Engaging Families in STEM through Digital Media

October, 2018

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Can computers and tablets be used in developmentally appropriate ways in early learning settings?

Are You...
A Teacher?
A Researcher?
A Center Director?
Other?
Your Background

Some Questions to Get us Started:

What are some successes and challenges that you’ve had or seen in the past trying to use digital resources to help young children learn?

What questions do you have about using digital resources with families?
Agenda/Overview

- What do we know about how parents think about supporting their young children’s learning?
- Why go digital?
- Research on high-quality media
- Mediation for effective use of media and tech to promote learning at home
- Try things out
- Examples and outcomes from our research
- Sharing
- Q & A
What Parents Talk About When They Talk About Learning

Findings From a National Survey About Young Children and Science

July, 2018
Introduction
Parental Involvement in Early Science

- Early science experiences can provide a foundation for a variety of skills
- Parents can play an important role in improving their children’s literacy and math learning
- Similarly, parent involvement could be vital in improving children’s science learning—especially given many early education programs do not address science
- Children from low-income families tend to have less science knowledge at school entry.
Role of Media

- Media are ubiquitous in most families with young children.
- Educational media may help parents support science learning.
This Study

• Purpose: Explore how parents and caregivers view their role in supporting their three- to six-year-old children’s learning, particularly science learning.
Research Questions

How do parents and caregivers help their young children learn in general and learn science in particular?

• What are parents’ attitudes and beliefs about children’s early learning?

• How do parents support their children’s early learning?
Research Questions

How do parents describe their children’s use of educational media, particularly science-related media?

- What are parents’ attitudes and beliefs about using media to support learning at home?
- What kinds of media activities do parents and children undertake together?
Methods

What Parents Talk About When They Talk About Learning: A National Survey
National Survey

- National telephone survey of 1,442 parents with at least one 3-6-year-old child living at home
- 909 families (63%) had an annual household income of $50,000 or less
Qualitative Study

- Eight focus groups with a total of 65 families in three locations
- Two home visits with 10 families (selected from focus group participants to ensure variety of comfort with science and use of digital media)
- Science journal between home visits
Results
Responsibility for Learning

99% of parents

Report that they want to be involved in their children’s education
### Parent perceptions of the importance of science

<table>
<thead>
<tr>
<th>Subject</th>
<th>More important than science</th>
<th>As important as science</th>
<th>Less important than science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and writing</td>
<td>44%</td>
<td>54%</td>
<td>3%</td>
</tr>
<tr>
<td>Social skills</td>
<td>47%</td>
<td>49%</td>
<td>3%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>26%</td>
<td>71%</td>
<td>3%</td>
</tr>
</tbody>
</table>
I think high school is a good time for them to learn science. I think it's overrated, seriously, because my daughter, she's in first grade, and they're teaching her science, and she looks at me like, "What the heck am I supposed to learn with this?" …I think they should focus on other things more important than science. I know it's going to be more important at one point because it has to do with math and everything, but right now I don't feel that it's necessary in the first grade.
"It's important for education. It's important for the kids to know, like you says, where's the food come from? It's important to know how is the water we drink so clean if we know it comes from a reservoir that's full of yucky stuff. It's very important to educate them."
## Confidence

Percentage of Parents Who Feel “Very Confident” in their Ability to Help Their Children Learn Age-Appropriate Skills

<table>
<thead>
<tr>
<th>Skill</th>
<th>Confidence Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and writing skills</td>
<td>75%</td>
</tr>
<tr>
<td>Math skills</td>
<td>73%</td>
</tr>
<tr>
<td>Behavioral, social, and emotional needs</td>
<td>71%</td>
</tr>
<tr>
<td>Science skills</td>
<td>54%</td>
</tr>
</tbody>
</table>
Confidence

Percentage of Parents Who Feel “Very Confident” in their Ability to Help Their Children Learn Age-Appropriate Skills, by Parent Education

Social and behavioral skills:
- Less than High school: 66%
- High school grad: 68%
- Some college: 76%
- College grad+: 70%

Mathematics:
- Less than High school: 47%
- High school grad: 67%
- Some college: 76%
- College grad+: 82%

Reading and Writing:
- Less than High school: 67%
- High school grad: 69%
- Some college: 79%
- College grad+: 78%

Science:
- Less than High school: 41%
- High school grad: 43%
- Some college: 57%
- College grad+: 65%
Parents described their confidence about science in terms of their ability to…

- answer spontaneous questions, and
- communicate information appropriately.
Learning Activities

