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

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
Adaptation & Pre-testing Process

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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

- Animal Go/No Go: 92.3%
- Silly Sounds Stroop: 90.1%
- Pick the Picture: 75.1%

Columns represent different tasks: Animal Go/No Go, Silly Sounds Stroop, and Pick the Picture, with their respective mean percent accuracy.
Findings: Highs and Lows

% Zero Scores

Animal Go/No-Go: 0.9
Silly Sounds Stroop: 0.2
Pick the Picture: 1.5

% Ceiling Scores

Animal Go/No-Go: 73.4
Silly Sounds Stroop: 46.8
Pick the Picture: 0
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

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<tr>
<th>Predictors</th>
<th>Emergent literacy variables</th>
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<td>Letter names</td>
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*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.

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Use of EF Touch in Liberia

Findings

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