3rd International Conference on Research in EDUCATION, TEACHING and LEARNING

21-23 FEBRUARY, 2020 ROME, ITALY

Mindfulness in Elementary Schools

Anne Ritter[1], Isabel Alvarez[2,]

[1]Autonomous University of Barcelona (SPAIN)

[2]Autonomous University of Barcelona (SPAIN)

Abstract.

Mindfulness training is an accepted and effective didactic approach to improve the executive functions (EFs) of upper elementary school students. However, previous mindfulness studies conducted on upper elementary school students have been primarily led by external instructors, outside of the natural classroom and school-day routine. The methodologies of the previously conducted studies leave a deficit in the literature for teacher-led, curriculum-embedded mindfulness research upper elementary classrooms. This study seeks to address these shortfalls by evaluating the effects of a mindfulness intervention program, Mind Yeti, on the EFs of upper elementary school students when the intervention is implemented in the school curriculum and led by their classroom teacher. A diverse sample of 3rd, 4th, and 5th grade upper elementary school students (n = 177; aged 8 to 11 years old) participated in the Mind Yeti intervention in their general education classroom. The frequency of the intervention was six sessions per week for six weeks. Students' self-reported their levels of EFs by completing pretest and posttest questionnaires, Executive Function Student Questionnaire (EFSQ), which were collected and analysed. Paired-sample t-tests indicated that students significantly improved their levels of inhibition, working memory, and cognitive flexibility. Additionally, students in the 5th grade responded better to Mind Yeti than students in the 3rd grade. Results were consistent with the hypothesis, suggesting that curriculum based, teacher led, mindfulness training is an appropriate and effective intervention for improving the EFs of upper elementary school students, and thus may be a positive addition to curriculum at the upper elementary school level.

Keywords: Mindfulness, Elementary School, Mind Yeti, Executive Functions, School Curriculum

1. Introduction

The executive functions (EFs) are a set of interrelated, neurologically based behavioural and metacognitive skills that set the foundation for personal and academic success. The behavioural EFs include inhibition, emotional control, and cognitive flexibility, while the metacognitive EFs include sustained attention, working memory, and organization (Dawson, 2013). These skills are extremely important for the completion of academic tasks as they allow students to control their emotions, initiate tasks, manage time, pay attention, and remember details (Dawson, 2013; Dawson & Guare, 2009). Students who struggle with EFs difficulties (i.e. executive dysregulation), may face a lot of challenges throughout their academic lives. Some of these challenges include, having poor follow-through on

assignments, disorganisation, difficulty with language, comprehension (Dawson & Guare, 2009) and critical thinking skills. Additionally, these challenges may cause students to experience social rejection and bullying in school (Kusnyer & Stanberry, 2013) and may even continue into adulthood; negatively affecting "relationships and employment" (O'Toole et al., 2017). Therefore, it is imperative to provide students with tools and strategies to strengthen their EFs, especially students in the upper elementary grades who are increasingly required to complete more complex tasks and are often socially fragile. One tool that has been gaining momentum and has shown promising findings in improving the EFs of school children is mindfulness training (Flook et al., 2010; Burke, 2010; Huguet et al., 2017).

According to Kabat-Zinn, "mindfulness means paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1990). The physical practice of mindfulness varies by program and may include music, yoga, sitting, standing, and other movements. What is uniform about engaging in a mindfulness practice is the intention to practice, paying attention mindfully, and practicing with non-judgment (Eklund et al., 2017).

Mindfulness training can elicit structural changes in the brain, which is thought to improve EFs as it "fosters enhanced resilience and more optimal brain function" (Meiklejohn et al., 2012). Neurologists theorise that when students engage in mindfulness practice, their amygdala shrinks, which causes them to respond to stress in a more thoughtful and calculated manner (Taren et al., 2013). Additionally, there are changes in the physical structure of the prefrontal cortex, which is the area of the brain responsible for "higher order brain functions" (Moreno, 2017), such as attention, working memory, response inhibition, and cognitive flexibility (Basso et al., 2019). This ultimately reduces inattention (Diamond, 2013), inhibits distractions or unwanted thoughts, and improves awareness, focus, concentration, and decision-making capacity (Moore & Malinowski, 2009).

Clearly, the literature shows that mindfulness training has a positive impact on students' psychological and cognitive functions. Students who engage in mindfulness training have shown improvements in attention, self-regulation, mental processing, cognition, academic performance, and behaviour (Maynard et al., 2017; O'Toole et al., 2017). Additionally, students who engage in mindfulness practices also have "higher levels of mindfulness, better attentional performance, and higher cognitive flexibility" (Heeren et al., 2009). Additionally, in changing situations, they are more likely to substitute automatic responses with ones that are deliberate and flexible (Moore & Malinowski, 2009).