Percentage of Parents Who Report Engaging in Learning Activities With Their Child Daily

<table>
<thead>
<tr>
<th>General Learning Activities</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read or told stories</td>
<td>68%</td>
</tr>
<tr>
<td>Involved your child in household chores</td>
<td>63%</td>
</tr>
<tr>
<td>Worked on reading or writing skills</td>
<td>50%</td>
</tr>
<tr>
<td>Worked on numbers/shapes/math concepts</td>
<td>50%</td>
</tr>
<tr>
<td>Sang songs or played musical instruments</td>
<td>47%</td>
</tr>
<tr>
<td>Watched TV/videos/digital games/apps</td>
<td>43%</td>
</tr>
<tr>
<td>Played a sport or exercised</td>
<td>34%</td>
</tr>
<tr>
<td>Played games or completed puzzles</td>
<td>27%</td>
</tr>
<tr>
<td>Did arts and crafts</td>
<td>22%</td>
</tr>
<tr>
<td>Engaged in one or more learning activity</td>
<td>94%</td>
</tr>
</tbody>
</table>
## Science Activities

Percentage of Parents Who Report Engaging in Science-Related Learning Activities With Their Child Daily

<table>
<thead>
<tr>
<th>Science Learning Activities</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explored science outdoors</td>
<td>36%</td>
</tr>
<tr>
<td>Explored science in everyday activities</td>
<td>26%</td>
</tr>
<tr>
<td>Watched science-related videos/played digital games</td>
<td>20%</td>
</tr>
<tr>
<td>Built something</td>
<td>17%</td>
</tr>
<tr>
<td>Read about nature in science books or magazines</td>
<td>12%</td>
</tr>
<tr>
<td>Played with a science-related puzzle or board game</td>
<td>5%</td>
</tr>
<tr>
<td>Engaged in one or more science learning activity</td>
<td>58%</td>
</tr>
</tbody>
</table>
Science Activities

Low-income parents reported engaging in science-related activities more frequently than higher-income parents.

- Engaged in one or more general learning activity:
  - Less than $25,000: 95%
  - $25,000-$50,000: 94%
  - $50,000-$75,000: 94%
  - $75,000-$100,000: 92%
  - $100,000 or higher: 94%

- Engaged in one or more science learning activity:
  - Less than $25,000: 61%
  - $25,000-$50,000: 62%
  - $50,000-$75,000: 62%
  - $75,000-$100,000: 59%
  - $100,000 or higher: 48%
I guess, balance, that’s science right? […] Yeah, balance and motion and, gosh all this other terminology that I don’t remember from 6th grade.
Supports

Percentage of Parents Who Reported That a Given Support Would Help "a Lot" in Doing More Science at Home

- **45%**
  Better access to technology

- **52%**
  Ways to get yourself more interested in science

- **64%**
  Ways to get your child more interested in science

- **64%**
  Information about what your child should learn about science

- **71%**
  Ideas for doing science activities with everyday materials

- **71%**
  Ideas for science activities to do with your child
Supports

Percentage of Parents Who Reported That a Given Support Would Help “a Lot” in Doing More Science at Home, by Family Income

<table>
<thead>
<tr>
<th>Support</th>
<th>Less than $25,000</th>
<th>$100,000 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideas for doing science activities with everyday materials</td>
<td>77%</td>
<td>67%</td>
</tr>
<tr>
<td>Ideas for science activities to do with your child</td>
<td>76%</td>
<td>63%</td>
</tr>
<tr>
<td>Ways to get your child more interested in science</td>
<td>74%</td>
<td>57%</td>
</tr>
<tr>
<td>Information about what child should learn about science</td>
<td>79%</td>
<td>51%</td>
</tr>
<tr>
<td>Ways to get yourself more interested in science</td>
<td>68%</td>
<td>39%</td>
</tr>
<tr>
<td>Better access to technology</td>
<td>63%</td>
<td>31%</td>
</tr>
</tbody>
</table>
Parents Say

I think identifying ideas that ... I can do without it being, you know—I don’t know if this is going to sound bad—but, like, a really huge thing. Because we’re super stressed for time, too. So, I can’t go and make her something that’s going to take, you know, 20 minutes to set up and 30 minutes to do, and then an hour to clean it off everything...
Parents Say

“Whatever I can really scrounge up. If she wants to learn something about animals, or basic animals like hamsters or turtles or fishes, I go to Petco, because I need to get food for the dogs, and she loves looking at animals, fishes, especially we pass by Walmart or anywhere, she'll ask me questions now and then.”
Digital Media Supports

