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Ready To Learn **Research**

November 2019

Summary

Early Science & Engineering

The Impact of *The Cat in the Hat Knows a Lot About That!* on Learning

The Importance of Early STEM

Early science and engineering experiences provide children with an important foundation for future science and engineering learning.

Exploring science and engineering also help to develop other important skills children need to be ready for school, including critical thinking, problem-solving, language, and socio-emotional skills. However, many children, especially those living in resource-lean communities, lack opportunities to learn about science and engineering in both preschool and at home.

Digital media—television, video, apps, digital games—have promise to support children’s science and engineering learning. Young children spend substantial time using media every day, and it is easily scaled. Media can engage and model ways of talking about and doing science. Through digital media children can manipulate—zoom in, slow down, speed up—and experience scientific phenomena in ways that are not otherwise possible in the physical world.

About

Little is known about the effects of science-related media on young children's learning. Over 450 children living in low-income households across the U.S. participated in this study, which explores whether providing families with access to science and engineering videos, digital games, and hands-on activities can help 4- and 5-year old children learn physical science and engineering concepts and practices.

We focused on a specific set of resources: videos and digital games from the PBS KIDS series *The Cat in the Hat Knows a Lot About That!*[™] PBS, in partnership with the Corporation for Public Broadcasting (CPB), developed the resources under the 2015–2020 Ready To Learn Initiative, which is funded through the U.S. Department of Education.

Ready To Learn **Research**





Who participated
in the study?

A diverse sample of families,
all living in low-income households.

454

Children:
Ages 4 and 5 years

The study recruited families living in five locations.



San Francisco,
California

Phoenix,
Arizona

Minneapolis,
Minnesota

Boston,
Massachusetts

New York,
New York

→ Children

25%

Speak a language at home other than or in addition to English

33%

Attend school or center-based care for 30+ hours a week

→ Parents

51%

Have a household income less than \$50,000

17%

Have a high school education or lower

→ Children's Ethnicity

35% White

23% Multi-Race

19% Hispanic

18% Black or African American

3% Asian

2% Other

What was the study design?

This study was an 8-week randomized controlled trial.

A randomized controlled trial is a rigorous design that allows researchers to make causal claims about the effects of a program. Researchers randomly assigned families to one of two groups — Treatment (*The Cat in the Hat Knows a Lot About That!*) or Control.

	Treatment Group Families Received	Control Group Families Received
New tablet computer with data	✓	✓
<i>The Cat in the Hat Knows a Lot About That!</i> videos, games app, and real-world activities	✓	
Study and similar PBS KIDS science videos and games blocked		✓
Instruction to have child use the media for one hour/week	✓	✓
Weekly text messages about the content and media log link	✓	
Calendar indicating weekly theme	✓	

→ Data

To understand whether the study resources affected children's understanding of science and engineering concepts and practices, the Study Team assessed children's understanding using:

Lens on Science

Externally developed and validated science assessment used at the beginning of the study

Lens-Modified

A version of the Lens on Science that the Study Team modified to focus only on topics in physical science and engineering and technology domains, used at the end of the study

Hands-On Preschool Assessments of Science and Engineering

Researcher-developed performance-based assessments

The Study Team also collected:

