

Supporting Parent-Child Experiences with *PEG+CAT* Early Math Concepts:

Report to the CPB-PBS *Ready To Learn Initiative*



Executive Summary

November 2015



SRI Education

Context

This research is part of the summative evaluation of the CPB-PBS *Ready To Learn Initiative*, which is supported by the U.S. Department of Education. The goal of the *Ready To Learn Initiative* is to develop engaging, high-quality educational programming and supports for two- to eight-year-old children living in low-income households.

During the 2010-2015 grant cycle, *Ready To Learn* aimed to deliver early mathematics resources on both established technologies (computers, video displays, and gaming consoles) and emerging digital platforms (tablet computers, interactive whiteboards, and smartphones) to create anytime-anywhere learning experiences that leverage the unique capabilities of transmedia for young children's learning. For the purpose of this study, transmedia means the use of familiar characters, settings, and narrative themes or stories across different media formats, such as digital video and interactive online games.

As the summative evaluation team for CPB-PBS *Ready To Learn*, Education Development Center (EDC) and SRI Education (SRI) document and, whenever possible, measure the impact of PBS KIDS transmedia mathematics resources on children's school readiness.

Study Overview

The study presented here addresses the question of how time spent viewing and playing with PBS KIDS educational, non-commercial media at home can foster positive outcomes for children and parents/caregivers. The study focused on the PBS KIDS program, *PEG+CAT* a first-generation transmedia resource designed to promote children's mathematics and approaches to learning (ATL) skills.

The goals of the study were to identify and describe:

- How use of *PEG+CAT* resources (including videos, online games, and other supplemental activities) influenced children's knowledge of target mathematics and ATL skills
- How use of *PEG+CAT* resources (including media resources and supports for families) influenced parent/caregiver attitudes, beliefs, and behaviors
- How children and families engaged with selected *PEG+CAT* resources in their homes

Target mathematics skills included patterns, geometry (2-D and 3-D shapes), ordinal numbers and counting, and measurable attributes and spatial relationships, and target ATL skills included problem solving, perseverance, and self-regulation.

To address the goals of the study, researchers employed a two-condition randomized controlled trial (RCT) design in which participating families were randomly assigned to one of two groups:

- A PBS KIDS treatment group: Families were provided with technology tools (an Android tablet and a Chromebook laptop), a curated *PEG+CAT* experience (videos, games, and supplemental activities addressing target mathematics and ATL skills), and supports for joint engagement (parent tip videos addressing joint engagement with media, math talk, and ATL skills; an Experience Guide; and weekly text messages).
- A non-treated business as usual comparison group: Families were asked to continue with their typical home behaviors with regard to children’s technology and media use.

Methods and Sample

The study sample included 197 four- and five-year-old children and their families from low-income communities in the New York City and San Francisco Bay areas. Study families were predominantly Latino, Asian American, and African American. The research team examined children’s mathematics and ATL learning outcomes as well as outcomes for parents and caregivers. Child learning and parent outcome measures were pre-post, and were administered at the beginning and the end of the study.

Children’s mathematics learning outcomes were evaluated using two researcher-developed measures:

- (1) An assessment, consisting of items focusing on the target skills addressed in the *PEG+CAT* intervention but not aligned directly to the resources themselves
- (2) The Math Concepts and Problem Solving checklist (MCPS), a short teacher measure of children’s understanding of the intervention’s focal skills and their ability to apply mathematical skills in their everyday life when solving problems

To assess children’s ATL skills, the team administered the Preschool Learning Behavior Scale (PLBS; McDermott, Green, Francis, & Stott, 2000), a validated teacher measure of young children’s classroom learning behaviors that was developed in partnership with preschool teachers for use in low-income samples.

Outcomes for parents’ and caregivers’ were evaluated using a survey that gathered information about parents/ caregivers’ attitudes, beliefs, and behaviors related to media and technology use at home; early mathematics, including home math talk and activities for supporting children’s mathematical skills; and children’s approaches to learning, including problem solving and persistence.

