



USAID Read Liberia

An examination of executive function skills in primary 1 students from Liberia

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RTI International

USAID Read Liberia Activity

- Five-year education activity supporting the development of...
 - Emergent literacy skills for Liberian students in public kindergarten (KG) schools in six targeted counties
 - Early grade reading skills for students in grades 1 and 2
- Two-year KG pilot
 - Teacher training, coaching, and materials
 - 60 schools reaching 2,700 students
 - Baseline assessment conducted in October 2018

Overview

- 1 What is Executive Function (EF) and how is it measured?**
- 2 Use of EF Touch in Liberia**
- 3 Children's EF skills: Findings**
- 4 The relationship between EF and Literacy: Findings**
- 5 Contributions to the Field**

— What is Executive Function and how is it measured?



What is Executive Function?

- Executive function is made up of three cognitive skills
 - Inhibitory control
 - Cognitive flexibility
 - Working memory
- Support a student's ability to learn and coordinate goal-directed behavior and activities
- Important to measure in young children because EF skills are the underpinning of learning
 - Important for mathematics and reading

Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000; Blair & Razza, 2007; Nesbitt, Baker-Ward, & Willoughby, 2013

How is Executive Function measured?

- **Variety of tasks**
 - Forward digit span
 - Backward digit span
 - Hearts and flowers
 - Stroop
 - Flanker
 - Heads Toes Knees Shoulders

- **Essentials are the same**
 - Inhibitory control: Task must require that the child inhibit a dominant response for a different response
 - Working memory: Task must require that the child hold information that is needed for a later decision
 - Cognitive flexibility: Task must require that the child shifts attention between different instructions or tasks.

EF Touch

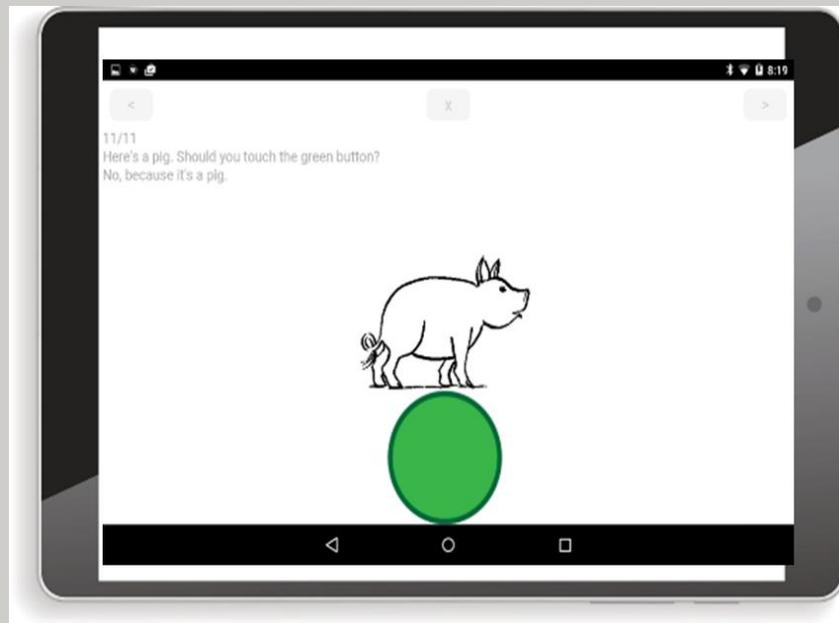
- A computerized battery of EF tasks that were designed specifically to use with young children
- Suite of tablet-administered tasks that assess the three cognitive skills.
- Children respond to stimuli presented in the task by touching a touch-screen tablet.
- The assessor first demonstrates how the task works, and children then complete training items, or trials, before moving on to the test items.
- Reaction time and accuracy of the child's response are automatically recorded for all tasks.