Parent Perceptions

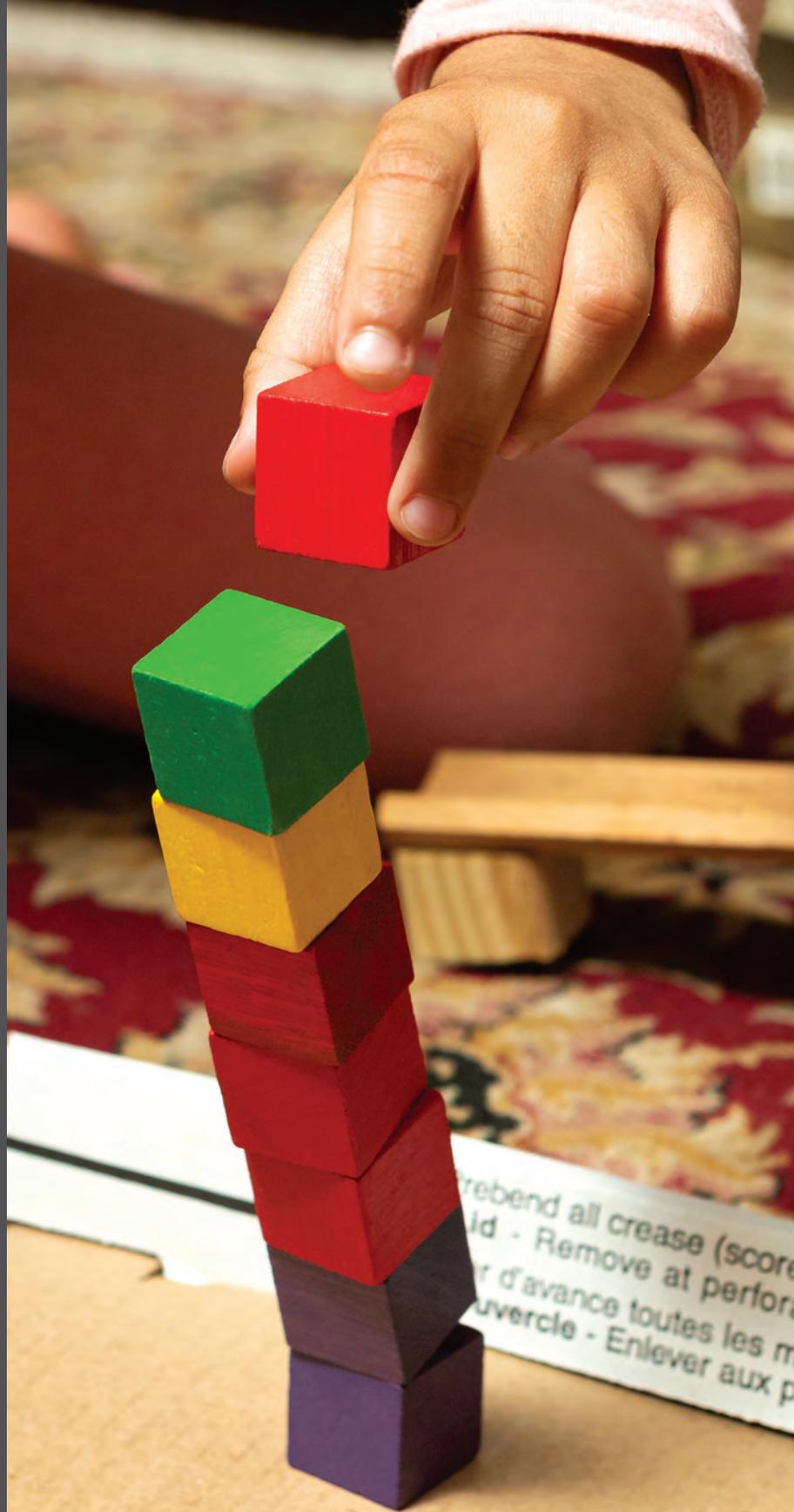
of the intervention, using pre- and post-surveys and media logs

Usage Data

from tablets to understand how participants used the videos and games

Parent Interviews

with a random sample of 20 Treatment Group parents



What did families do?

The study experience was an optimized version of what young children might experience when they use *The Cat in the Hat Knows a Lot About That!* media in everyday life.

The Study Team provided the children and their parents with access to *The Cat in the Hat Knows a Lot About That!* videos, games, and hands-on activities through a tablet computer and printed hands-on activities.

PBS KIDS producers organized the videos and games into six content themes.

- **Bridge-a-rama:** Bridges
- **Slide-a-ma-zoo:** Slides and friction
- **Sorta-ma-gogo:** Sorting objects
- **Sounda-pa-looza:** Sounds and soundwaves
- **Builda-ma-loo:** Building and engineering
- **Be curious:** Five senses and making observations



1 hour / week
for **8** weeks

The Study Team and written family guide encouraged families to use the media for about one hour per week for each of the 8 weeks of the study. A calendar guided families to focus on a particular content theme each week for the first six weeks followed by two weeks of free choice.

