Children's Engagement with an Intelligent Game for Learning Early Math Skills

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Introduction

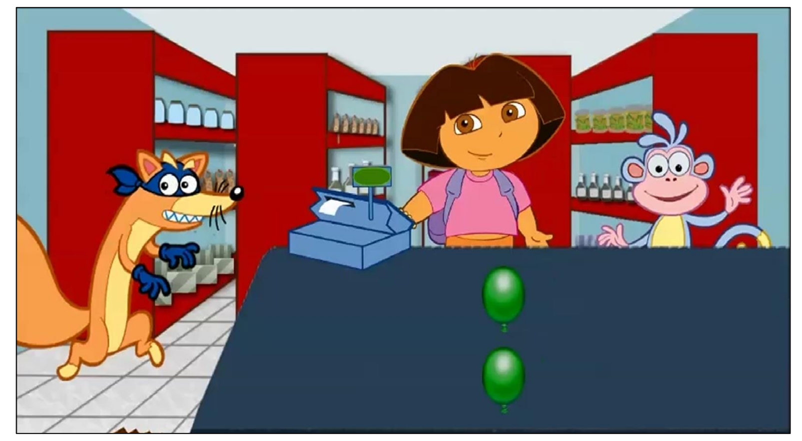
- STEM skill deficiency in the United States.[1]
- Media characters as children's friends, playmates & teachers
- Onscreen characters vary in:
  - Social meaningfulness & Social contingency[2]
- Vary social meaningfulness in an interactive intelligent prototype by comparing character presence versus absence
- Teach add-one rule: knowing automatically that adding one to a number increases it by one unit (e.g., 1+1 = 2; 2+1 = 3; 3+1 = 4; 4+1 = 5)[3]
- **Purpose:** to determine how important a popular character versus no character is to teach the add-one rule

Hypotheses

- During game play, children in the intelligent character condition will perform faster, be more attentive, and interact with the game more when compared to the no character control group.
- After game play, children in the intelligent character condition will perform faster on the add-one rule in a transfer task than children in the no character control group.

