



**Title Registration for a Systematic Review:
The Tools of the Mind Curriculum for
Improving Self-regulation in Early Childhood:
A Systematic Review**

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TITLE OF THE REVIEW

The Tools of the Mind Curriculum for Improving Self-regulation in Early Childhood: A Systematic Review

BACKGROUND

The problem

Self-regulation, defined as volitional control of attention, emotion, and executive functions for the purposes of goal-directed actions (Blair & Ursache, 2011), is associated with myriad child outcomes during the schooling years (Calkins, S. D., Howse, R. B., & Philippot, 2004; Diamond & Lee, 2011; McClelland & Tominey, 2011). For example, children with robust self-regulation have been shown (Fisher, Hirsh-Pasek, Newcombe, & Golinkoff, 2013; Ramani, 2012) to more cooperatively participate in classroom activities, sustain focus on tasks (Bierman, Nix, & Greenberg, 2008; Drake, Belsky, & Fearon, 2014), and exhibit reduced behavioral issues (Feng et al., 2008; Ponitz, McClelland, Matthews, & Morrison, 2009).

Conversely, underdeveloped self-regulation skills predict higher externalizing behavior (Flouri, Midouhas, & Joshi, 2014; Olson & Lunkenheimer, 2009), diminished attentional capacity (Raver et al., 2011; Tough, 2012), and lower academic achievement (Kim, Nordling, Yoon, & Kochanska, 2014; Nota, Soresi, & Zimmerman, 2004; Soares, Vannest, & Harrison, 2009). In addition to academic outcomes, children with poor self-regulatory competencies are more likely to have worse health and financial outcomes in adulthood (Moffitt, Arseneault, & Caspi, 2011; Schlam, Wilson, Shoda, & Mischel, 2013).

Given the role of self-regulation in promoting both child and adult outcomes, early interventions in preschool context hold considerable promise for improving a child's development trajectory. As Nobel laureate economist James Heckman noted, early "skill begets skill; learning begets learning" (Heckman & Masterov, 2007, p. 3). Indeed, the trajectories of children who have high versus low early self-regulation typically diverge significantly over time (Bierman et al., 2008). Relatively small self-regulatory differences in early childhood can be magnified to progressively larger differences over time (Alexander, Entwisle, & Kabbani, 2001; O'Shaughnessy, Lane, Gresham, & Beebe-Frankenberger, 2003). Thus, early childhood emerges as an especially critical period in which to intervene.

Unfortunately, in the United States, a nationally representative survey indicated that 46% of American kindergarten teachers reported that at least half of their students routinely struggled with self-control (Rimm-Kaufman, Pianta, & Cox, 2000). Another survey of American teachers indicated that a quarter of students' self-control failures led to externalizing behaviors such as kicking or threatening their peers at least once per week (Tough, 2012).

Certain sub-populations of children exhibit diminished self-regulation from a young age. For example, previous research indicates that low-income children often have severe self-regulation deficits (Raver, Blair, & Willoughby, 2013; Raver, 2012), which makes them susceptible to disciplinary action inside and outside of school (Alloway, Lawrence, & Rodger, 2013; Miller, Nevado-Montenegro, & Hinshaw, 2012). A Washington DC report (Office of the State Superintendent of Education, 2013) indicated that students aged three and four received 181 suspensions during the 2012-2013 year for incidents. Nationwide, studies show that American preschool children are three times more likely to be expelled for unmanageable behavior than students in primary and secondary schools (Gilliam, 2005).

Despite the observed associations between self-regulation and a range of life outcomes, the developmental dynamics of children's self-regulation are not adequately understood. Preschool contexts are thought to substantially affect children's self-regulation skills, which develop most rapidly during early childhood. However, the Institute of Educational Sciences (IES) funded a study that included 14 preschool curricula; the results indicated that none of the curricula significantly improved children's self-regulation skills beyond traditional comparator programs (Preschool Curriculum Evaluation Research Consortium, 2008). Moreover, despite abundant research indicating the benefits of self-regulation, none of the 14 curricula in the IES-funded review identified self-regulation growth as a primary aim.

To the best of our knowledge, only one early childhood curriculum identifies self-regulation cultivation as its paramount aim: *Tools of the Mind* (Tools). Since its development in 1995, the curriculum has been adopted in parts of the United States, Canada, and South America. In certain areas such as the Washington DC Public Schools district, Tools has been implemented in the majority of local preschools, whereas schools in 20 other U.S. states have implemented Tools in smaller numbers (Bodrova & Leong, 2015). In the face of the program's proliferation, the question emerges: does Tools enhance children's self-regulation and other relevant developmental outcomes significantly more than traditional 'business-as-usual' curricula? This review aims to be the first to address that question.

