Press, Swipe, and Read:
Do Interactive Features Facilitate Engagement and Learning with e-Books?

Ying Xu, Joanna C. Yau, & Stephanie M. Reich; School of Education, University of California, Irvine

Introduction

• Many children's e-books contain hotspots – interactive areas children can press to receive immediate auditory or visual feedback.

• Hotspots may stimulate children's interests and cognitive engagement and help children understand and remember the content of the story.

• However, hotspots may also increase cognitive load thus impeding children's full engagement with the story.

• These two conflicting views suggest a need for empirical evidence to clarify children's learning with interactive e-books containing hotspots.

Research Questions

RQ1a: What types of engagement behaviors occurred when children interact with hotspots?

RQ1b: Do children's interactions with hotspots tend to statistically co-occur with engagement behaviors identified in RQ1a?

RQ2: Are interactions with hotspots associated with reading comprehension?

Study Design

• **Participants:**
  ○ 76 preschool children in Western USA
  ○ Aged 3-5 years (M = 48.5 m; SD = 9.7 m)
  ○ 55% girls; 64% White, 27% Asian

• **Experiment procedure:**
  ○ Reading Chris P. Bacon on iPad using the Read-to-Me feature
  ○ Encouraged to press anywhere as they want

• **Data sources:**
  ○ Reading sessions video-taped
  ○ Post reading comprehension assessed
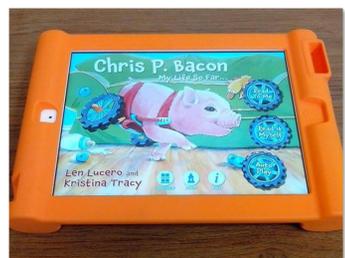
Reading Materials and Instruments

Reading Materials

• Hotspots embedded both in images and in the text
• Would be activated when children press on them
• De-activated during narration - light buzz sound only

I'm not very old, just a little piglet, but my life sure has been exciting so far!

○ **Press on the pig image:**
  * Narrate the name: "Chris P. Bacon"
○ **Press on words in the text:**
  * Narrate the word
○ **Press on background:**
  * No resulting effects

Comprehension Questionnaires

• Post-reading test (a total of 14 items in four domains)
• Two variables: i) % correctness of all items; ii) correctness of one item on the main character name

○ **Memory for story facts** (recall main characters and events)
  * Containing one item of recalling the name of the main character
  * First free recall; if fail, then provide children prompts
○ **Story order**
○ **Text awareness** (identify words appeared in the story as a prominent image)
○ **Novel vocabulary** (define words introduced in the story narration)

Analyses & Results

RQ1a: Qualitive analysis used to identify 7 behaviors in 3 categories when children interact with hotspots. General theme adapted from Rosko et al. (2012) and Noorhidawati et al.(2015).

Multi-sensory participation: 1) looking; 2) gesturing; 3) mimicking
Emotional expression: 4) facial emotion expression; 5) verbal emotion expression
Verbal communication: 6) talking about story; 7) talking about device

• Coding scheme developed based on the behaviors identified
• Coded i) whether child used hotspots; ii) whether each engagement behavior occurred every 10 seconds

RQ1b: Multi-level logistic regression used to test whether engagement behaviors co-occur with hotspot interactions
Main independent variable: whether child used hotspot
Outcomes: whether children exhibited engagement behaviors
Statistical model: two-level growth model (coding time segments nested within child); Level 1 control: time; Level 2 control: average hotspot use, age, gender

Outcomes	Multi-sensory participation			Emotion expression		Verbal communication	
	Looking	Gesturing	Mimicking	Facial expression	Verbal expression	About story	About device
Fixed effects							
Hotspot presses (level 1)	2.583***	1.601	0.540	1.959***	1.810	0.937	0.652
	(0.725)	(1.031)	(0.285)	(0.335)	(1.226)	(0.267)	(0.329)

Note. Odds ratio reported. *SE* in parentheses.

RQ2: OLS and logistic regression used to examine the association between hotspot use and comprehension.

Overall hotspot use and total score

Outcome	Comprehension total score
Overall hotspot presses	0.000
	(0.000)

Note. SE in parentheses. Controlling for gender and age

Main character name hotspot use and recall the name

Outcomes	Correct answer	Correct answer with free recall
Character name hotspot presses	1.090†	1.257*
	(0.051)	(0.118)

Note. Odds ratio reported. *SE* in parentheses. Controlling for gender and age.

Conclusions

RQ1a. Engagement behaviors
• A wide variety of engagement behaviors emerged with hotspot interactions, including multi-sensory participation, emotional expression, and verbal commination.

RQ1b. Hotspot usage and Engagement
• When interacting with hotspots, children were more likely to look at the book and show positive facial expressions
• However, hotspots did not appear to promote engagement through verbal utterance (e.g., communication, verbal emotional expression).

RQ3. Hotspot usage and comprehension
• Overall hotspot usage is not associated with comprehension total score.
• However, an increase of specific hotspot usage was associated with children's increased likelihood of answering relevant items correctly both from free recall and with prompts.

Discussion

• Hotspots appear to facilitate engagement and comprehension
  ○ More e-books may want to incorporate this feature
• However, the design of hotspots in this particular e-book may not be effective in terms of eliciting comments
  ○ Future design may want to consider incorporating hotspots that may facilitate verbal engagement

Limitations

• Within-subject design: the results are correlational
• Sample primarily high-SES children
• Only testing one form of interactive features (on-screen visual or audio stimulus)

Acknowledgements

[1] Blewitt, P., Rump, K. M., Shealy, S. E., & Cook, S. A. (2009). Shared book reading: When and how questions affect young children's word learning. *Journal of Educational Psychology, 101*(2), 294. [2] Takacs, Z. K., Swart, E. K., & Bus, A. G. (2014). Can the computer replace the adult for storybook reading? A meta-analysis on the effects of multimedia stories as compared to sharing print stories with an adult. *Frontiers in Psychology, 5.* [3] Noorhidawati, A., Ghalebandi, S. G., & Hajar, R. S. (2015). How do young children engage with mobile apps? Cognitive, psychomotor, and affective perspective. *Computers & Education, 87,* 385-395.