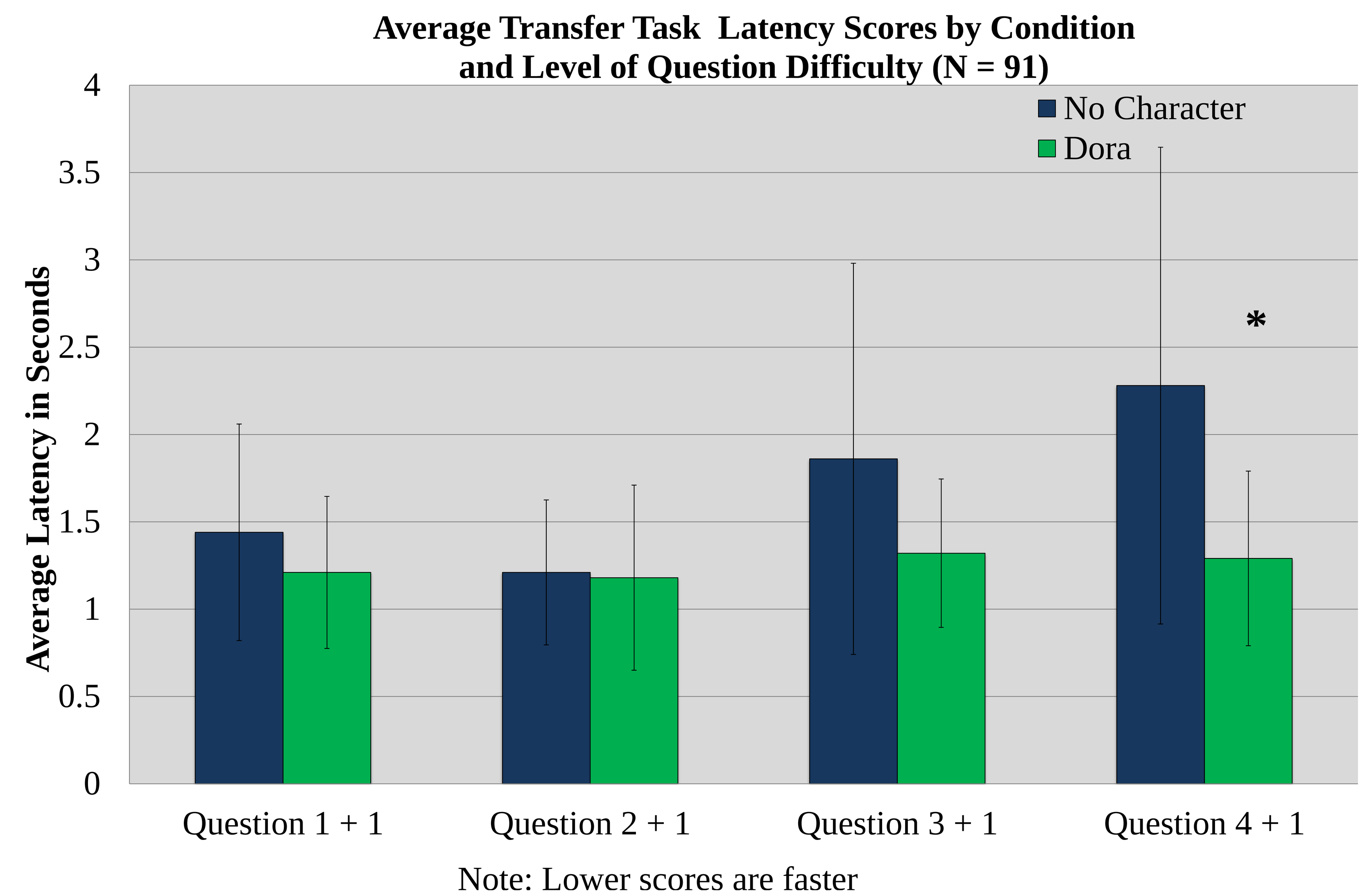
Method

- Preschool children (M_{age} = 4.84 yrs.; N = 102; 53 males) played with an intelligent game prototype for an average of 8.74 mins.
- 3 rounds: sequential; sequential fast; random fast
- Conditions: Dora the Explorer Intelligent Character (n = 49*)* or a No Character Control Group (n = 53)
- Game included small talk (e.g., what's your favorite color) and math talk (e.g., accurate answer to add-one problems)
- After play, children completed an add-one transfer task.
- Wizard of Oz Approach



Results

- **Transfer task**: Children who played the game prototype with Dora performed significantly faster on the add-one problems than those in the no character group, $F(1, 98) = 4.87$, $p = .03$. There was also a trend for an interaction of condition & question difficulty level, $F(2.35, 230.61) = 2.45$, $p = .08$, driven by the most difficult question (i.e., 4 + 1), $p = .02$.



- **Online Processing**: Children in the intelligent character and no character control conditions performed similarly in quickness, attentiveness to the prototype, & interactions with the game (i.e., small talk & math talk). Means are in the table.
- Rounds increased in difficulty level, but latency was similar for Round 1 (12 sec), Round 2 (10 sec), Round 3 (11 sec).
- **Game Beliefs:** Most children thought that the game could see and hear them, perhaps because of contingent replies.

Percent of Attention, Parasocial Interactions, and Beliefs about Game by Condition

Condition	Attention to Game	PSI Small Talk	PSI Math Talk	Game Hears Them	Game Sees Them
No Character	85.90 (8.1)	77.72 (24.15)	94.15 (8.19)	79.6	61.2
Dora	85.25 (12.18)	70.11 (15.07)	93.03 (12.42)	73.8	57.1
Total	85.60 (10.13)	74.21 (20.71)	93.63 (10.31)	76.9	59.3

N = 91 (Dora = 42; No Character = 49)

Discussion

- Overall no online differences between conditions in attention, latency, or believing the character can see or hear them.
- Transfer task effects from onscreen to off-screen settings indicate a more general, non-context-specific impact on learning[4] the add-one rule in the intelligent character condition than in the no character control condition.
- Findings suggest that transmedia presence of popular characters like Dora improve learning outside of immediate contexts.
- Popular Intelligent Characters can improve children's knowledge of early math skills that are a foundation for more advanced learning, paving the way for a new wave of educational interactive characters and games that can respond contingently to what children say.[5]

References

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Presentation Forum & Acknowledgments

Presentation at the biennial meeting of the Society for Research in Child Development, April 8, 2017.

A very special thank you to the children, families, preschools, and Dr. Naomi Aguiar, Dr. Daniel Anderson, Charlotte Wright, Angella Liu, Marie Frolich, Alessandra Puccio, Audra Fitzgerald, Sana Charania, Elizabeth Fantini, Isabella Alvarez, Elisabeth Mah, and our Advisory Board who made this project possible. Support for this research was provided by DRL Grant #1252113 from the National Science Foundation to Dr. Sandra L. Calvert. This material is also based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-1444316. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.