- **94%** of parents reported that their child watched educational TV shows or videos in the past month.
- **84%** of parents reported that their child had played a digital game or app in the past month.
Digital Media Supports

Many children use science media weekly or more

- **TV shows/videos about science**: 66% weekly or more, 22% once or twice this past month, 12% did not do this past month
- **Video games/apps about science**: 45% weekly or more, 24% once or twice this past month, 31% did not do this past month
- **Websites about science**: 25% weekly or more, 20% once or twice this past month, 55% did not do this past month
## Digital Media Supports

Parents’ report of supports they provide while using science media, among parents who used science media in the last month

<table>
<thead>
<tr>
<th>Support</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor child’s viewing and playing</td>
<td>95%</td>
</tr>
<tr>
<td>Compliment or encourage a child</td>
<td>94%</td>
</tr>
<tr>
<td>Explain or talk about something that you’re watching or playing</td>
<td>86%</td>
</tr>
<tr>
<td>Watch a show or play a game or app along with child</td>
<td>75%</td>
</tr>
<tr>
<td>Help your child access and play a show, app, or game</td>
<td>73%</td>
</tr>
<tr>
<td>Talk about connections between a show, app, or game</td>
<td>69%</td>
</tr>
</tbody>
</table>
Digital Media Supports

• Parents most frequently use science media to search for answers to specific questions
• View science media as entertainment rather than educational
• Lack of explicit goals for children’s use of science media
Implications

What Parents Talk About When They Talk About Learning: A National Survey
How to support parents

• All parents are interested and invested in their children’s education.
• Many may not recognize the role they play in science exploration.
• Inspiration, encouragement, ideas, modeling and accessible resources may help.
  • Build on the science in everyday routines.
  • Communicate importance of science for early learning
Guide parents in using media resources

• Young children use educational media & science-related media regularly.

• Media resources have the potential to bring information on a large scale into homes and directly to children
  • Potential for media to engage, provide models and support parents as well

• Parents need help finding these resources and understanding how best to use them with their children to support learning
Full and summary reports available at:

http://www.edc.org/what-parents-talk-about
Can media and technology support early learning?

Impacts on learning:

• Engagement with public media in lab, school and home settings can increase learning in literacy, science, and math, and improve other academic-related outcomes (Fisch, 2004; Kearney & Levine, 2015; McCarthy et al., 2012; Pasnik & Llorente, 2013; Pasnik et al., 2015; Penuel et al., 2012)
Using media for learning: your experiences

Question for discussion:

What kinds of media do you look for when thinking about young children and STEM?
What characteristics do you look for?
What kinds of things can children and their families learn from media?
Digital resources can provide powerful models of teaching and learning

High quality digital resources

Show promise as effective supports for early learning
Are designed to be developmentally appropriate and to support critical skills including problem solving, experimentation and collaboration
Enable children and adults to interact with content and phenomena that may be otherwise unobservable
Provide tailored learning opportunities to individuals
Engage parents and support them to better understand the early learning content that is developmentally appropriate for young children
Are accessible

Can computers and tablets be used in developmentally appropriate ways in early learning settings?
Digital resources can provide powerful models of teaching and learning

Features of media that relate to learning:

- Foster intrinsic **interest, motivation and engagement** (Renninger, 2000)
- **Model behavior**, e.g. ways of thinking, talking, and cooperating, and math content knowledge (Gola, Richards, Lauricella, and Calvert, 2015; Troseth, Saylor, & Archer, 2006)
- Games provide **feedback** to children and invite their active response, and videos can invite **questioning**, which can support engagement and learning (Anderson et al., 2000; Crawley et al., 2002).
Can computers and tablets be used in developmentally appropriate ways in early learning settings?
How families can best use media together: your experiences

Question for discussion:

Can you think of examples of shared media use that helped support learning, in your professional or personal life? How was using the media enhanced through the shared experience?
What is mediation?

The intentional supports built into and used in combination with digital resources to foster learning, providing a key role for caregivers. For example:

- Selecting and sequencing media and materials with specific learning goals in mind
- Supporting children to interact meaningfully with the materials on their own, with peers, and/or with caregivers
- Guiding learning towards more sophisticated and comprehensive understandings
- Helping children to demonstrate their understanding and connect prior knowledge to digital content
Parents and media

Impacts of media on parents

**Engage** parents in topics they feel are complex, such as science or math

**Model, scaffold** how to support their children’s learning generally and through media

May be especially effective for parents who **lack confidence** (Berkowitz et al., 2015)
Resources

Ready To Learn Website

www.cct.edc.org/rtl/

Videos
These videos demonstrate classroom use of the Ready To Learn materials by teachers who participated in the 2009 Media-Rich Literacy Study. Many of the teachers continued to use and value the materials after our research was concluded.

