

**Lessons from Cookie Monster:
Educational Television, Preschoolers, and Executive Function**

EXECUTIVE SUMMARY

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Introduction

Executive function (EF) encompasses a complex cognitive regulatory system that guides behavior in a goal-directed manner. Three core EFs include inhibitory control (refraining from performing an action); cognitive flexibility (attention-shifting between two competing tasks), and working memory (holding information in mind when completing tasks; Diamond, 2013). These skills are critical for school readiness because a formal school situation requires that children control impulses, follow directions, transit smoothly between activities, and focus on relevant task information. These skills also predict other academic skills including reading, math, and science. Early interventions targeting executive function are both important and especially effective because these skills are rapidly developing and consolidating during the preschool period (Diamond, 2013). Recently, *Sesame Street* developed a new curriculum to teach preschoolers EF skills. The purpose of this study was to test whether exposure to the TV curriculum supported preschoolers' inhibitory control, cognitive flexibility, and working memory.

Method

In total, 59 preschool children (Mean age = 52.94 months, SD = 8.44; 55.1% boys) residing in a small Midwestern city participated in this study. Parents reported an average of 17.97 years of education. Ninety-one percent were European American, 3% were African American, and 6% were Asian American.

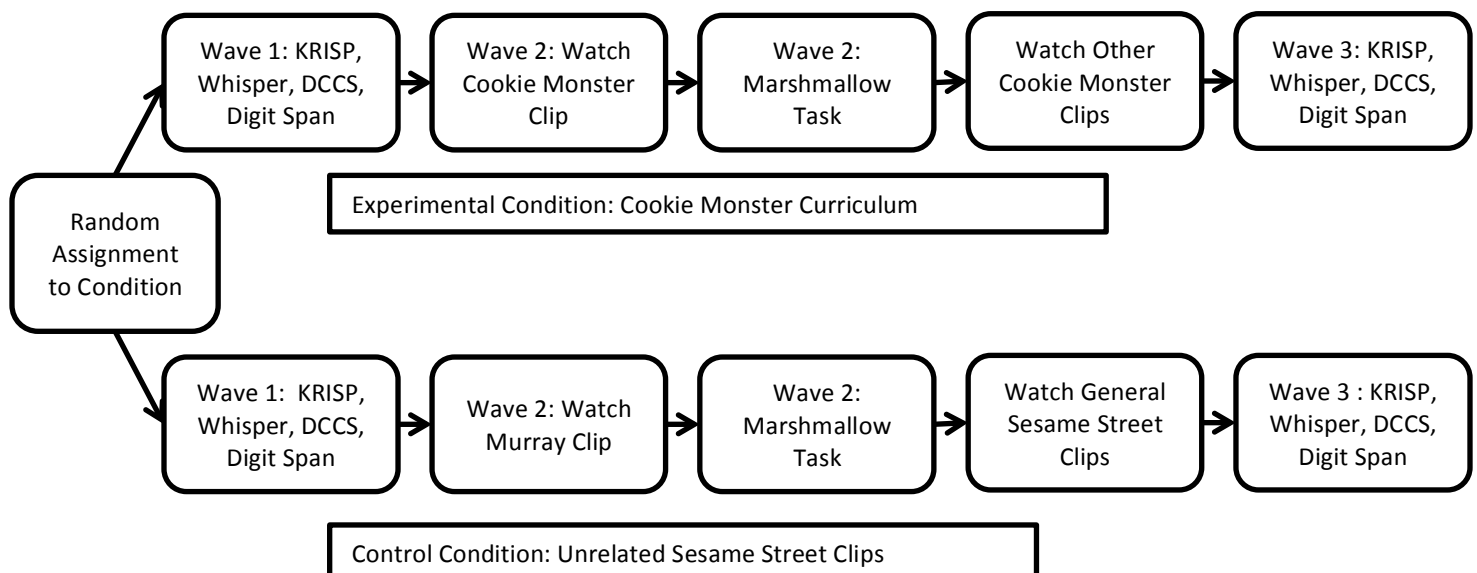
- Assignment to the Cookie Monster curriculum group (experimental; n = 30) or the control viewing group¹ (n = 29) was completed using random assignment. There was one session where children viewed their assigned clip with an experimenter and an extended home viewing session where parents were asked to show their child clips related to their viewing condition. Content on these DVDs totaled approximately 2 hours.
- Children in both groups were evaluated at three time points: pretest/prior to viewing; mid-test/immediately after viewing with experimenter; and post-test/after 3 weeks of extended viewing.
- Measures included parent questionnaires and direct child assessment of three core executive function skills (i.e., inhibitory control, cognitive flexibility, working memory)
 - ~ **Parent questionnaires** documented basic family demographic information.
 - ~ **Inhibitory Control:** the ability to selectively attend while suppressing distractors or impulsive behavior. Inhibitory control is not a unitary phenomenon (Evenden, 1999; Reynolds, 2006). Rather, it is comprised of different types of processes that influence responding (Dougherty,