→ *The Cat in the Hat Knows a Lot About That!* Study Resources

Based on the popular Dr. Seuss character, *The Cat in the Hat Knows a Lot About That!* resources support learning by modeling science practices and language and exploring science and engineering content through animated stories. Study resources include:

28 **videos** (3 hours and 43 minutes of content) in a video app

5 **digital games** in *The Cat in the Hat Builds That* app

20 **game-aligned guides** for hands-on activities embedded in the game app

3 **printed descriptions** of science and engineering activities from the website

→ Use of Study Resources

Over the 8-week study, on average, Treatment Group children used

- Digital games for 2 hours 48 min
- Videos for 4 hours 20 min

24% used videos/games < 2 hours total

59% used video/games > 20 hours total

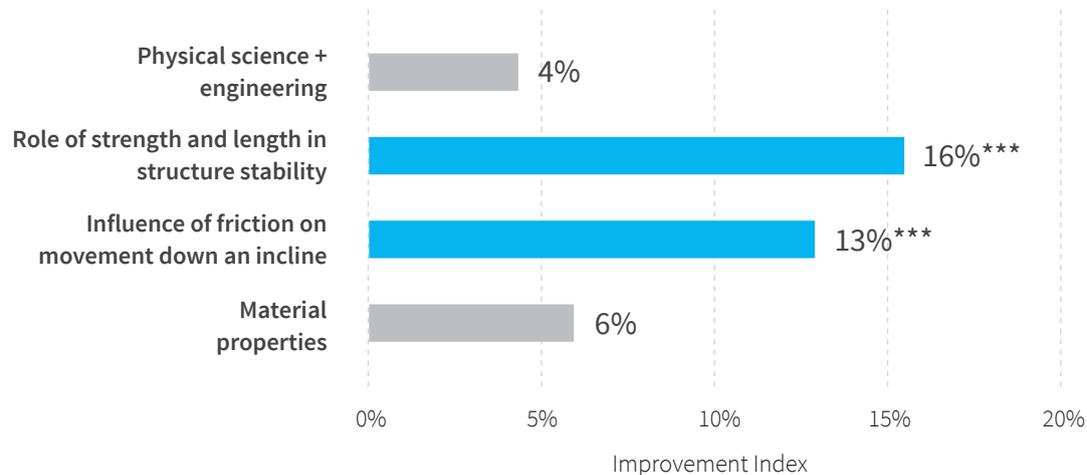


What did children learn?

Study resources had a **clear positive effect** on children's understanding of physical science concepts related to matter and forces.

The study found impacts on children's understanding of: **(a)** how the properties of objects and materials and natural and applied forces contribute to the stability of structures, and **(b)** how the properties of materials and friction influence how objects move.

→ Impact of Access to *The Cat in the Hat Knows a Lot About That!* Improvement Indices by Assessment



Note: Asterisks indicate a statistically significant difference between Treatment Group (*The Cat in the Hat Knows a Lot About That!*) children and Control Group children. * $p < .10$. ** $p < .05$. *** $p < .01$.

The What Works Clearinghouse Improvement Index describes the average percentage point increase in percentile rank for a child in the Treatment Group as compared to a child in the Control Group. We report the impacts of access to the *The Cat in the Hat Knows a Lot About That!* as effect sizes in the full report.



We found suggestive evidence that study resources improved children's **(a)** general understanding of physical science concepts and science and engineering practices and **(b)** ability to sort objects by size, color, shape, and use. These effects were small and approached, but did not reach, the conventional threshold for statistical significance.

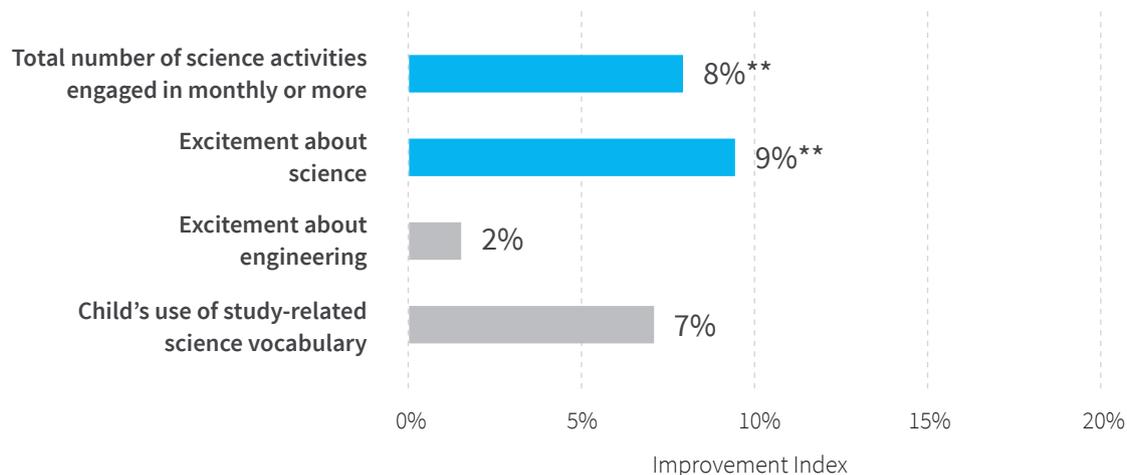
We examined whether the effect of the study resources on children's science and engineering knowledge and practices was different for different kinds of children, such as children with greater science knowledge, age, gender, ethnicity, parent education, home language, and attendance at center-based care or kindergarten. We found no differences in the effect across these subgroups with one exception: Children who spoke only English at home seemed to benefit more from access to study resources relative to children from families who spoke languages in addition to or other than English at home.