Table 4. Weekly sample schedule of the PBS KIDS Transmedia Math Supplement activities

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Co-Viewing (25 minutes)</td>
<td>Mathematics Detective Journal (20 minutes)</td>
<td>Mathematics Circle Routine (10 minutes)</td>
<td>Challenge Game Play (25 minutes)</td>
</tr>
<tr>
<td></td>
<td>Easy Game Play (10 minutes)</td>
<td>Guided Reading (15 minutes)</td>
<td></td>
</tr>
<tr>
<td>Computer Center (~10 minutes per pair of children)</td>
<td>Computer Center (~10 minutes per pair of children)</td>
<td>Computer Center (~10 minutes per pair of children)</td>
<td>Computer Center (~10 minutes per pair of children)</td>
</tr>
<tr>
<td></td>
<td>Hands-On Centers (~10 minutes per pair of children)</td>
<td>Hands-On Centers (~10 minutes per pair of children)</td>
<td>Hands-On Centers (~10 minutes per pair of children)</td>
</tr>
</tbody>
</table>

Common Sense Media:
https://www.commonsensemedia.org/
Resources
Next Generation Preschool Math:

NSF funded initiative to support the design of a series of tablet-based applications (apps) that teach early math (equipartitioning and subitizing) to preschool children.

Apps can be played independently or in a formal setting, supporting teachers with resources for use of the apps.
# Next Generation Preschool Science

## Supporting Student Scientists!

<table>
<thead>
<tr>
<th>Plant Toolkit</th>
<th>Sunflower Sprout</th>
<th>Wonder Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides opportunities to record observations (photos with labels and measurements)</td>
<td>Allows children to interact with simulation that demonstrates growth</td>
<td>Provides an opportunity for children to explore how different variables affect growth over time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ramp Toolkit</th>
<th>Star Stop</th>
<th>Textures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides opportunities to record, predict and compare movement observed in hands-on investigations</td>
<td>Allows children to explore how changing different variables affects movement</td>
<td>Provides an opportunity for children to explore how different textures affect movement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shadow Toolkit</th>
<th>Shadow Simulation</th>
<th>Sunrise at the Park</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides opportunities to record observations and create flipbooks of shadows as they change</td>
<td>Allows children to explore what makes different shadows and what makes shadows change</td>
<td>Provides an opportunity for children to make different shadows and explore how they change over time</td>
</tr>
</tbody>
</table>
Examples from our research

Demonstrate that young children from low-income homes can learn in environments where well-crafted digital media are available and supported

- Math study (home)
- Science study (home visiting project)
Math Study (Home)

The PEG+CAT Home Study was implemented over a 12 week period in children’s homes. Families were provided with an activity schedule including games, videos and hands on activities to complete each week. Included were short video clips with tips for parents on how to support their child’s learning.
Math Study (Home)

Parents in the intervention condition:

- Reported more joint media use
- Were more confident about supporting math learning for their children
- Were more likely to agree that technology and media could be tools for math learning
- And more likely to report engaging in problem-solving strategies (such as exploring “what if” scenarios) with their children
Math Study (Home)

Children in the intervention exhibited greater improvements in:

- ordinal numbers
- spatial relationships
- 3-D shapes
Science Study (Home Visiting Organizations)

- The PEEP Family Science Study was implemented over a 12 week period in children’s homes with the support of educators from home visiting programs.
- Families were provided with three four week “units” in the form of apps that included parent videos, live-action and animated videos and hands-on activities to complete each week.
- Throughout, parents were encouraged to use specific pedagogical strategies to support their children’s science learning.
Parents in the intervention condition, compared to a similar comparison group enrolled in the same home visiting program reported:

- doing substantially more science activities with their child
- using the target parent engagement strategies more frequently
- using joint engagement strategies more frequently
- Parents with low confidence were more likely to feel more confident about their abilities to help their children learn science
Resource review and discussion

Question for discussion:

Review the media resources on the tablets
Select one for discussion and share:

1. What characteristics of the media would help support children’s learning?
2. How would you use this resource with families? What kinds of supports would families need to use the resource to support learning?
Acknowledgements

Funding from the U.S. Department of Education Ready To Learn Initiative (U.S. Department of Education Award Number U295A100), in collaboration with CPB-PBS.
Thank You