Although previous studies on mindfulness in elementary schools are positive, there is a need for more rigorous evidence-based scientific research in this area. "The use of mindfulness-based interventions (MBIs) in schools has proliferated over the past decade, resulting in the development and marketing of programs and curricula with differences in the underlying content, methods, dosage, and effectiveness" (Leyland et al., 2018) For example, the majority of previous studies on mindfulness in elementary schools have been implemented on small, targeted samples, aimed at improving emotional regulation, attention, behaviour, and/or academic achievement (Burke, 2010). In contrast, only few studies have investigated the effect of mindfulness on the individual EF composites, such as working memory, cognitive flexibility, and organisation (Flook et al., 2010; Dawson, 2013). Furthermore, the

duration and frequency of mindfulness sessions (i.e. dosage) in previous studies have varied greatly. Plus, those studies were mostly led by external instructors in clinical settings, outside the regular curriculum and classroom.

The purpose of this study is to provide researchers with preliminary findings on the effectiveness of a novel classroom based MBI, called Mind Yeti, for improving the EFs of upper elementary school students, 8 to 11-year olds. The Mind Yeti curriculum was chosen because it features several administrative components that have been lacking in previous studies: smaller dosage, led by classroom teachers, and delivered in a classroom setting. We hypothesised that elementary school students, aged 8 to 11 years old, who engage in this classroom-based mindfulness intervention program would show pretest to posttest improvements in the six EFs examined.

2. Methodology

2.1. Participant

The sample (n = 177) consisted of 46% female and 54% male upper elementary students between 8 and 11 years old. A total of eight classes were included in this study: four 3rd grade classes, one 4th grade class, and four 5th grade classes. Each class had an average of 26 students.

2.2. Measures

The Executive Function Student Questionnaire (EFSQ), used to measure the students' EFs at the beginning and at the end of the study (&=.75), was inspired by the Behavior Rating Inventory of Executive Function - Adult Version (BRIEF-A) (&=.73-.90) (Leyland et al., 2018) and the Executive Function Skills Questionnaire (Dawson, 2013). To develop the EFSQ, the researchers reviewed and compared the questions on the BRIEF-A (Gioia et al., 2000) and the Executive Function Skills Questionnaire (Dawson, 2013). They selected 18 of the most appropriate questions relating to the six EF composites being studied. Some of the questions were adapted to age-appropriate language.

There were 18 questions on the EFSQ and each question related to one of the six EF categories. Furthermore, of the 18 questions, groups of three targeted each EF category. For example, questions 1 to 3 related to Inhibition, questions 2 to 6 emotional control, and questions 7 to 9 related to sustained attention. Students were asked to answer each item/question by selecting one of the following five options (Likert scale): 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, to 5 Strongly Agree. To find patterns in the data, researchers looked at how students reported on individual items/questions, then compared students' self-reporting on the pretest to the post test. Additionally, to obtain the students' EF composite score for each of the six EF categories (inhibition, emotional control, sustained attention, working memory, organization, and cognitive flexibility), the mean score of the three questions relating to each EF category was calculated. For each EF category, higher

mean scores indicated higher levels of EF difficulties and a lower score from pretest to posttest indicated an improvement in the EFs.

Questions were electronically compiled as a questionnaire to be completed online. The morning of the pretest, teachers were sent the link to the EFSQ and then forwarded this link to their students via Google classroom. Students were encouraged by their teachers to answer the questions as best as they could and to ask for clarification if they had any doubts about the items on the questionnaire. Data collection was administered in the same order each classroom and lasted approximately 30 min. Due to limited timing and in order to minimize fatigue, students were only required to complete one pretest and one posttest.

2.3. Procedure

To test our hypothesis, we conducted an intervention where students took part in a mindfulness intervention program using the Mind Yeti curriculum. Preceding the intervention, the researchers conducted a 15-min presentation to the classroom teachers to inform them of the study, explain the data collection procedure, and answer any questions. Teachers were also sent a document with additional information about the study and the intervention program. They were given a Mind Yeti Playlist to be used as a guide for the 6-week intervention. The Mind Yeti Playlist consisted of 30 different Mind Yeti lessons to be taught over the course of the 6 weeks. Each week focused on a different core EF through the introduction of different skills, such as focusing the attention on specific sounds, on counting breaths, pretending to be plants (tree in the city), pretending to be animals (whale talk), pretending to be professional workers (sound scientist), identifying their own feelings, and calming down through belly breathing (diaphragmatic breathing). To strength previously learned skills as well as teach new strategies, the week-by-week structure of the program included a lot of overlapping and repetition of previously mindful activities. For example, each week had deep breathing activities which were taught during the first week as a strategy to improve inhibition.