Willoughby & Blair, 2016; Willoughby, Piper, Kwayumba, and McCune, 2018

Inhibitory Control

Animal Go/No-Go Task

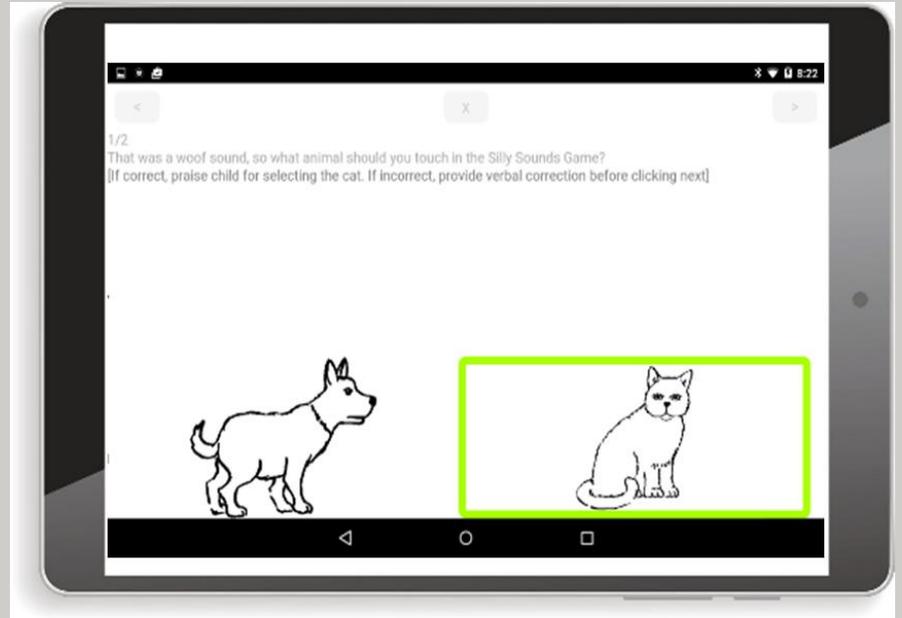
- Presents a series of animals to the child and asking the child to “press the green button when you see an animal, but not when you see a pig.”
- Students must inhibit their automatic response to hit the green button when an animal appears on the screen.
- The Animal Go/No-Go task consists of 40 items, out of which 8 require inhibitory control skills (i.e., no-go items when the pig was presented).
- Each item was presented for 3,000 milliseconds
- Mean accuracy across the 8 no-go items was used to represent performance.



Inhibitory Control

Silly Sounds Stroop

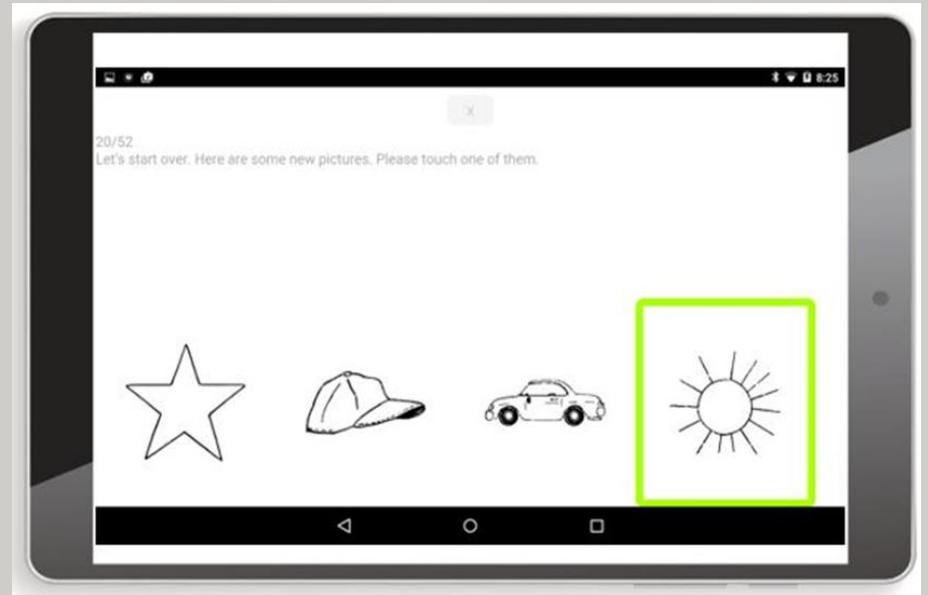
- Directs students to select the dog picture when a “meow” sound occurs, and to select a cat picture when a “woof” sound occurs.
- The students must use their inhibitory control skills to inhibit the automatic response to choose the animal that the sound represents in the real world.
- The Silly Sounds Stroop task consists of 17 items.
- Each item is presented for 3,000 milliseconds
- Mean accuracy across all items was used to represent performance.



Working Memory

Pick the Picture

- Directs students to remember and select pictures from an array of pictures (a set) that were presented on the screen.
- Students must use working memory skills to remember the pictures that he/she already selected, and difficulty increases over time.
- The Pick the Picture task consists of 32 items.
- The mean accuracy of responses in each picture set was used to represent task performance.



