The Effects of Mindful Awareness Teaching Practices on the Executive Functions of Students in an Urban, Low Income Middle School

Cheryl T. Desmond, Ph.D.
Laurie Hanich, Ph.D.
Millersville University
Millersville, Pennsylvania

Purpose

This research project evaluated the effectiveness of a school-based program of mindful awareness on the executive functions of 40 sixth grade children, ages 11-12 years, in an urban, low income, public middle school in a randomized control study. Although mindful awareness is often viewed as a multi-faceted construct, this study operationally defines mindful awareness as defined by the Wellness Works in Schools™ Program and is based primarily on research on the executive functions behaviors that manifest themselves cognitively, emotionally, and physically. Inhibition, emotional control, initiation, working memory, monitoring, and organizational skills are examples of executive function capabilities.

Self regulation and focused attention behaviors as related to executive function are important for children's emerging academic achievement in school (Blair & Razza, 2007). Poor executive function may manifest as a lack of concentration, impulsivity, inability to understand and/or retain information, inability to transition to new tasks, and poor socio-emotional adjustment; all of which can affect academic functioning in the classroom.

This study builds on the existing work of Flook et al (2010) which found some support for improved executive functioning in elementary and preschool children as a result of participation in a mindful awareness program. However, to date, there is no known research that looks at the effects of mindful awareness programs on executive function behaviors in urban, low-income middle school aged students. We believe we fill a much-needed gap in the research literature by conducting the present study with such a population.

Theoretical framework

The teaching practices of the mindful awareness program are based primarily on research on the executive functions within an individual's repertoire of cognitive, emotional, and physical behaviors. The executive functions are a collection of processes that are responsible for guiding, directing and managing cognitive, emotional, and behavioral functions, particularly during active novel problem solving. Goia et al. (2000) stated that the "term, executive function, represents an umbrella construct that includes a collection of interrelated functions that are responsible for purposeful, goal-directed, problem-solving behavior"… executive functions relate to the highest levels of cognition: anticipation, judgment, self-awareness, and decision making" (p.1). These higher cognitive behaviors differ from the more basic cognitive functions such as language, visual-spatial activities, and memory abilities. Key aspects of the executive function behaviors include the "ability to initiate behavior, inhibit competing actions or stimuli, select relevant task goals, plan and organize a means to solve complex problems, shift problem-solving strategies flexibly when necessary, and monitor and evaluate behavior" (p.1). Goia et al also included

working memory as a subdomain of executive function since the individual would most likely need to retrieve relevant information for complex problem-solving tasks.

Brain-based research has determined that the capacity for executive function behaviors occurs within the frontal system of the brain and relies on connections of the frontal regions with the cortical and subcortical regions of the brain. The developmental course of the executive functions within an individual follows the path of one's neurological development. Conversely, dysfunction can arise from a variety of forms of damage to the frontal region as well as to the interconnected cortical and subcortical regions of the brain.

Goia et al contended that the executive functions of self-awareness and control develop in parallel with specific areas of content. For example, as basic memory skills develop, knowledge about how to use and control these memories, or "metamemory," develops concurrently. Based on research studies on metamemory, Goia et al highlighted the importance of self-control strategies within the context of specific processes such as reading or writing (p.3).

In addition to the theoretical underpinnings of executive functions, we also draw on recent empirical research in this area. Flook et al (2010) and Smalley et al (2008) conducted randomized control studies of the effects of mindful awareness practices (MAPs) in elementary and in Pre-K children. Teachers and parents assessed the executive function of the two age levels of children before and after the treatment periods. Children in the MAPs group who were less well regulated showed greater improvement in EF as compared with the control groups.

We conducted an observational study of the impact of the mindful awareness teaching practices on the cognitive, physical, and emotional behaviors of six learning support and emotional support sixth grade students in the same middle school over a five-month period in 2008-2009 school. The mindful awareness teaching practices had the most significant effect on the behaviors of the three emotional support students, supporting the research findings of the Flook et al study. The observational study, however, was limited 1) by the small number of the students in the program, 2) by the influence of the observer's bias on the rating of student behaviors, and 3) by the study being conducted on student behaviors as they participated in the treatment class. It did not investigate the transference of the changes in students' behaviors to their regular, subject content classrooms. To address these limitations, the researchers conducted the study of the mindful awareness practices (MAP) that are evaluated in this paper. Based on our previously conducted pilot work and the existing Flook et al. study (2010), we hypothesized that MAP training would result in improved executive functions behaviors among adolescents from an urban, low-income middle school.

Data source

Participants were 40 sixth-grade students, ages 11-12, from a middle school located in the northeast United States. Fifteen students were randomly assigned to the treatment group and twenty-five students were randomly assigned to a control group, prior to the study. Descriptive information about the sample is displayed in Table 1.