¹ Control group participants viewed a similar-length clip that featured Murray and Little Lamb going to an ice skating rink.

Marsh, Mathias, & Swann, 2005; Nigg, 2000). Two types of inhibition were evaluated in this study: action inhibition and attention inhibition. Action inhibition refers to inhibiting a prepotent or dominant behavioral response (e.g., wanting a smaller reward immediately vs. waiting a length of time for a larger reward; shouting out a favorite character's name despite requests to whisper). Attention inhibition refers to an ability to resist distractors while selectively attending to key features of a stimulus.

- *Action Inhibition via the Marshmallow Task* (Mischel, Ebbesen, & Raskoff Zeiss, 1972): This task measures children's ability to resist temptation and delay gratification. Children are asked to wait (i.e., max of 15 minutes) for two preferred snacks (e.g., marshmallows, cookies) versus choosing one immediately.
- *Action Inhibition via the Whisper Task* (Kochanska et al., 1996): This task measures the ability to inhibit a dominant response by asking children to voluntarily lower their voice when asked to name familiar and engaging TV characters. Children were randomly presented with 8 familiar and 4 unfamiliar characters. The unfamiliar characters were included so that when a child sees a familiar character, s/he might be more tempted to shout out that character's name.
- *Attention Inhibition via the Kansas Reflective-Impulsivity Scale for Preschoolers* (KRISP; Wright, 1971): This task measures sustained attention and cognitive reflectivity (i.e., ability to slow down and reflect before making a response). Children were required to match an exemplar to one from a set of 4 to 6 pictures, continuing to select until the correct match or 3 errors were made. Total errors are scored.
- ~ **Cognitive Flexibility:** the ability to change perspectives or switch gears in an effort to adjust to changed demands, priorities, or perspectives.
 - *Dimensional Change Card Sort Task* (DCCS; Zelazo, 2006): This task measures children's ability to switch between two salient dimensions. Children first sort cards based on color, then shape, and then proceed to switch fluently between shape and color.
- ~ **Working Memory:** the ability to hold information in mind and mentally manipulate it. Working memory is critical in relating one thing to another or using information to solve problems (Diamond, 2013).
 - *Digit Span:* This task measures a child's working memory capacity. Children are asked to repeat an increasingly larger sequence of numbers.

