Intelligent Media Characters for Teaching Young Children Mathematics

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Introduction

- STEM skill deficiency in the United States.[1]

- Media characters are children's friends, playmates & teachers

- Onscreen characters vary in:
  - Social meaningfulness & social contingency[2]

- **Purpose:** to determine whether a popular character versus no character is more effective in teaching the add-one rule

- Vary social meaningfulness in an interactive intelligent prototype by comparing character presence versus absence (voiceover)

- 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]

Hypotheses

- Children with stronger attachment and friendship scores with the character will answer more math problems correctly on the 1st try

- Children who engage in more meaningful math talk with the game will answer more math problems correctly on the 1st try

Method

- Children (M_{age} = 4.84 yrs.; N = 107; 55 males) randomly assigned to conditions to play an intelligent game prototype
- Pretest: Parasocial Relationship Survey-attachment & friendship[4]
- Wizard of Oz paradigm
- 3 math rounds: sequential; sequential fast; random fast
- Conditions: Contingent Dora the Explorer Intelligent Character (n = 54) or a Contingent No Character Control Group (n = 53)
- Game included small talk (e.g., what's your favorite color), math talk (e.g., numerical answers to add-one problems), & math scaffolds

Results

Table 1: OLS Regression Predicting Percent of Add-One Problems Answered Correctly on First Attempt

	Model 1		Model 2		Model 3		Model 4	
	B	SE	B	SE	B	SE	B	SE
Attachment and Friendship[1]	.05**	.02	.05*	.02	.05**	.02	.05**	.02
Condition[2]	.04	.04	.04	.04	.06	.03	.05	.03
Meaningful Small Talk Ratio[3]			.12	.11	-.03	.09	-.03	.09
Meaningful Math Talk Ratio[4]					.81**	.19	.74**	.20
Age in weeks							.001**	.0004
R^2	.09		.10		.26		.30	
Adjusted R^2	.07		.07		.22		.26	
F	3.23*		2.77*		8.16**		9.35**	
df	2, 91		3, 90		4, 89		5, 88	
N	94		94		94		94	

*$p \leq 0.05$; ** $p \leq 0.01$; Robust standard errors
[1] Average of cute, trust, friendship, safety from Child Parasocial Survey
[2] Dora condition is coded as 1, No Character is coded as 0
[3] Mean Number of small talk prompts responded to correctly: On-task/Number of small talk prompts available to the child
[4] Number of math talk prompts responded to correctly: On-task/Number of math talk prompts available to the child

Results

- 88% of children completed the game, playing an average of 8 min, 43 seconds (SD = 2 min., 43 sec.)

- Children answered an average of 10.09 add-one problems correctly on the first attempt (SD = 2.35), needing an average of 1.34 (SD = 1.16) scaffolds across all 3 game levels

- Attachment and friendship with Dora, meaningful math talk with the agent, & age improved children's skills at answering add-one problems accurately on the first attempt

- Condition was not a significant predictor of the percent of math problems answered correctly on the first attempt

Discussion

- Stronger feelings of attachment and friendship with Dora yielded better performance on an add-one math task

- Social contingency was effective, regardless of whether feedback was from the character or only a voice

- Children's who were on task (meaningful math) during game play answered more math problems correctly on the 1st try

- Intelligent favorite characters, as well as disembodied intelligent voices, will increasingly serve as teachers who can respond contingently to children's replies to academic problems

- Such innovations will lead to more effective social partners who can reshape children's 21st century academic success[5]

References

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