Abstract Title Page
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Title: A Media-Rich Curriculum for Improving Early Literacy Outcomes of Low-Income Children: Evaluation Results for the *Ready to Learn* Initiative

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Abstract Body
Limit 5 pages single spaced.

Background/context:
Description of prior research, its intellectual context and its policy context.

All children should arrive on the first day of kindergarten ready to learn. They should have the knowledge and skills that are the foundations for literacy, such as being able to name letters, associate letters with sounds, and understand the basic concepts of print (National Reading Panel, 2000). Yet children from low-income families are least likely to begin school with strong literacy skills. Although early childhood education programs exist, they are not reaching the large numbers of children who could benefit from early learning support, nor are they being implemented well by early childhood educators who have limited formal training (Davidson, Fields, & Yang, 2009). Further, strong evidence of effectiveness has been found for few programs: A recent review of experimental studies on the impacts of preschool curricula revealed that just 2 of 15 had significant positive effects on early literacy skills (Preschool Curriculum Evaluation Research Consortium, 2008).

Some studies suggest that digital technologies could play a role in improving the early literacy skills of preschoolers, but their use in early childhood education settings is controversial. Experimental studies of programs that incorporate interactive computer games (Barker & Torgesen, 1995), that use electronic "talking books" (Chera & Wood, 2003), and that include video content from educational television shows like *Sesame Street* and *Between the Lions* (Chambers et al., 2006) have shown positive effects on children's literacy skills. At the same time, critics have argued that adults should not promote the use of technology like video or computers by young children, arguing that these technologies make children passive and reduce their opportunities to learn from interacting with adults and peers. Curricula that use technology can also be hard for teachers to implement, since many preschools have limited access to technology and training for teachers to use it (Davidson, et al., 2009). Whether technology can be used effectively by preschool teachers and in ways that promotes children's active engagement is an important question for research to address.

Described here is a study on the efficacy of a digital media-rich curriculum based on the idea that children can learn best from *media synergy*, that is, when children have opportunities to learn skills by engaging in repeated practice with them in many different formats and media (Neuman, 1995). The study is part of the *Ready to Learn Initiative*, a program to develop educational television programming and outreach activities that increase school readiness for 2- to 8-year-old children living in low-income households. In 2005, the U.S. Department of Education awarded one of two Ready to Learn programming grants to the Public Broadcasting System (PBS) and the Corporation for Public Broadcasting (CPB).

Purpose / objective / research question / focus of study:
Description of what the research focused on and why.

The current study took place in early childhood education centers and is the culminating study in a series of studies conducted as part of the summative evaluation of the Ready to Learn Initiative. The first study was a meta-analysis conducted of research on media and its effects on

early literacy, intended to inform the design of an intervention and determine the necessary sample size for an efficacy trial of a multimedia intervention (Authors, 2007). The second was a study of an existing intervention that included components that the literature review suggested were essential; that study focused on children's learning with parents in the home. Because we found that implementation was variable in that study and the intervention not sufficiently strong to achieve significant effects, the study team developed and tested a new curriculum for the current study, using available materials from producers. In addition, the study team decided to ask teachers in early childhood centers to implement the curriculum and designed professional development to help the teachers implement the curriculum. The study is an efficacy study, rather than an effectiveness study, since the study team was involved in integrating the components of the intervention and supporting its implementation (Flay, et al., 2005). The main research question we investigated in this efficacy study was: *Can a multimedia early literacy intervention implemented by teachers in early childhood centers positively impact low-income children's early literacy skills?*

Setting:
Description of where the research took place.

The study took place in early childhood education centers in the New York City or San Francisco metropolitan areas, where researchers were located. San Francisco's PBS station, KQED, was also a target of outreach efforts of the Ready to Learn Outreach Grant; therefore, the community was of special significance to CPB as a potentially valuable study site. The centers selected for the study served primarily low-income children.

To be eligible to participate in the study, center classrooms needed to meet several requirements. Their class needed to have at least four children between the ages of 3 ½ and 4 ½ who had enough knowledge of English to be assessed in English. The classroom needed to have access to a computer with a DVD player for showing video clips. Teachers in classes also had to be willing to receive coaching, allow for periodic visits from researchers, and to implement the curriculum for the full duration (10 weeks). Teachers had flexibility in scheduling how they would implement the curriculum, but they were asked to implement 2.5 hours per week and to incorporate all the elements of the curriculum.

Population / Participants / Subjects:
Description of participants in the study: who (or what) how many, key features (or characteristics).

Eighty classes at 47 different early childhood education centers participated in the study. These centers ranged in type, with some part of large-scale programs such as Head Start, others run by school districts, and others part of small, privately run facilities, some home based. More than two-thirds of the early childhood educators (69%) had a postsecondary degree.

