NATIONAL HEAD START ASSOCIATION

Research Blast

August 2014:
Science, Technology, Engineering, and Math!

Background

As a child, where did your world of imagination take you? When you played inside, did you ever build a fort from couch cushions and a sheet? We didn't know it then, but our time spent on creative play helped nurture skills that would later benefit us in developing math and science knowledge. Indeed, there has been a plethora of research that supports learning through creative play and how it benefits children academically. In addition, creative play has shown to develop skills such as, creativity, communication, and collaboration. Why are these skills important? In the 21st century, our children need them for individual success in a modern economy filled with science, technology, engineering, and math (STEM) careers. It is estimated that only 16% of American high school seniors are proficient in mathematics and interested in a STEM career. In addition, our most vulnerable youth have been historically underrepresented in STEM fields.

The articles below address the importance of introducing science, technology, engineering, and mathematics during the early years along with resources to help keep the innovation going. Many programs across the nation have used creative play in their programs. For instance, this last year students at El Valor's Reyes Center in Chicago, IL learned about architecture, engineering, and home design when they recreated scale model replicas of buildings in their community. What a great way to use creative play to strengthen community and learning!

To highlight the need to foster 21st century skills in early education, this October Head Start programs across the nation will be invited to participate in the Global Cardboard Challenge and to use the materials programs and families have on hand to build whatever children can imagine! This event will be a part of the year-long celebration of Head Start's 50th anniversary and can provide valuable opportunities for creative play and STEM discussions. For further information, please email 50th@NHSA.ORG.

Resources

National Center on Quality Teaching and Learning

Mathematics Knowledge and Skills and Science Knowledge and Skills

These toolkits from the National Center on Quality Teaching and Learning are designed as professional development activities and resources to enhance your program's math and science curricula. The Know, See, Do, and Improve sections can be used to learn about and try best practices in math and science teaching at the early childhood level.

Math http://eclkc.ohs.acf.hhs.gov/hslc/tta-system/teaching/practice/curricula/MKandS.html

Science http://eclkc.ohs.acf.hhs.gov/hslc/tta-system/teaching/practice/curricula/SKandS.html

Math is Everywhere

This free, bilingual kit created by PNC Grow Up Great and Sesame Street includes a magazine for parents and caregivers, a children's story with activities, and video! Educators can also download a guide that can help them incorporate math activities into their programs.

https://www.pnc.com/grow-up-great/resources/kits/math-is-everywhere.html

PNC Grow Up Great Science Lesson Center

These theme-based lessons include step-by-step instructions and easily-accessible materials. The content was created in collaboration with the Smithsonian National Air and Space Museum, Carnegie Science Center, and other outstanding museums. Lesson are aligned with the Common Core State Standards and include kid-friendly vocabulary, as well as bilingual Home Connections to share with families. Check back often for new lessons!

https://www.pnc.com/grow-up-great/resources/lessons.html

STEM Sprouts Teaching Kit

This teaching kit was created through partnership between National Grid, Boston Children's Museum, and WGBH. The goal of this curriculum is to assist preschool educators in focusing the naturally inquisitive behaviors of three to five-year-olds on science, technology, engineering, and math (STEM).

http://www.bostonchildrensmuseum.org/sites/default/files/pdfs/STEMGuide.pdf

Picture This: Increasing Math and Science Learning by Improving Spatial Thinking

This insightful article by Dr. Nora Newcombe, a Professor of Psychology at Temple University and PI of the Spatial Intelligence and Learning Center (SILC), focuses on improving spatial thinking - a skill that is crucial to student success in STEM. In this article, the author offers some suggestions to preK and elementary teachers about how to foster spatial thinking.

http://files.eric.ed.gov/fulltext/EJ889152.pdf

Research

Proceedings of the National Academy of Sciences of the United States of America
Number sense in infancy predicts mathematical abilities in childhood
by Ariel Starr, Melissa E. Libertus, and Elizabeth M. Brannon, Edited by Rochel Gelman
http://www.pnas.org/content/110/45/18116.short

Even before they can count to ten, even before they can speak, infants have a sense of when groups are larger or smaller, more or less. In this study, the authors show that preverbal number sense in infancy predicts mathematical abilities when children reach preschool. Babies' scores at 6 months old were related to both standardized math test scores and nonsymbolic number comparison scores when they were three and a half. These findings suggest that preverbal number sense is key to development later on. What is more, this study highlights the importance of exposing infants to many different activities that will develop their number sense - even in infancy. For ideas and tips on teaching Math Knowledge and Skills, review the resources provided by the National Center on Quality Teaching and Learning!

Developmental Science
Children's spatial thinking: does talk about the spatial world matter?
by Shannon M. Pruden, Susan C. Levine, and Janellen Huttenlocher
http://onlinelibrary.wiley.com/doi/10.1111/j.1467-7687.2011.01088.x/abstract
When the "Word Gap" comes up, we talk a lot about how parents should use more words around their babies, but do the words themselves matter? This study examined parents' use of spatial language about objects' size, shape, placement, etc. when they children were 14 to 46 months and how it later predicted their children's abilities both to use that kind of language and also to do tasks that required spatial reasoning. The more spatial language that a parent produced, the more a child produced, and children who produced more spatial language performed better on problem solving tasks when they were four and a half. Activities that involve using spatial reasoning, such as mental paper folding, help develop spatial language and strengthen spatial skills. Why are spatial skills important? Much research has shown that a strong spatial skills predict achievement in STEM and emerging research has shown that spatial attention ability predicts later reading scores. Whether children are building with blocks or making origami, this study underscores the importance of helping parents talk with children using rich vocabulary about sizes, shapes, and contours and modeling the same kind of language during classroom play.

Science Education
Science Interests in Preschool Boys and Girls: Relations to Later Self-Concept and Science Achievement
by Mary Leibham, Joyce Alexander, & Kathy Johnson

http://onlinelibrary.wiley.com/doi/10.1002/sce.21066/abstract;jsessionid=8AD6DF537B4891E1EE75E53D1E550A48.f02t03?deniedAccessCustomisedMessage=&userIsAuthenticated=false

According to the National Science Board, in 2010 women made up half of college educated workers in the US, but only 28% of the workers in science and engineering. Leibham, Alexander, and Johnson focus on how science interests in preschool age children are related to their later self-concept and science academic achievement, with a particular focus on how science interests and later outcomes are different for girls and boys. The researchers examined the intensity of children's science interest between the ages of 4 and 6, to look at age 8 self-concept and science achievement. Although boys displayed higher overall levels of science interests than girls, it wasn't related to how they saw themselves later on. However, girls who had intense science interests were more likely to have higher self-concepts at age 8 and higher science achievement. When Head Start classrooms offer all children - but particularly girls - the opportunity to deepen their experiences with science, it can propel them to later success.

Discussion Questions

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1. Has your program worked on a project where children used Creative Play such as the one at the El Valor's Reyes Center? After reading the articles and resources, what are some new strategies that you would like to incorporate into the project next time?

2. The Leibham, Alexander, & Johnson article suggests that girls may benefit even more than boys from earlier exposure to science. How do you make sure science activities in the classroom are accessible for both boys and girls?

3. After reading the Pruden, Levine, and Huttenlocher article on spatial language use, what would you suggest to a family about opportunities to use rich vocabulary with their child?

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Do you know of other recent research that may be of interest to the Head Start field? Do you have other questions, comments or concerns? E-mail Emmalie Dropkin (edropkin@nhsa.org).