- What is Executive Function and how is it measured?
- Use of EF Touch in Liberia



Adaptation & Pre-testing Process

EF Touch

- Two-day adaptation workshop held with Read Liberia KG and M&E staff and representatives from the Ministry of Education
- Pre-testing with students in Grade 1 classrooms in 2 schools
- Findings of the pre-test indicated necessary revisions to instructions and two stimulus pictures



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- Revisions
 - Change in the dog and cow stimuli to make the images more familiar to children
 - Change in instructions to the Animal Go/No-Go task
 - Original: “In this game, I want you to press the green button as fast as you can every time you see an animal, but not when it is a pig.”
 - Revised: “In this game, you do not touch the green button when you see a pig. Touch the green button as fast as you can when you see the other animals. Let us try it.”

- What is Executive Function and how is it measured?
- Use of EF Touch in Liberia
- Findings

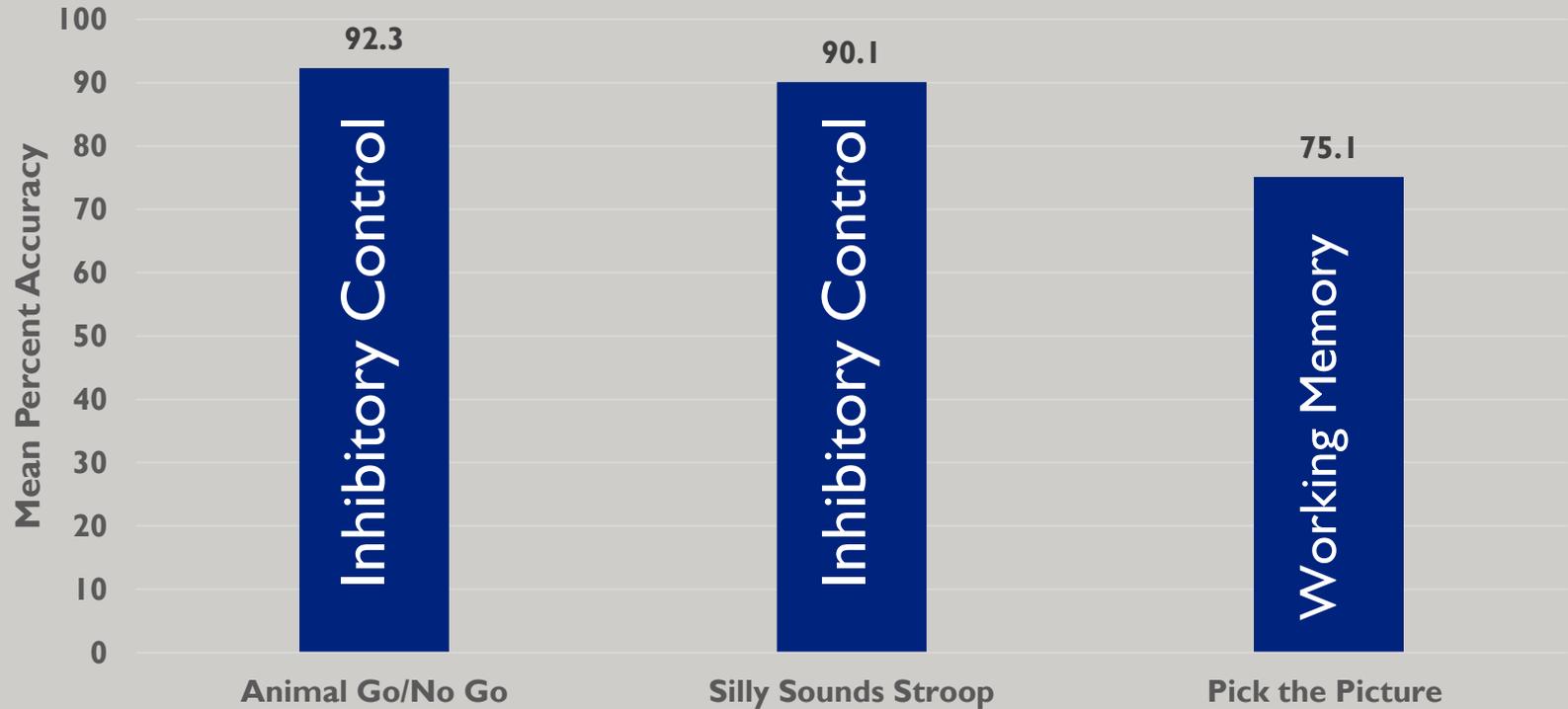


Sample

- Participants
 - 291 students
 - Randomly selected
 - Non-repeaters who attended KG 2
- Sample Description
 - Mean pupil age: 10.2 years
 - 48.9% girls; 51.1% boys