A total of 398 children (mean age at pretest, 4 years, 9 months) participated in the study. A majority (60%) of these children spoke English at home, and a third (31%) spoke Spanish at home. Some (8%) spoke both languages at home. Over all the children in the sample, 20 different languages were spoken at home. Although groups were equivalent at baseline in background characteristics, for some scores on outcomes treatment children were higher. These differences were not statistically significant, however.

Attrition was very low. No classroom left the study, and only 9.9% of children who completed a pretest did not complete a posttest. There was no difference in attrition between the treatment and comparison groups. In addition, there were no differences in pretest scores between children who left the study and those who stayed.

Intervention / Program / Practice:
Description of the intervention, program or practice, including details of administration and duration.

The intervention was a 10-week media-rich early literacy curriculum that integrated video from educational television programs and associated online games from three Ready to Learn producers with classroom activities to foster skills for later reading success. Full episodes of *Super Why!* and self-contained segments from *Sesame Street* and *Between the Lions* along with digital content produced by Sesame Workshop, Out of the Blue Enterprises, WGBH Boston/Sirius Thinking, Ltd. were integrated with whole-group classroom activities, small-group experiences, and individual exploration.

The curriculum addressed the development of three early literacy skills: recognition of letter names, identification of letter sounds, and understanding of print concepts. Video from *Sesame Street*, *Between the Lions*, and *Super Why!* was the anchor for hands-on and teacher-led curriculum activities focused on these skills. The curriculum called for early childhood educators to engage children in active viewing of segments and episodes. When showing video to the children, teachers introduced the key skills, paused the video to encourage active processing of information, and reflected on areas of learning embedded in the video. Review and repeated focused viewings occurred on consecutive days and over the course of the 10-week curriculum so that skills introduced in earlier weeks as part of initial viewings were reviewed in the following weeks.

Teachers implementing the curriculum received teachers' guides containing daily scripts and 10 weeks of activities, as well as manipulatives such as magnetic letters, clay, pointers, alphabet charts, and letter and word cards. To increase the depth and quality of implementation, teachers also received ongoing professional development.

Research Design:
Description of research design (e.g., qualitative case study, quasi-experimental design, secondary analysis, analytic essay, randomized field trial).

The summative evaluators conducted a randomized experiment to test the impact of the curriculum. They randomly assigned teachers in each participating center to either a treatment or comparison group, using a screening tool (Early Language and Literacy Classroom Observation (ELLCO); Smith & Dickinson, 2002) and a blocking procedure described below to make sure the groups were equivalent in their literacy environments outside the curriculum. The treatment group educators implemented the literacy curriculum, and those in the comparison group implemented a science curriculum of the same duration and with rich media components. The use of the science curriculum was to facilitate clear interpretation of findings; evaluators wanted to avoid the possibility that results could be explained by children's excitement about media use.

Data Collection and Analysis:
Description of the methods for collecting and analyzing data.

Members of the evaluation team blind to children's condition pretested and posttested children in both conditions individually within a 3-week window before and after the conclusion of implementation using the following measures:

Alphabet Knowledge. This subtest of the Phonological Awareness Literacy Screening for pre-Kindergarten (PALS-PreK; Invernizzi, Sullivan, & Meier, 2001) measures knowledge of the 26 upper case letters presented in random order. If 16 or more letters are correctly identified, the child takes the lower –case alphabet task. Those who recognize 9 or more will be asked to produce sounds associated with the 23 letters and 3 consonant digraphs.

Letter Sounds. In this PALS-PreK subtest, child must provide an appropriate sound (phoneme) that corresponds to each letter (only given if student knows 9 or more upper-case letters). Beginning Sound Awareness. In this PALS-PreK subtest, child must match 10 pictures based on their initial sound (phoneme).

Number of Letters in Children's Names Children Can Identify. For many children, the first letters they can recognize are letters in their names, and they may be able to distinguish them from other letters even if they cannot identify them in ways that other measures require (Treiman, Cohen, Mulqueeny, Kessler, & Schechtman, 2007). So that our assessment protocol included a measure that would be sensitive to children with few prior early literacy skills, we developed a measure in consultation with researchers at Washington University-St. Louis that aimed to identify how many (out of 3) of the letters in children's names children could identify. For this task, assessors were instructed to arrange 6 magnetic letters (of the same color) randomly on a tray that included on the tray 3 letters from the child's name, and then ask children to identify what letters were in their name. The assessors then recorded the number of letters children could identify.

Story and Print Concepts. This measure, developed collaboratively by researchers at the University of Pennsylvania and Mississippi State University assessed constructs targeted by the intervention related to book and story skills. The assessment included 14 items for which a total of 19 points were possible. Children scored points for being able to identify correct orientation of the book, left-to-right reading, title and author name, and key story elements when asked to recall them.

The evaluators compared posttest scores of children in the literacy condition with those of children in the science condition for each outcome by fitting hierarchical linear models (Raudenbush & Bryk, 2002) to the data and controlling for pretest scores. The magnitude of effects when using pretest scores as covariates were similar for models fit to the data that did not include pretest scores or that analyzed gains. A second set of models fit to the data explored potential moderating variables, including mother's education and home literacy environment.

