa et al., 2012). Another direction may be to analyze self-esteem and self-concept (Telles et al., 2013) or self-efficacy (Case-Smith et al., 2010) as opposed to self-regulation skills in school-based yoga programs.

The data has potential for intervention implications during the COVID-19 pandemic. With restrictions on in-person schooling, many students have been attending school entirely virtually or in a hybrid format. Our results suggest use of yoga at home was related to greater changes in self-regulation. Schools can work to encourage students' continued practice of yoga at home. ZenWorks has sessions already pre-recorded and can be shared with students for personal use and/or used in class while maintaining social distancing. Adults who practiced yoga virtually during the COVID-19 shutdown were found to have more effective coping and maintenance of wellbeing (Sahni et al., 2021). Students are also likely to still experience benefits from yoga outside of an in-person school-based session. Use of yoga at home is a variable lacking in several studies in the literature and future research should control for and analyze the effects of use at home in school-based programs.

Although the current findings did not corroborate existing literature, the evidence is supportive of students attaining benefits from self-regulation. All children in the United States are required to attend school. This setting is an ideal setting to educate students on coping skills and mental health concepts. Existing SEL programs are effective at providing skills to children (Durlak et al., 2011; Kragg et al., 2006); however, do not meet the mark with stress, anxiety, and depression still on the rise with the country's youth, even more so through the current COVID-19 pandemic (Salari et al., 2020). Trauma-informed yoga programs can be effective in improving emotion regulation and helping adolescents cultivate self-regulation skills (Ovissi & Hadaman, 2020), particularly with incarcerated youth (Himelstein et al., 2011; Tibbitts et al., 2021). Some instructors through the ZenWorks organization are trained in trauma-informed yoga and

would be a beneficial protocol to study for students needing specialized programs or additional skill building. Mindfulness and mediation are tools and skills a person can always have through the breath or changes in perception; as opposed to fidget spinners, cellphones, or other objects people use to regulate. Yoga also has the added component of physical exercise that is associated with better well-being outcomes (Yüce & Muz, 2019).

The present research, therefore, contributes to a growing body of evidence suggesting that school-based intervention programs are effective at improving social-emotional or adaptive functioning skills. Use of yoga at home is suggested to increase the amount of change students report in their overall self-regulation; however, there is great room for improvement with self-regulation conceptualization as a uni- or multi-dimensional construct, psychometrics with children and school-based programs, and greater understanding of the specific mechanisms of self-regulation targeted by yoga and mindfulness practices. Greater standardization and detailed records of program content is needed within school-based yoga intervention programs to control for a large degree of confounding variables. School is an ideal location to educate children on skills needed to succeed in daily life with inclusion of all individuals in the country. Joint research and community-based programs can improve existing procedures and provide necessary support for the continued implementation.

4.3 Conclusions

Our study did not support positive changes overall in self-regulation after participation in a school-based yoga program or the influence of self-regulation change scores on adaptive functioning outcomes. The present research did provide support for the influence of yoga practiced at home on higher individual changes in self-regulation

and self-reported benefits to adaptive functioning outcomes (e.g., focus and pay attention, avoid fights, and calm down when upset). No gender differences were found in self-regulation or adaptive functioning outcomes. Although the hypotheses were not fully supported, there is some evidence that yoga can improve children's perceived ability to focus and pay attention in class. Specifically, younger children were more likely to report greater benefits in adaptive functioning outcomes. Early interventions would be advantageous for lasting changes in students' adaptive functioning outcomes and teaching children several skills necessary for success in school, work, and as productive, resilient adults in society.

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APPENDIX A

(Self-Regulation Questionnaire)

*Circle **N** if the sentence **never** describes how you feel.*

*Circle **S** if the sentence **sometimes** describes how you feel.*

*Circle **O** if the sentence **often** describes how you feel.*

*Circle **A** if the sentence **almost always** describes how you feel.*

Read each sentence carefully, and circle the answer that matches you.

1. I can pay attention to one thing at a time.
2. I can notice what I think and feel.
3. I can recognize and identify many different emotions.
4. I can recognize my strengths and feel confident.
5. I can set and accomplish goals.
6. I can manage my behaviors and actions.
7. I can take responsibility for my behaviors and actions.
8. I can be kind to myself and others.
9. I can appreciate differences in others.
10. I can respect other people's feelings.
11. I can express my thoughts, feelings, and need appropriately.
12. I can work in a team.
13. I can recognize and appreciate the people, places, and things in my life.
14. I can make healthy and kind choices.
15. I can care for my own space and the space around me.

APPENDIX B

(Yoga Involvement and Impact)

Please answer the following by checking the Yes or No box.

Pre

1. Have you ever done yoga in the past?
    a. Did you enjoy it?
2. Have you ever used calming down strategies to help you?

Post

1. Have you ever done yoga in the past?
    a. Did you enjoy it?
2. Have you ever used calming down strategies to help you?
3. Did you enjoy your yoga classes?
4. Has learning yoga helped you in your life?
5. Have you used yoga on your own?
6. Do you think you will use yoga in the future?
7. Have you taught anyone you know about yoga?

APPENDIX C

(Adaptive Functioning Outcomes)

1. Yoga has helped me:

   (check all that apply)

   a. Work together better with teammates or other students
   b. Be better at sports, music, or other activities
   c. Be happier where I live
   d. Focus more or pay attention better during activities
   e. Calm down when I am upset
   f. Avoid fights or arguments
   g. Listen more carefully to my teachers or coaches
   h. Fall asleep at night
   i. Make decisions
   j. All of the above
   k. Yoga has not helped me