Examining the Implementation and Impact of a Curriculum Supplement that Integrates Transmedia to Support Early Mathematics Teaching and Learning

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Introduction

The goal was to examine how technology such as educational digital games and videos can enhance mathematics teaching and learning in preschools that serve children who may be at risk for academic difficulties due to economic and social disadvantages. We conducted a 10-week prekindergarten mathematics randomized control trial study that integrated digital media with traditional hands-on activities to support early mathematics teaching and learning with 699 children in 86 prekindergarten classrooms in the New York City and San Francisco Bay areas. We found significant positive findings for both children and teachers.

This research was sponsored by the U.S. Department of Education's *Ready To Learn* initiative, which seeks to support early learning and school readiness for traditionally underserved children, ages 2–8.

What is *Transmedia*?

Transmedia describes digital games and videos about familiar characters, settings, and narrative themes or stories across various media platforms.

Theoretical Framework

There is growing recognition of the importance of early mathematics learning, and increasing awareness of the tremendous potential all children have to develop a broad range of mathematical reasoning skills. Early mathematics achievement is one of the strongest predictors of later school achievement. The National Association for the Education of Young Children and the National Council of Teachers of Mathematics jointly have called attention to the need for appropriate, challenging, and effective early childhood mathematics programs (2010). Yet most preschool teachers are not trained in early mathematics pedagogy and often are not familiar with instructional strategies to promote early mathematics learning.

Research Questions

Implementation Outcomes

- To what extent do teachers in the Transmedia Math Supplement group implement the curriculum supplement with fidelity?
- What are the successes and barriers, if any, that teachers in the Transmedia Math Supplement group encounter while implementing the curriculum supplement?

Teacher Outcomes

- What is the impact of the Transmedia Math Supplement and Technology & Media experiences on teachers' attitudes and beliefs about early mathematics education and using technology and media to support mathematics learning?

Child Outcomes

- What is the impact of the Transmedia Math Supplement and Technology & Media experiences on young children's mathematics learning?

Three Condition Randomized Controlled Trial (RCT)

PBS KIDS Transmedia Math Supplement

10-week supplementary curriculum experience integrating technology and Ready To Learn transmedia with traditional hands-on mathematics instruction.

Participants received:

- 10-weeks PBS KIDS Mathematics Supplement Teacher's Guide
- IWB + laptops + Internet access + technology support
- Selected PBS KIDS videos + games
- Hands-on Materials
- Math + technology training and coaching

Technology & Media

10-week period; teachers used technologies and transmedia materials to target the same mathematics skills as the PBS KIDS Transmedia supplement condition, but did not have the transmedia experience structured by a curriculum supplement.

Participants received:

- Math as usual
- IWB + laptops + Internet access + technology support
- Teacher-selected videos + games
- Technology training and coaching

Business as Usual

10-week period; teachers continued providing the same learning opportunities as before the study began.

Participants received:

- Math as usual
- Technology as usual
- Post hoc PD

Data Collection

Implementation and Teacher Outcomes

- Observational data on the quality of instruction and fidelity to the Supplement
- Weekly teacher and coach logs
- Pre- and post- coach surveys
- Back-end browser data about use of digital resources

Teacher Outcomes

- Pre- and post- teacher surveys

Child Outcomes

- Pre- and post- standardized and supplement-aligned assessments of early mathematics learning

Study Implementation Schedule

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Preparation				Study Implementation										Post			
Technology	Tech Installation				Ongoing In-Classroom Technology Support										Tech Redistribution			
Child Data Collection		Child Pre-Assessments			Ramp Up	Full Implementation of Curriculum Supplement with Teachers and Children									Child Post-Assessments			
Coaching and PD		Teacher Professional Development			Coaching										Close-out Visits			
Teacher/ Classroom Data Collection			Teacher Survey					Implementation Observations							Teacher Survey			

Findings

Implementation

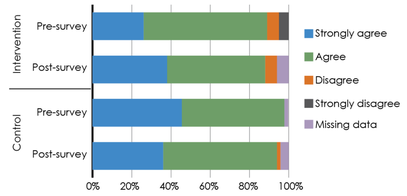
- Transmedia Math Supplement group teachers generally implemented the Supplement as intended, using the distinctive features—the warm-up and wrap-up, the video and book-reading pause points, and the instructional strategies emphasized in the PD.
- Teachers had challenges using digital resources and fitting activities into the daily schedule. Notably, Technology & Media teachers received more on-site coaching support than did the Transmedia Math Supplement teachers.

Teacher

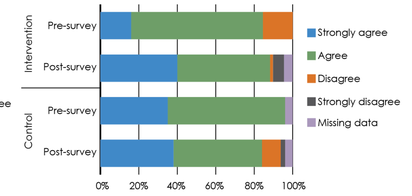
- Transmedia Math Supplement teachers reported significant changes in their confidence and comfort with early mathematics concepts and teaching with technology They also reported greater increases in their understanding of the concepts of number/operations and geometry relative to Business as Usual Teachers ($p<.05$).

Figures 1 & 2. Teacher agreement levels with the statements:

"I understand the concepts of numbers and operations as they apply to my students."



"I understand the concepts of geometry as they apply to my students."



Child

- Children in the Transmedia Math condition exhibited higher mathematics skills than did children in the Business as Usual condition, as assessed by a Supplement Based Assessment (SBA) developed by our team (1.51 points, $g = 0.24$, $p<.001$).

Table 1. Summary of Transmedia Math Supplement Impact Estimates

Impact Contrast	Coefficient	Std. Error	Hedges' g (Effect size)	p	Multiple Comparison Test*
SBA					
(1) PBS KIDS Transmedia Math Supplement vs. Business as Usual	1.51	0.302	0.24	<0.001	Significant
(2) PBS KIDS Transmedia Math Supplement vs. Technology & Media	1.43	0.288	0.22	<0.001	Significant
REMA					
(1) PBS KIDS Transmedia Math Supplement vs. Business as Usual	1.09	0.589	0.15	0.064	---
(2) PBS KIDS Transmedia Math Supplement vs. Technology & Media	1.09	0.571	0.15	0.056	---

*Note: thresholds for statistical significance adjusted for six pair-wise comparisons using the Bejamini-Hochberg False Discover Rate procedure.

Conclusions

- As the centerpiece of a curricular supplement, transmedia can advance content-area learning for young children from economically disadvantaged backgrounds who are often less prepared for kindergarten than are their more socially and economically advantaged peers.
- Curriculum materials can be a powerful support for teaching, especially when teachers are integrating technology and media into their existing routines.

References

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