The study used a repeated-measures design with pretest and posttest questionnaires. Teachers and students were assigned confidential Mind Yeti login numbers on the first day of the study. Teachers distributed the numbers to the students. Each student's number was available to the researcher, classroom teachers, and the student themselves. Teachers were instructed to remind the students to keep the numbers confidential and to discard them after completing the questionnaires. On the first day of the study, the teachers sent out the pretest questionnaires to their students using Google Classroom. Once the students completed the EFSQ and pressed submit, the responses were automatically sent to the researchers. Teachers di not have access to the students' responses. Teachers described the study to their students, guided the students through the questionnaires, answered questions, and made clarifications in age-appropriate language. After the 6 weeks of intervention, the students completed the posttest questionnaire via the same procedure. To guard against biases due to variability in reading proficiencies, the teacher read the questions aloud, and the students marked their answers by selecting one of the five Likert Scale options.

2.4. Intervention

The intervention program used was the Mind Yeti curriculum, a resource from Committee for Children. It was designed to help kids reduce stress, improve focus, and build empathy through an app/website-based mindfulness program. Mind Yeti actively engages and guides the students through short, narrated, meditative scripts for a variety of moods: calm down, focus, get along, reset, create, and go to sleep (Committee for Children, 2017). The program refers to mindfulness as settling the Hubbubbles. The Hubbubbles are essentially some of the EF dysregulations (the distracting thoughts, feelings, and sensations) that students experience throughout the school day. The guided mindfulness sessions from Mind Yeti help students reduce the Hubbubbles, thus improving the EF by helping to boost their focus, calming their bodies, and improving their social-emotional learning (SEL).

The Mind Yeti program was selected for this study because it was appropriate for the target population of the study. For example, the Mind Yeti sessions used language that was suitable for students in a school setting between eight and eleven years old. The short duration of the sessions, 5-7 minutes, was also consistent with the recommendation of previous empirical studies. The program was app based and the sessions were primarily audio-visual, with images of the Hubbubbles floating on the classroom whiteboards. Mind Yeti was easy to implement in the regular classroom setting without any formal training to teachers. Teachers were not required to invest planning time since the predesigned Mind Yeti sessions were guided and only required that teachers clicked the playlist for their classes to listen to the guided Mind Yeti session. The Mind Yeti program was designed to be an active, mindfulness learning experience which could take place online and be conducted in the classroom setting. This app-based program also allowed us to gauge the exact time frame of how long students were being mindful based on the length of the mindfulness sessions. Finally, and most importantly, the skills taught with the Mind Yeti curriculum directly targeted the 6 different EF areas of inhibition, emotional control, sustained attention, working memory, organization, and cognitive flexibility.

2.5. Data Analysis

Statistical analysis was accomplished using the Statistical Package for the Social Sciences (SPSS) version 24. Paired-sample t-tests were used to assess the significance of pretest to posttest changes in EF subdomain scores. First, we examined the change from pretest to posttest for the whole group (Grades 3, 4, and 5 combined). Then we examined the changes at grade level for Grades 3 and 5 (excluding Grade 4). The significance level was set at alpha .05 ($p < .05$).

3. Result

For this study, we looked at whether or not there were significant changes from pre to posttest according to two variables: gender and grade. Overall, the results from the EFSQ suggested pretest to posttest improvements in students' 3 EFs: inhibition ($p = <0.05$), cognitive flexibility ($p = <0.05$) and, working memory ($p = <0.05$). Improvement in the EFs is indicated by a decrease in score from pretest to posttest. In other words, lower scores from pretest to

posttest reflect higher EF skills. Table 1 shows pretest and posttest scores for the entire sample, 3rd grade, and 5th grade students.

Table 1: Pretest and posttest descriptive statistics for the entire sample, 3rd grade, and 5th grade.