The research team conducted a range of data collection activities during the 12-week study period to document families’ practices around the use of media in both conditions and the uptake of the *PEG+CAT* resources in the PBS KIDS condition. Families in both conditions completed weekly Media Diaries and researchers conducted home visits and focus groups with a sub-sample of families in both conditions. Researchers also analyzed system log data from devices distributed to families in the PBS KIDS condition.

Findings

Children who participated in the PBS KIDS *PEG+CAT* intervention exhibited statistically significant improvements in the mathematics skill areas of ordinal numbers, spatial relationships, and 3-D shapes as compared to children in the business as usual condition. There were no differences between children in the PBS KIDS *PEG+CAT* and business as usual conditions in teacher ratings of children's approaches to learning and math concepts and problem solving.

Parents and caregivers in the PBS KIDS condition reported a higher frequency of joint parent-child technology use, more joint gameplay, and more conversation connecting digital media and daily life than did business as usual parents and caregivers. PBS KIDS parents and caregivers also reported significant increases in their confidence to support math learning for their children, as compared to business as usual families. A higher proportion of parents and caregivers in the PBS KIDS condition reported engaging in problem-solving strategies with their children at the close of the study than did parents/caregivers in the business as usual condition.

Most PBS KIDS families progressed through the intervention experience over the 12-week study period, accessing all the intervention resources that exposed them to all of the target mathematical skills and, with less frequency, to all of the target ATL skills. There was considerable variation among PBS KIDS families with respect to their access of the intervention resources, and limited data on length or quality of engagement with the resources within the PBS KIDS condition.

Children used the *PEG+CAT* intervention media resources most often with their parents/caregivers, and parents in the PBS KIDS condition engaged in more joint media use with their children when compared to parents in the business as usual group. PBS KIDS families reported finding the majority of the *PEG+CAT* intervention resources to be fun and engaging, and some parents noted how the games and videos complemented each other in a beneficial way, making the content more meaningful through opportunities for practice.

While PBS KIDS parents found value in the support materials they were provided as part of the *PEG+CAT* intervention, actual usage of these resources varied. The majority of families reported the text messages they received as a part of the intervention, providing concrete strategies for supporting children's learning to be helpful, practical, and useful, showing promise for the use of text messaging as a convenient and effective way to connect with families.

Conclusion

Analyses of child assessment data in this study indicate that the PBS KIDS *PEG+CAT* intervention had a significant positive influence on some target mathematics skills. In particular, the study identified positive outcomes for math skills that are less commonly taught and practiced in early childhood settings, such as ordinal numbers, spatial relationships, and 3-D shapes. This suggests that through the *PEG+CAT* experience, children in the PBS KIDS group were likely to have been introduced to, and provided with opportunities to explore and practice mathematics skills beyond those that children are typically likely to encounter at home and school.

Parents in the PBS KIDS group reported that they were more likely to watch videos and play games together with their children, and connect educational media with lived experience; they also reported increased confidence in supporting mathematics learning. All of these are positive signs for leveraging public media in support of early learning.

Positive shifts in PBS KIDS parents' confidence and behaviors related to children's mathematics learning may have resulted from exposure to the *PEG+CAT* intervention resources, which included specific information for parents about target math concepts, using technology to support learning, and engaging in media with children. While parents already may have recognized activities such as counting, making patterns, and identifying 2-D shapes as math, the *PEG+CAT* intervention introduced parents to information about additional math skills and encouraged them to extend children's mathematical exploration beyond the familiar basics.

PBS KIDS families took up the curated resources included in the *PEG+CAT* intervention, engaging with the materials and concepts introduced in the study. While PBS KIDS families engaged with study experiences in high numbers, there was considerable variation (in terms of frequency and sequence of experiences) among families. The degree of variation—how much and in what order treatment families chose to engage with the *PEG+CAT* media—brings into focus the question of how much the sequencing or ordering of particular resources matters when it comes to the acquisition of specific skills, like knowledge of 3-D shapes.

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Support Provided By



The contents of this document were developed under a cooperative agreement from the U.S. Department of Education (Award Number U295A1005). However, these contents do not necessarily represent the policy of the U.S. Department of Education and you should not assume endorsement by the Federal Government.