Findings / Results:
Description of main findings with specific details.

On four of the five measures in the study, the differences were statistically significant in favor of the literacy condition.

PALS Letter Recognition (Letter Naming). Children in the early literacy condition knew an average of 21.2 letters at posttest compared with 16.8 letters for children in the comparison condition. This difference was statistically significant ($p < .001$). Children in the early literacy condition learned on average 2.3 more letters than children in the comparison condition. The estimate for the standardized effect size of the early literacy curriculum on letter naming was +0.34 standard deviations.

PALS Letter Sounds. On the posttest, children in the early literacy condition knew an average of 10.0 letter sounds compared with 6.3 for children in the comparison condition. This difference was statistically significant ($p < .001$). In the early literacy condition, children learned 3.8 more letter sounds on average than children in the comparison condition. The estimate for the standardized effect size of the early literacy curriculum on letter sounds was +0.53 standard deviations.

Story and Print Concepts. The average posttest score for children in the early literacy condition was 10.8 and that for children in the comparison condition was 9.5 (Figure 3). This difference was statistically significant ($p = .026$). On average, children in the early literacy condition increased their scores on the concepts of print measure 0.5 more than children in the comparison condition. The estimate for the standardized effect size of the early literacy curriculum on story and print concepts was +0.26 standard deviations.

Knowledge of Letters in Name. Children in the early literacy condition knew an average of 2.7 letters in their names on the posttest, whereas children in the comparisonio condition knew 2.5. This difference was statistically significant ($p = .035$). Children in the early literacy condition learned an average of 0.07 more letters (out of three) in their own name than children in the comparison condition. The estimate for the standardized effect size of the early literacy curriculum on knowledge of letters in their names was +0.19 standard deviations.

Conclusions:
Description of conclusions and recommendations based on findings and overall study.

The results show that digital media, including public television programming, can support early literacy skills when thoughtfully integrated with teacher-led interactive activities. Although children in each group improved their literacy scores, children in the early literacy condition showed significantly more improvement than those in the science condition. As a point of comparison, the magnitude of the estimated effects of the literacy curriculum was larger than the magnitude of effects reported in the recent U.S. Department of Education-sponsored review of 15 preschool programs (Preschool Curriculum Evaluation Research Consortium, 2008). In that review, reported effects of curricula on phonological awareness ranged from -0.16 standard deviations to +0.32 standard deviations. For 13 of the programs reviewed, estimated effects on these skills were lower than the effects estimated for this curriculum.

Appendices
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Appendix A. References
References are to be in APA version 6 format.

Authors. (2007).

Barker, T., & Torgesen, J. K. (1995). An evaluation of computer-assisted instruction in phonological awareness with below average readers. *Journal of Educational Computing Research, 13*(1), 89-103.

Chambers, B., Cheung, A., Madden, N. A., Slavin, R. E., & Gifford, G. (2006). Achievement effects of embedded multimedia in a Success for All reading program. *Journal of Educational Psychology, 98*(1), 232-237.

Chera, P., & Wood, C. (2003). Animated multimedia "talking books" can promote phonological awareness in children beginning to read. *Learning and Instruction, 13*, 23-52.

Davidson, M. R., Fields, M. K., & Yang, J. (2009). A randomized trial study of a preschool literacy curriculum: The importance of implementation. *Journal of Research on Educational Effectiveness, 2*, 177-208.

Flay, B. R., Biglan, A., Boruch, R. F., Castro, F. G., Gottfredson, D., Kellam, S., et al. (2005). Standards of evidence: Criteria for efficacy, effectiveness, and dissemination. *Prevention Science, 6*(3), 151-175.

Invernizzi, M. A., Sullivan, A., & Meier, J. D. (2001). *Phonological Awareness Literacy Screening: Pre-kindergarten*. Charlottesville, VA: University of Virginia.

National Reading Panel (2000). *Report of the National Reading Panel: Teaching children to read*. Washington, DC: National Institute of Child Health and Human Development, National Institutes of Health.

Neuman, S. B. (1995). *Literacy in the television age: The myth of the TV effect*. Norwood, NJ: Ablex.

Preschool Curriculum Evaluation Research Consortium (2008). *Effects of preschool curriculum on school readiness (NCER 2008-2009)*. Washington, DC: U.S. Government Printing Office.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.

Smith, M. W., & Dickinson, D. K. (2002). *User's guide to the Early Language and Literacy Classroom Observation (ELLCO)*. Baltimore, MD: Brookes Publishing.

Treiman, R., Cohen, J., Mulqueeny, K., Kessler, B., & Schechtman, S. (2007). Young children's knowledge about printed names. *Child Development, 78*(5), 1458-1471.

Appendix B. Tables and Figures
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