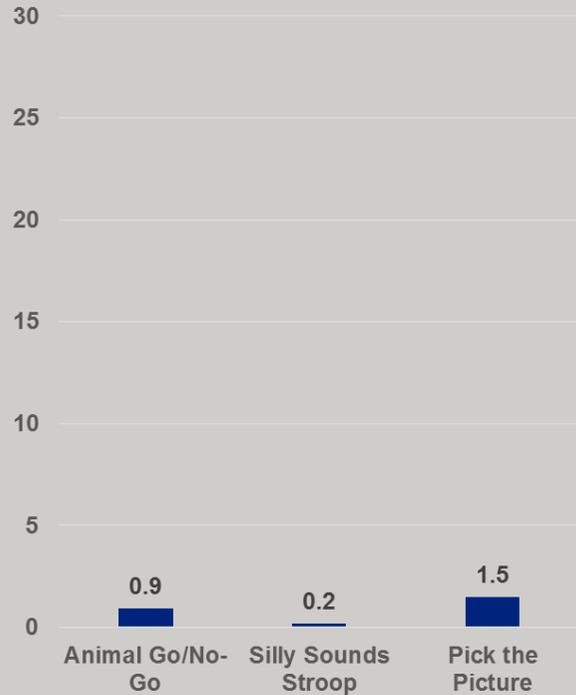


Findings: Accuracy

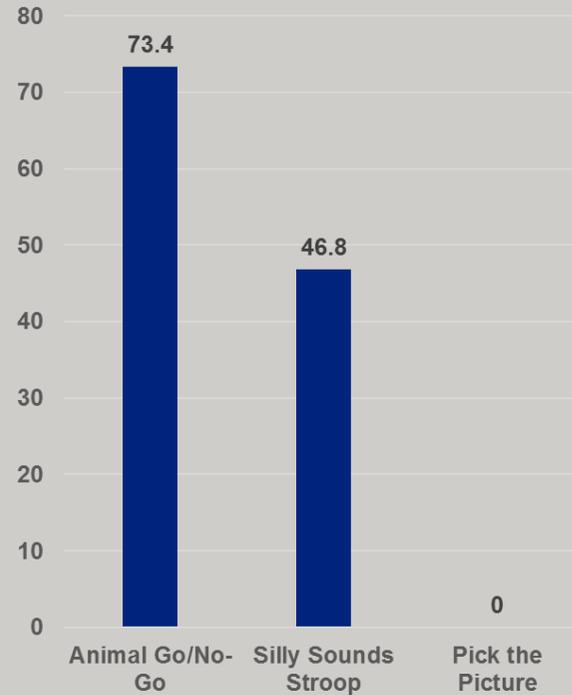


Findings: Highs and Lows

% Zero Scores



% Ceiling Scores



What do these findings mean?

- Students were highly accurate on all tasks
 - Likely due to older ages of students
- Pick the Picture and Silly Sounds Stroop seemed more difficult than Animal Go/No-Go
 - More variability in student performance in these tasks

Findings: EF and Pre-literacy

Predictors	Emergent literacy variables			
	Letter names	Letter sounds	Expressive vocabulary	Listening comprehension
Pick The Picture Percent Score	0.07	-0.22	0	0.48**
Silly Sounds Stroop Percent Score	0.24**	0.10	0.20**	-0.03
Pupil Age	1.77***	0.53	2.11*	0.21
Boy	0	0	0	0
Girl	-0.48	0.01	-0.21	-0.65
Lofa^	0	0	0	0
Montserrado	3.34	0.23	22.15***	6.28
Nimba	-2.09	-10.00*	14.27***	-19.43***
EF Touch Baseline Reaction Time	-0.01*	0	-0.02***	-0.03***
Low SES^	0	0	0	0
Mid-Low SES	-0.87	-6.19	4.50	11.04*
Mid-High SES	4.89	16.91**	8.36*	11.54**
High SES	7.89**	27.24***	9.77**	22.08***
_cons	47.33***	50.86*	27.84	38.00*
N	260	260	256	251

* $p < .05$; ** $p < .01$; *** $p < .001$

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Inhibitory control skills, as measured by Silly Sounds Stroop, was related to letter identification and expressive vocabulary performance

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Working memory, as measured by Pick the Picture, was related to listening comprehension performance

Nimba	-2.09	-10.00*	14.27***	-19.43***
EF Touch Baseline Reaction Time	-0.01*	0	-0.02***	-0.03***
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- Contributions to the Field



Contributions

- Feasibility of using tablet-based measurement of executive function in Liberia
- Revise tasks to increase difficulty for older children
- Provision of more evidence of the EF-literacy link
 - Inhibitory control skills contribute to letter knowledge and oral language skills
 - Working memory skills contribute to listening comprehension
 - Can we strengthen EF skills to in turn influence learning?

Special Thanks



Participating schools and students

Read Liberia Activity Kindergarten
and M&E staff

The Khana Group