Methods/Mode of inquiry

The research study is a quasi-experimental design that utilizes quantitative data analytic procedures. The study was conducted across a ten-week period spanning mid-November, 2009, to the end of January, 2010. Control students participated in a homeroom period while treatment students received MAP instruction for 25-45 minutes, once a week, across a ten-week period.

Limitations of the study included a delay in the onset of the study, missed weeks of the program, due to two holiday vacations and weather, and the school's scheduling demands.

As described by its developers, Kinder Associates, the MAP program uses "focused awareness and self regulation practices and curricula to promote positive neurological system function and behavioral expression" (2009, pp 1-2). Each lesson for the treatment group included: 1) a preliminary group discussion of selected emotional, physical and social behavioral topics, (e.g. handling challenging emotions such as anger or sadness, mental fitness, and inner and outer physical, cognitive, and emotional regulation), 2) the practice of skills on MAP, including self- attention, concentration, planning and organization, and emotional control where the student focus shifts from external stimuli to internal awareness to sort out thoughts, emotions and physical behaviors in a non-reactive way; healthy breathing to promote slowing down and reflection; and physical movements with cognitive connection to release tension and stress; and 3) closing group reflections to allow students the opportunity for inquiry and comment.

Two teachers, who were formally trained in the MAP teaching practices, had previously taught in the elementary feeder school to the middle school and had been teaching in the Wellness Works program in this and other school districts for at least two years were the instructors for the treatment group.

A core classroom teacher in one of the children's content areas, e.g. communication arts, mathematics, or science, completed the questionnaire, the Behavior Rating Inventory of Executive Function (BRIEF), assessing both control and treatment student's executive function behaviors immediately before and following the ten-week period. This measure assessed 86 executive function behaviors across eight scales (inhibit, shift, emotional control, initiate, working memory, plan/organize, organization of materials, and monitor). Two broad composites are scored across the eight scales: Behavioral Regulation Index and Metacognition Index, which combine to yield an overall Global Executive Composite. Items were scored on a 3-point scale indicating whether the behavior was observed "never (3)", "sometimes (2)" or "often (1)". Raw scores on the scale were converted to t-scores prior to data analysis.

Results

Using SPSS, a series of data analytic procedures were conducted. First, independent t-tests were conducted to determine that there were no existing differences between treatment and control groups. No significant differences were found on Behavioral Regulation, Metacognition, or Global Executive Composite (all ps > .05).

Next, multivariate analysis of variance (MANOVA) with group as a between-subjects factor (treatment v control) and time as a within-subjects factor were conducted to examine group by time effects. Figure 1 depicts the mean t-scores by group and time point (pre and post) for the Metacognition Index, Behavioral Regulation Index, and the Global Executive Composite. None of the analyses revealed a significant main effect of group nor a significant main effect of time. Nor were there significant time by group interactions (all ps > .05). Mean pre and post test executive function scores for each of the scales are presented in Table 2.

To determine the effects of initial global executive composite scores as moderators of change, we conducted a series of multiple regression analyses using pre- to post-test difference scores as outcome variables for Metacognition Index, Behavioral Regulation Index, and Global Executive Composite. Group membership (treatment v control), initial Global Executive Composite score (pre test), and an interaction term (group membership x Global Executive

Composite pre test score) were entered as predictor variables. Results from these analyses are displayed in Table 3. There were no significant interaction terms for any of the outcome variables.

We also examined interaction terms among the 8 subscales that measure executive function behaviors. The only significant interaction between Global Executive Composite pre-test score and group membership for predicting executive function difference scores was for Shift (β = -0.82, p < .05). Children in the treatment group showed greater improvement in their ability to shift than children in the control group. None of the other subscales yielded significant group by time interactions: Inhibit (β = 0.13, p > 05), Emotional Control (β = -0.44, p > 05), Initiate (β = 0.16, p > 05), Working Memory (β = -0.42, p > 05), Plan/Organize (β = -0.28, p > 05), Organization of Materials (β = -0.27, p > 05), and Monitor (β = 0.26, p > 05).

The Global Executive Composite pre test scores were a significant moderator of change for differences in pre-test to post test scores for Metacognitive Index (β = 0.70, p < .01, for Behavioral Regulation Index (β = .46, p < .05), and for Global Executive Composite (β = .30, p < .01).