	Pretest		Posttest					
EFs	M	SD	M	SD	t	df	Sig. (2-tailed)	Cohen's d
Whole Sample (n = 177)								
Inhibition	2.50	.77	2.23	.77	5.77	176	.00*	.40
Sustained Attention	3.80	.63	3.74	.80	1.16	176	.43	.10
Emotional Control	2.42	.87	2.25	.93	3.19	176	.09	.20
Working Memory	2.31	.85	2.13	.83	3.60	176	.04*	.30
Organization	2.39	.81	2.33	.80	1.07	176	.48	.10
Cognitive Flexibility	2.43	.69	2.21	.83	4.56	176	.001*	.30
3rd Grade (n = 64)								
Inhibition	2.58	.83	2.31	.81	2.55	63	.010*	.32
Emotional Control	2.67	.87	2.54	.93	1.39	63	.170	.14
Sustained Attention	3.80	.93	3.74	.93	1.31	63	.195	.06
Working Memory	2.39	.84	2.35	.87	.42	63	.680	.04
Organization	2.53	.83	2.57	.77	–.37	63	.710	.05
Cognitive Flexibility	2.63	.71	2.44	.86	2.10	63	.040*	.23
5th Grade (n = 86)								
Inhibition	2.43	.71	2.14	.75	4.85	85	.000*	.40
Emotional Control	2.16	.72	2.06	.86	1.48	85	.140	.13
Sustained Attention	3.86	.69	3.88	.83	-.23	85	.82	.03
Working Memory	2.19	.83	1.98	.76	2.79	85	.010*	.26
Organization	2.33	.82	2.21	.80	1.70	85	.090	.15
Cognitive Flexibility	2.31	.65	2.11	.79	4.85	85	.000*	.27

*P < .05

Gender

There were significative differences in two of the six EFs. Inhibition (p = 0.030) and Organization (p = 0.014). See Figures 1 and 2.

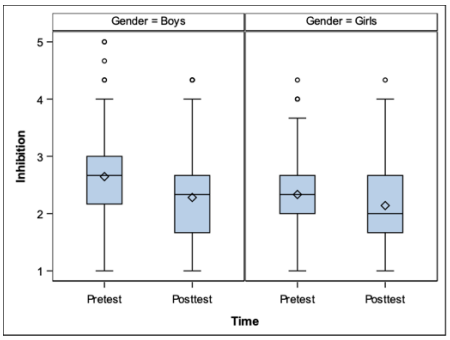

Figure 1. Inhibition differences according to gender.

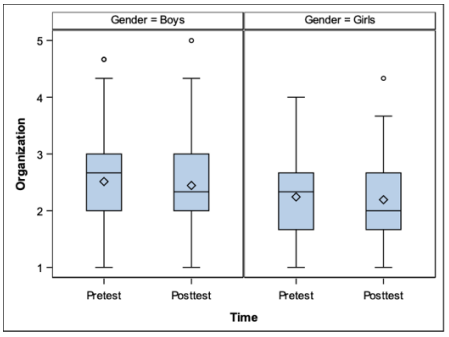

Figure 2: Organization differences according to gender

Grade

According to the grade there were significative differences in three of the EFs. Emotional Control (p = 0.001), Organization (p = 0.0284), Cognitive Flexibility (p = 0.008). See Figures 3 and 4.

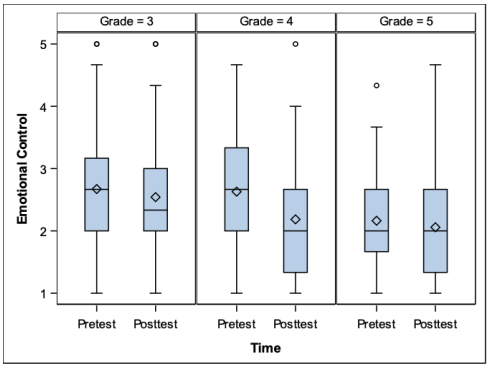

Figure 3. Emotional Control differences according to Grade level.

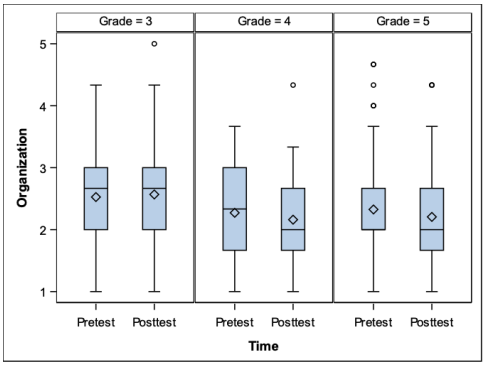

Figure 3. Organization differences according to Grade level.

