



Fostering Pre-Literacy Skills in Low-SES Preschool Children With an Educational App: A Randomized Controlled Trial

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INTRODUCTION

"Schools do not create achievement gaps. By the time children enter kindergarten, dramatic SES and racial gaps are deeply entrenched" (Loeb & Bassok, 2007)

- Poor phonological awareness/ print knowledge → lower school readiness and higher likelihood of academic failure (Duncan et al., 2007)
- A substantial portion of the SES gap is attributable to differences in home learning; low-SES children have dramatically fewer educational materials and educational opportunities (Miller, Parkes, Vandell, & Duncan, 2014)

Mobile Technology: Can Smartphones be Smart?

- Mobile technology is now commonplace in even the lowest SES families; more families have access to smartphones than toilets (Pew Research Center, 2018). 97% of these children used mobile devices regularly for hours a day (Kabali et al., 2015; United Nations News Center, 2014)
- Apps could be a potential medium for narrowing this SES-gap in terms of access to educational materials
- Ways apps can foster learning:
 - Scaffold and adjust to children's knowledge level
 - Offer repeated, varied practice on skills
 - Give specific, constructive feedback
 - Engaging and fun
- However, most "educational" apps are not tested (Hirsh-Pasek et al., 2015)

Current Study: Evaluation of the Khan Academy Kids (KKIDS) App

- Can the KKIDS app foster pre-literacy skills in preschoolers from low-income families?
- Will children enjoy and use the KKIDS app appropriately? Without increasing screen time, can we ensure the time they do spend on phones is used constructively?

METHODOLOGY

Participants:

- The sample was drawn from the Springfield, MA area
- $N = 49$ 4-5-year old children who had not yet entered Kindergarten (61% girls)
- $M = 59.73$ months, $SD = 6.16$ months
- 38.8% Hispanic, 26.5% multiracial, 18.4% African American, 14.3% Caucasian, 2% Asian-American
- Median income: \$24,000/year

Methods/Measures:

- Pre-test: Parents filled out questionnaires and childrens' preliteracy skills were assessed using the Test of Preschool Early Literacy (TOPEL; $\alpha = .86-.96$)
- Children were randomly assigned to either KKIDS or control group apps (Bord and MiniPiano) on a loaned iPad. KKIDS group was encouraged to use app 20 mins/day. Control group was not given any specific instructions on use.
- KKIDS app use was tracked; text check-in every week to increase/decrease app use.
- Post-test: 10 weeks later, children were administered the TOPEL again and parents filled out app satisfaction questionnaire and all families received the KKIDS and control apps to keep on personal devices.

Khan Academy Kids App



Figure 1. Beginning letter sounds: "Help spell the word "jam"



Figure 2. Phonological awareness: "Put the 'y-ak' in the hat"

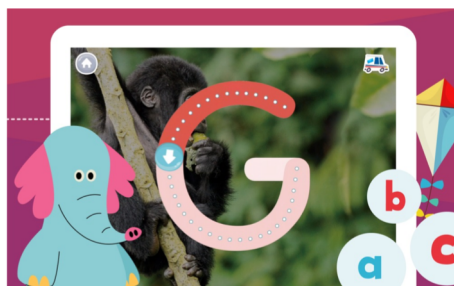


Figure 3. Print knowledge. Trace the letter "G".

RESULTS

- 2-factor ANCOVA (time X group) controlling for parent educational achievement and % time English was spoken in the home was conducted to determine intervention effects
 - Interaction was significant: $F(1,45) = 113.17, p = .019$
 - KKIDS group TOPEL scores went from 34th percentile to 47th percentile (national average)
 - On the phonological awareness subtest, KKIDS group went from 23rd percentile to 47th percentile, $F(1,45) = 257.66, p = .045$
 - For children who averaged at least 1 hour app use/week ($N = 19$), TOPEL scores went up 6.3 points (compared to 1.2 in those who used it less) and phonological awareness scores went up by 11.3 points (compared to 1.5)
 - On the print knowledge and vocabulary subscales, there were no significant differences in scores between groups
- Parents reported enjoying the KKIDS app ($M = 4.16$ on 5-point scale) and reported it gave them ideas on how to teach literacy skills ($M = 3.84$)

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RESULTS (cont.)

	KKIDS (N = 25)		Control (N = 24)		Effect size Cohen's d
	Pretest (SD)	Posttest (SD)	Pretest (SD)	Posttest (SD)	
Overall Preliteracy*	93.84 (10.57)	98.92 (10.25)	94.41 (11.90)	95.08 (12.11)	.72
Print Knowledge	100.68 (13.83)	101.16 (12.03)	98.13 (14.77)	97.17 (15.41)	
Vocabulary	97.04 (8.72)	99.52 (8.77)	98.29 (8.38)	97.75 (8.20)	
Phonological Awareness*	88.96 (12.04)	97.88 (12.13)	91.33 (12.89)	94.21 (13.66)	.56

Note: Scores are standard scores (national mean = 100, SD = 15)
* $p < .05$

Graph 1. Pretest and posttest means and standard deviations for TOPEL preliteracy test. Effect sizes represent group differences in posttest-pretest scores, divided by the pooled SD of these differences.



Graph 2. KKIDS app use over 10 weeks

DISCUSSION

- Despite very little educational app use reported at the beginning of the study, KKIDS was well-received and substantially used. There were few problems with overuse and parents reported learning new ideas for teaching school readiness skills
- Size of gains on phonological awareness were as large as those found by much more expensive interventions (eg: Nelson, Benner & Gonzalez's 2014 pre-reading intervention of 25 one-on-one sessions with a trained, professional tutor)
- Limitations: Could not examine app effects on emergent math development, another precursor to school success; app use may have been affected by loaned device and weekly check-in with parents; could not examine child or family moderating characteristics
- Future work: Longer term study to see effects into Kindergarten; specifically gear towards English Language Learners; evaluate app benefits in even younger children
- Our study has is one of few to look at home app use promoting skills before formal schooling. Results are encouraging and point to the promise of further research on home educational app use to narrow the achievement gap for low-SES preK children

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