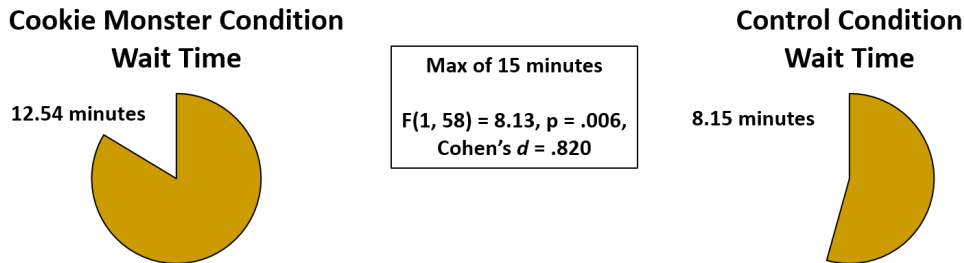
Procedure



Results

Inhibitory Control

- Action Inhibition via the Marshmallow Task:* Cookie viewers waited significantly longer than their control group peers



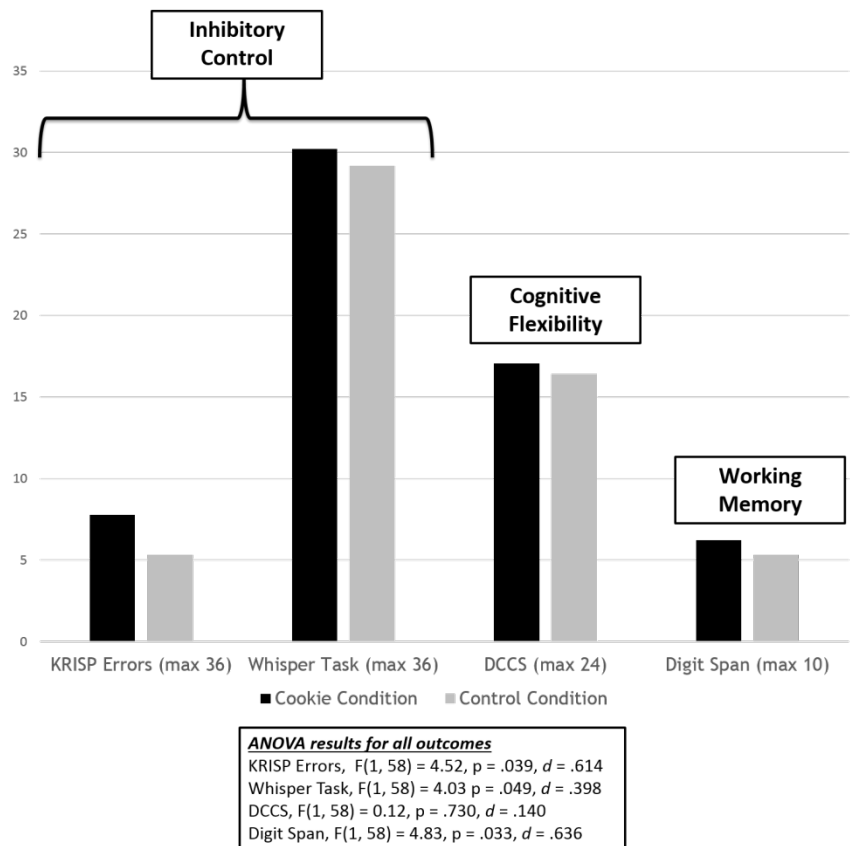
- Action Inhibition via the Whisper Task:* Cookie Monster viewers were more successful at inhibiting the urge to shout out characters' names (Cookie: 30.23, SD = 2.14) when compared to their control group peers (Control: 29.20, SD = 2.15), a moderate effect (Cohen's $d = .398$)
- Attention Inhibition via the KRISP:* Control group viewers made significantly fewer errors (Control: 5.33 errors, SD = 3.76) when compared with their Cookie Monster viewing peers (Cookie: 7.78 errors, SD = 3.76), a moderately large effect (Cohen's $d = .614$)

Cognitive Flexibility

- DCCS:* There were no significant differences between Cookie viewers (Cookie: 17.08, SD = 6.48) and their control group peers (Control: 16.40, SD = 6.48) on the ability to switch between color and shape when sorting (Cohen's $d = .140$)

Working Memory

- Digit Span:* Cookie Monster viewers were able to recall significantly longer digit spans (Cookie: 6.23, SD = 1.52) when compared to their control group peers (Control: 5.34, SD = 1.51), a moderate effect (Cohen's $d = .636$)