4. Discussion

Results from paired-sample t-tests on the entire sample suggested that when elementary students took part in an MBI with specifically tailored administrative components, their levels of inhibition, working memory, and cognitive flexibility were significantly improved from pretest to posttest. The findings partially supported the hypothesis. Previous studies also had inconsistent results, with some studies showing significant improvements (Flook et al., 2010; Felver et al., 2017), and others showing nonsignificant changes (Leyland et al., 2018), in students' EFs after they participated in an MBI. One similarity between this study and that of Flook et al. (2010) is that they also found statistically significant improvement in the area of Working Memory. On the other hand, they found a statistically significant difference in what they referred to as Organize, whereas the present study did not find a significant improvement in Organization. This could have been due to methodological differences between the studies, especially in the types of mindfulness activities in which the students were engaged in. For example, in the intervention by Flook et al. (2010), students engaged in three different types of activities (sitting meditation, games and activities, and modified body scan or meditation), in each session. Whereas, in the present study, the organization activities included imagination and following the breath.

Results were also examined at the grade level, for the 3rd and 5th grades only. In the area of Inhibition, the findings indicated that at the 3rd and 5th grade levels - as well as for the entire sample, students showed statistically significant improvements in their Inhibition levels, which is in agreement with previous studies. For example, these findings are consistent with those by Felver et al. (2017) who conducted a study on the effectiveness of mindfulness to regulate off-task behaviour. They found that the Soles of the Feet (SOL) mindfulness intervention may reduce off-task behaviours in 3rd grade elementary school students. They described off-task behaviour as "[becoming] angry or defiant," "refusing to comply with adult directives," or "becoming frustrated and noncompliant" (Felver et al., 2017). In the present study, we described these behaviours as examples of not exhibiting inhibition, which is the aptness to resist the temptation to act or change one's attention, emotions, thoughts, and/or behaviour impulsively.

Following the Mind Yeti intervention, the present study found a statistically significant improvement in Working Memory scores for the entire sample, and for 5th graders. Similarly, in a pioneering study that investigated the effectiveness of an MBI for working memory capacity (WMC) in adolescents, Quach et al., (2016), found that, after the intervention, participants showed statistically significant improvements in their WMC compared with the waitlist control groups. The participants in their study were adolescents, somewhat older than the elementary school students in the present study.

In the area of Cognitive Flexibility, following the Mind Yeti intervention, participants in the present study showed a statistically significant improvement for 3rd and 5th grade levels, as well as for the entire sample. This was consistent with the findings of Heeren et al. (2009) and Moore and Malinowski (2009). Heeren et al. (2009) conducted a Mindfulness-Based Cognitive Therapy intervention with adults. They found that when adults practiced meditation, they displayed improved cognitive flexibility. Similarly, Moore and Malinowski (2009) found that mindfulness training may positively influence cognitive flexibility.

Contrary to what was expected, the findings for Emotional Control, Sustained Attention and Organization did not show statistically significant changes from pretest to posttest. Although these results do not support our hypothesis, our findings, particularly for Sustained Attention, are in agreement with those by Tarrasch (2017) who conducted a mindfulness intervention on a similar sample. A possible explanation for these results could be that students did not fully understand the questions, an argument proposed by Felver et al., (2017). Additionally, as with similar studies (e.g. de Carvalho et al., 2017), students rated themselves very high on the pretest, so there was little to no opportunity to see growth on the posttest.

Regarding the intervention program itself, Mind Yeti is good for learning how to engage in mindful moments throughout the day and with any mood. However, it is important to consider that some students may require a visual component, which is not part of the current Mind Yeti program. For example, students who are not comfortable closing their eyes, such as those with auditory processing challenges, and even English language learners, may benefit from an additional visual aid on the screen, much like the introductory Mind Yeti video. Additionally, at the time of the intervention, Mind Yeti had not yet published a sequence of lessons. They have since added multiple playlists to their website, classified by grade levels and consisting of 15 sessions each. Nonetheless, Mind Yeti still has the potential to create longer playlists for

longer interventions. Since Mind Yeti is relatively inexpensive, and it can be implemented in short dosages with little to no preparation time by the teacher, administrators should consider implementing the Mind Yeti curriculum in their schools.

5. Conclusion

This paper makes an important contribution to the literature on the effects of mindfulness training for the EFs of elementary school students. Though our results were mixed, they were also promising. The present study showed that elementary school students' participation in an MBI was associated with improvements in their level of inhibition, working memory, and cognitive flexibility. These are fundamental skills for academic and social success, and our study demonstrates that they can be enhanced by engaging in mindfulness exercises. At the time of writing, only one study had been conducted using the Mind Yeti curriculum, and that study was conducted on pre-schoolers. To our knowledge, this is the first study conducted to test the effect of the Mind Yeti curriculum on elementary school students. Thus, educators can be more confident that Mind Yeti is an evidence based MBI for use in elementary classrooms.

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