Scholarly significance

At this point in our interpretation of the statistical analysis, we report no significant effects on executive functions for the treatment group except in the ability to shift. Treatment scores do indicate they are showing improvement in EF on the Metacognition Index and Global Executive Composite (Figure 1). However, the control group scores (Figure 1) are indicating a decline in executive functions in all three categories. Further statistical analysis of the control and treatment scores is needed. In addition, the decline in control group EF scores warrant sociological analysis to understand the behavioral and academic implications for urban school populations of very low SES and with very high percentages of Latino and African Americans who are entering sixth grade in a middle school, grades 6-8, in Corrective Action 3. The study is of high importance as a controlled study of the challenges for this population in regard to executive functions and the possible importance of MAP programs in mitigating decline in EF.

Limitations of the Study

In May 2009, the primary researcher and one of the MAP instructors met with the incoming sixth grade core teachers for September 2009 and the guidance counselor. At this meeting, we requested their agreement to participate in the study and if granted, to introduce the BRIEF inventory which would require their completing the inventory pre and post the program on both control and treatment groups. District approval of the study was completed in August 2009. Principal approval for the program to begin in the last week of September was assured in August 2009. Written parental permission for students to participate in the study was completed by the second week of September. However, administrative scheduling of the two groups as well as the overall sixth grade class was not completed until late October. As a result, the treatment program did not begin until the first week of November. Due to school holidays in late November and late December and to music program interruptions in student availability to participate in the program, the instructors were not able to instruct MAP weekly for eight consecutive weeks, a potential limitation of the effects of MAP on student EF. In addition, treatment students often arrived to the MAP training five to ten minutes late during the early

weeks of the program, a second potential limitation affecting the consistent practices of the program. A letter from the researcher to the core and homeroom teachers as well as an additional endorsement of the program by the principal improved the promptness of most students.

Note: Permission for duplication of this report must be secured by emailing cheryl.desmond@millersville.edu.

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Table 1. *Descriptive information for participants, by group.*

Group	N	percent male/female	percent minority [a]	percent low income	percent learning support
Treatment	15	67/33	93	93	20
Control	25	52/48	88	100	36

Note. [a] Within each group, children identified as minority were primarily Hispanic.

Table 2. *Mean pre- and post-test executive functioning scores, by group.*

	Pre-test		Post-test	
	control	treatment	control	treatment
	Mean	Mean	Mean	Mean
Inhibit	69.48 (23.99)	60.13 (19.52)	73.96 (23.63)	60.60 (16.47)
Shift	66.12 (18.64)	53.67 (13.44)	69.96 (21.55)	59.67 (16.91)
Emotional-control	65.44 (22.47)	58.67 (21.41)	71.04 (21.24)	59.40 (21.05)
Behavioral regulation index	68.76 (22.94)	58.40 (18.74)	74.56 (24.04)	60.80 (19.39)
Initiate	65.40 (9.56)	59.53 (13.71)	63.08 (14.27)	61.67 (13.29)
Working memory	67.40 (15.32)	61.47 (16.21)	65.32 (22.46)	62.80 (14.81)
Plan/organize	66.16 (13.22)	59.60 (15.08)	65.96 (15.53)	60.93 (12.83)
Organization	59.20 (26.65)	58.40 (15.52)	65.12 (22.86)	52.40 (19.29)
Monitor	68.60 (14.46)	57.73 (23.32)	71.16 (16.93)	63.47 (16.47)
Meta-cognition index	63.96 (23.60)	58.00 (22.79)	66.56 (23.02)	57.07 (21.21)
Global executive index	64.60 (25.95)	58.00 (23.95)	71.36 (26.15)	56.93 (22.69)

Note. Lower scores reflect higher executive functioning. Standard deviations are shown in parentheses below mean scores.

Table 3. *Multiple regression analyses with Pre-test Global Executive Composite (GEC) scores moderating the change in pre to post-test executive function difference scores.*

	B	SE B	β	t
Metacognition index				
Constant	-58.99	12.85		-4.6**
Group	8.61	20.84	0.13	0.41
GEC pre-test	0.87	0.19	0.70	4.72**
Group x GEC pre-test	0.01	0.32	0.01	0.04
Behavioral regulation index				
Constant	-27.72	9.71		-2.86**
Group	21.13	15.73	0.56	1.34
GEC pre-test	0.34	0.14	0.46	2.43*
Group x GEC pre-test	-0.27	0.24	-0.46	-1.10
Global Executive Composite				
Constant	-68.46	13.92		-4.92**
Group	20.71	22.57	0.30	0.92
GEC pre-test	0.96	0.20	0.71	4.76**
Group x GEC pre-test	-0.11	0.35	-0.11	-0.33

**$p < .01$, *$p < .05$

Figure 1. *Mean t-scores by group and time point (pre and post) for the Metacognition Index, Behavioral Regulation Index, and the Global Executive Composite*