What did parents report?

Parent surveys suggest that the intervention **increased** children's interest in and engagement in science.

On average, parents in the *The Cat in the Hat Knows a Lot About That!* Group rated their children's excitement about science higher than did parents in the Control Group (but did not rate their excitement about engineering higher). These parents also reported their children engaged in more science activities over the past month than were reported by Control Group parents.

→ **Impact of Access to *The Cat in the Hat Knows a Lot About That!* Improvement Indices for Parent-Reported Outcomes**



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The What Works Clearinghouse Improvement Index describes the average percentage point increase in percentile rank for a child in the Treatment Group as compared to a child in the Control Group. We report the impacts of access to the *The Cat in the Hat Knows a Lot About That!* as effect sizes in the full report.

Why are these findings important?

This study adds new knowledge about the **promise of media to support science and engineering learning.**

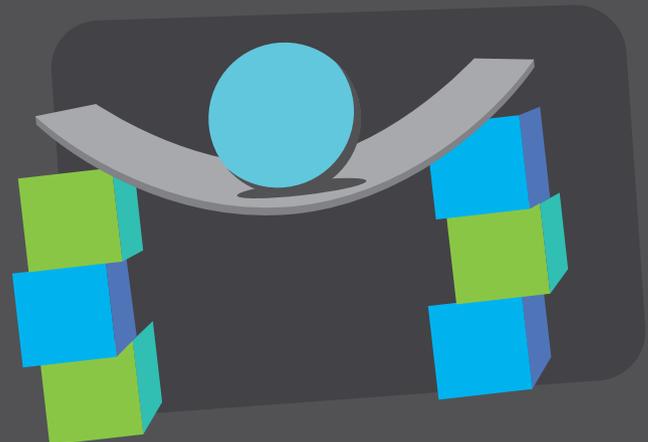
Providing access to the resources measurably improved some aspects of children's physical science knowledge and science and engineering practices. Although our certainty about the effects is stronger for a subset of content knowledge and practices in physical science and engineering, the results provide consistent evidence that *The Cat in the Hat Knows a Lot About That!* helps children learn about science and engineering.

Previous research suggests that transferring knowledge from videos and digital games can be challenging, especially for young children. That children in this study were able to apply what they experienced virtually in the games and videos to the real world is meaningful and indicates that virtual screen experiences, when developmentally appropriate, aligned to national standards, and focused on active learning, can support real-world learning.

Young children regularly use media; ensuring that this time is spent productively using high-quality media seems both paramount and also possible.

These findings illuminate the importance of careful design that aligns with key learning goals relevant for young children. The results of this study also suggest that a relatively short intervention—a suggested one hour per week, in this case—can improve young children's learning.

Together, these results suggest that developing a broader array of high-quality science-focused media, and directing families to existing high-quality media and providing some guidance for parents about how to use the media, represent an important step in improving young children's engagement in science.



Learn More

These study highlights are just the beginning. The full report includes rich descriptions of parent experiences in their own words, a full set of findings, survey questions, data tables, and much more.

Visit: edc.org/early-science



About EDC

Education Development Center (EDC) is a global nonprofit that advances lasting solutions to improve education, promote health, and expand economic opportunity. Since 1958, we have been a leader in designing, implementing, and evaluating powerful and innovative programs in more than 80 countries around the world.

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SRI Education, a division of SRI International headquartered in Menlo Park, California, is tackling the most complex issues in education and learning to help students succeed. We work with federal and state agencies, school districts, major foundations, nonprofit organizations, and international and commercial clients to address risk factors that impede learning, assess learning gains, and use technology for educational innovation.

Design: EDC Digital Design Group

Photography: Burt Granofsky

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The contents of this report were developed under a grant from the Department of Education. However, those contents do not necessarily represent the policy of the Department of Education, and you should not assume endorsement by the Federal Government. [PR/Award No. U295A150003, CFDA No. 84.295A]

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