The intervention

Tools derives its inspiration from the research of Soviet psychologist Lev Vygotsky. In his book *Thought and Language* (1962), Vygotsky expounds upon the concept of 'mental tools,' which extend mental faculties in the way that physical tools extend physical faculties. For example, although young children typically struggle with task focus, they can be taught to use private speech in order to maintain concentration amid distractions. In this case, private speech serves as a mental tool that enables children to focus beyond their baseline abilities (Vygotsky, 1962).

According to the curricular developers, Tools is "rooted in cutting edge neuropsychological research on the development of self-regulation/executive functions in children" (Bodrova & Leong, 2015, p. 1). As such, Tools includes 61 instructional activities that simultaneously

target students' self-regulation as well as their literacy and numeracy ability. For example, one activity called "Buddy Reading" involves two students who cooperatively read a book. One child receives a picture of a mouth, which designates him or her as the reader; the other child receives a picture of an ear, which designates him or her as the listener. The reader then reads the story while the other child actively listens and checks for decoding errors. The children then switch roles after the first reader completes the story.

Given proper execution, the Buddy Reading activity simultaneously targets reading ability and self-regulation. Since self-regulation is defined by children's ability to autonomously control their attention and behavior, children engaged in Buddy Reading should theoretically hone their self-regulatory skills because children must 1) remember and act out their roles, 2) flexibly switch across roles, and 3) inhibit impulses to switch roles at inappropriate times (e.g., the listener attempts to become the reader before its his or her turn). Thus, Buddy Reading, as well as the complete set of 61 Tools activities, taxes the child's memory, attentional flexibility, and inhibitory control, which are the three central elements of executive function (Diamond, 2006).

Some Tools activities, such as Buddy Reading, target all three. Some other activities lack an academic component but instead serve exclusively as "attention-focusing" activities (Leong & Bodrova, 2011). For example, the "Freeze Dance" game prompts the teacher to hold up a picture card with a certain body position depicted on it (e.g., hands crossed over one's chest). The children view the picture while dancing; when the music stops, the teacher obscures the card, while the children strike the pose that had been illustrated on the card. Thus, children have to 1) remember and act out the card's content after it has been removed from view, 2) switch body poses without confusion across each card, and 3) inhibit the impulse to strike the card's pose when they first see the card and instead wait until the music stops.

In sum, whether children are engaged in literacy, mathematics, or even a dance break such as the one described above, each Tools activity is designed to target children's memory, attentional flexibility, and inhibitory control. Whereas many self-regulation interventions involve limited changes to children's learning activities in just one subject (e.g., social studies), Tools aims to transform every moment of a child's school day into an opportunity to cultivate self-control. This immersive component of Tools differentiates it from other self-regulation programs and emerges as the key mechanism of its purported effectiveness.

Relevance to policy and practice

Given self-regulation's role in promoting a multitude of desirable life outcomes, it is critical to identify educational practices that predict improved self-regulation skills. The Tools developers claim that the program effectively hones children's self-regulation skills, and the program has already spread in the United States, Canada, and parts of South America. Although Tools' proliferation has been consistent in recent years, the findings from Tools evaluation studies have been inconsistent. Thus, this meta-analysis aims to assess the quality of evidence and estimate Tools' curricular effect. It is hoped that this review will

provide educators and policymakers with useful information regarding whether and how to implement the program.

OBJECTIVES

This review will collect, synthesize, and meta-analyze results from rigorous evaluations of the Tools program. The key objectives of the current proposal include the following questions:

1. What is the effect of *Tools of the Mind* on young children's self-regulation development?
2. What is the effect of *Tools of the Mind* on young children's academic achievement?

A secondary objective of this review involves examining the potential for differences in relative effects between advantaged and disadvantaged populations. Thus, this review will consider available data from primary studies to investigate whether different categories of disadvantage (e.g., free and reduced-price meal status, special education status, and English language learner status) predict different levels of program effectiveness.

EXISTING REVIEWS

There are no existing systematic reviews specifically about the Tools of the Mind curriculum. Two previous Campbell reviews have analyzed self-regulation interventions (Piquero, Jennings, & Farrington, 2010; Thompson, Ruhr, Maynard, Pelts, & Bowen, 2013), but neither review included data pertaining to Tools. Piquero et al.'s (2010) review found that self-control programs effectively reduced delinquency and problem behavior. Their review, however, focused exclusively on young children who exhibited significant behavioral deficits including conduct disorder, oppositional defiant disorder, and antisocial behavior. This review would include both mainstream and special-needs student populations. Moreover, their review pertained to self-regulation programs outside of an academic focus, whereas this review will evaluate a classroom-based program.