Conclusion

The most prominent findings in this project were that preschool children who watched clips featuring Cookie Monster practicing executive function skills exhibited stronger inhibitory control of their actions and better working memory skills compared to their peers who watched other *Sesame Street* clips that did not feature executive function skills. First, Cookie viewers were able to wait more than 4 minutes longer during a delay of gratification task when compared with their peers. The ability to delay gratification in preschool has been linked to greater cognitive and social competence including higher scholastic success, better health outcomes, and better frustration and stress coping skills. Viewing a 5-minute clip where Cookie Monster engaged in a variety of strategies to wait for a second cookie was sufficient to induce preschoolers to wait longer to receive a larger reward. These short-term benefits were further observed in another action inhibition task after 3 weeks of extended viewing of the curriculum. Cookie viewers were better able to inhibit a natural tendency to shout out familiar and highly engaging TV characters' names when compared to their peers who watched other *Sesame Street* content. Stronger action inhibition skills have been linked to resisting temptations, finishing challenging and time-consuming tasks, following rules, and interacting appropriately in social situations.

Cookie viewers also displayed stronger working memory skills after extended viewing when compared with their control group peers. Research indicates that working memory supports inhibitory control because children must be able to hold a goal or task in mind in order to know what is relevant or appropriate compared to what should be inhibited or avoided (Diamond, 2013). The Cookie clips repeatedly include reminders to pay attention, listen, and remember. Stronger performance for both action inhibition tasks (i.e., Marshmallow Task, Whisper Task) and the working memory task are consistent with research linking these two executive functions. Specifically, focusing on particular task demands (e.g., if I wait until she comes back, I can have two cookies) requires that children remember these task demands while simultaneously inhibiting internal and external distractions (Diamond, 2013).

While Cookie viewers exhibited stronger action inhibition skills, their control-viewing peers exhibited stronger attention inhibition skills (as measured via the KRISP task). Attention inhibition refers to the ability to selectively attend to key stimulus features while simultaneously waiting to initiate a response until all features have been considered. Content likely explains the significant differences favoring the control group. This task required that a preschooler match an exemplar to one of 4 to 6 samples. The child is asked to continue to look for the correct exemplar if a wrong choice has been made. Scoring is based on the number of errors a child makes. In the Cookie clips, he often rushes initially to make a choice before listening to directions or thinking through the consequences of his actions. It is possible that this difference is a reflection of Cookie viewers imitating Cookie Monster's initial rush to make a choice or decision, especially because funny things happen when Cookie rushes in (e.g., when he engages in the wrong sequence of behavior, a chicken tumbles down on his head). This finding might be a novelty effect that could dissipate with extended exposure to the curriculum. Alternatively, this difference may be a consequence of exposure to content that only featured Cookie and his initial impulsivity. This result may not have occurred with exposure to a more balanced curriculum featuring other, more reflective characters and sketches in addition to the Cookie Monster clips.

Collectively, the gains that Cookie viewers displayed are noteworthy because stronger self-regulation and executive function skills indicate a greater capacity to think ahead about consequences and to consider other potentially more appropriate choices. In addition, children with better executive function skills will behave the same ways in the presence or absence of adult authorities because they have internalized these skills. Stronger executive function skills also predict preschoolers' later abilities to function in the classroom in both social (e.g., follow rules, interact appropriately in one-on-one and group settings) and cognitive capacities (e.g., follow direction, pay attention, remember content). Research indicates that early

interventions targeting executive functions are both important and especially effective because these skills are rapidly developing and consolidating during the preschool period (Diamond, 2013). Educational television and *Sesame Street* in particular provide highly engaging, accessible, and scalable ways for helping young children develop stronger executive function skills that will positively impact them in the short term across social/emotional and cognitive domains as well as contribute substantially to both later school and life success.

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