Thompson et al. (2013) are currently conducting the second Campbell self-regulation review, but that paper remains in the protocol stage. Thus, the studies and data included in that review have yet to be released to the research community. It remains unclear whether that review will incorporate Tools studies.

Finally, Jacob and Parkinson (2015) conducted a non-Campbell review that investigates associations between executive function and academic achievement across 67 RCT studies. Despite the consistent yet moderate ($r = .30$) correlation observed between executive function and academic achievement across studies (Jacob & Parkinson, 2015), the authors assert a lack of evidence that executive function causes higher academic achievement. The

authors cite three Tools evaluation studies and conclude that Tools does not significantly improve self-regulation or academic achievement.

Jacob and Parkinson's (2015) conclusions, however, do not align with the evidence. In fact, two of the three studies (Barnett et al., 2008; Diamond, Barnett, Thomas, & Munro, 2007) in the Jacob and Parkinson (2015) review showed significantly improved self-regulation skills for Tools students, but the authors dispute the studies' methodological strength (despite the authors' decision to include the studies in the review). Moreover, the authors did not include the most recently published Tools review study (Blair & Raver, 2014), which indicates both significantly improved self-regulation and academic skills for Tools children.

In sum, neither of the existing Campbell reviews included evidence from Tools studies. The most recent non-Campbell review to include such evidence omits the field's most updated research and fails to address the nuanced findings from the pre-existing research base. Overall, none of the aforementioned reviews specifically address the question of this review; that is, does Tools, which is the first curriculum to target self-regulation skills throughout the day, deliver on its mission to improve children's executive function skills? A targeted and rigorous synthesis of the Tools evidence is necessary to address that question.

INTERVENTION

Intervention

Tools is a comprehensive preschool curriculum that involves instructional guidance for academic subjects including literacy, math, social studies, and science. Teachers deliver the curriculum to all children in the class regardless of age, language-learning status, and special education status. The curriculum includes both a preschool version (aimed at both three- and four-year-old children) as well as a kindergarten version. Teachers and children working within the Tools framework use the curriculum throughout the entire school year (Bodrova & Leong, 2007).

Comparison

The comparison condition in existing Tools of the Mind studies consists of either 1) teachers and children in other treatment groups who are working with a different specified target curriculum, or 2) teachers and children in control classrooms who are using the 'business-as-usual' curriculum that is typically implemented in their school.

POPULATION

Inclusion criteria:

This review will include data on children who were educated using Tools as well as children in the comparator curricula. All children in the study samples will be included regardless of

their ages as well as their socio-economic, racial, ethnic, special education, or language-learner status.

Next, because the curriculum has only been implemented in the United States, Canada, and Chile, it is likely that only studies with samples from those countries will be recovered. Nonetheless, there are no a priori geographic exclusion criteria.

Exclusion criteria:

Studies that do not involve full implementation of the Tools curriculum (i.e., teachers only implement some activities some of the time) will be excluded from this review. Moreover, studies where Tools of the Mind is implemented alongside other curricula will be excluded. Such dual implementation designs preclude the analysis of the target curriculum's unique effect on children's self-regulation development because of the confounding influence of the second curriculum.

OUTCOMES

Primary outcomes:

1. Children's self-regulation skills as reported by teachers, educational administrators, parents, and/or researchers. These subjective reports generally derive from observation periods where a researcher or teacher watches the child in school and then rates the child's behavior.
2. Children's self-regulation skills as indicated by objective measures. Children's scores on objective tasks derive from children's task performance rather than from subjective adult ratings. For example, the task "Heads-Toes-Knees-Shoulders" involves touching the correct body part based on the teacher's instructions that change after each round. This activity engages multiple aspects of self-regulation: 1) working memory (remembering the teacher's directions and acting upon them), 2) cognitive flexibility (switching among the rules as they change during each round, and 3) inhibitory control (not touching the body part that you hear, but rather the body part that the teacher has previously specified through a rule).
3. Children's academic outcomes. For example, any outcome data regarding children's literacy and numeracy scores on preschool achievement tests will be included.

Secondary outcomes:

1. Teacher-report surveys regarding their evaluation of and satisfaction with Tools.

STUDY DESIGN

The included studies should have experimental, quasi-experimental, regression discontinuity, or other non-experimental designs that have adequate statistical mechanisms to control for potential confounds. At the least, studies must include pre-tests on the outcome measures of interest.

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POTENTIAL CONFLICTS OF INTEREST

The authors have no conflicts of interest.

PRELIMINARY TIMEFRAME

Note, if the protocol or review are not submitted within 6 months and 18 months of title registration, respectively, the review area is opened up for other authors.

- Date you plan to submit a draft protocol: 1 October 1 2015

- Date you plan to submit a draft review: 15 February 2016

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