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# Early Development Lab

## University of Virginia

### Winter 2007

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## Evaluating Montessori Education

Last winter, graduate students **Ashley Pinkham**, **Tracy Nishida**, and **Jennifer Van Reet** made two trips to Milwaukee, Wisconsin, to test 5- and 12-year-old children in inner-city public schools on a variety of cognitive achievement and social skills tests. Half of the children went to Montessori school, and the other half had been in a random lottery to get into that Montessori when they were 2-3 years old but were not admitted. We were interested in whether children who attended the Montessori school differed on our assessments from children who attended more traditional schools.

We found a significant positive impact of Montessori education at both ages. Specifically, 5-year-olds at the Montessori school performed much better on tests of early reading and math skills and executive functioning tasks. On the playground, they were more likely to be engaged in positive play with other children and less likely to be involved in ambiguous rough and tumble play, such as chasing without smiling. These children showed more understanding that different people can have different beliefs about the world and were more apt to appeal to justice and fairness in explaining why someone should share a toy.

The 12-year-olds in Montessori showed more advanced writing skills, such as using more complex sentence structures and writing more creative stories. They also were much more likely to choose positive assertive strategies to solve social problems. For example, they were more likely to report approaching a child who had wronged them and expressing their discomfort rather than simply ignoring the offender or trying to hurt him/her back. Finally, the Montessori children reported feeling a much stronger sense of community at their school, reporting that they could trust others at their school and that students at their school respect each other.

Professor **Angeline Lillard** recently published these findings in *Science* ([www.science.org](http://www.science.org)). For more information, please visit our website.



*Craig Montessori School,  
site of the Montessori outcomes  
assessment*

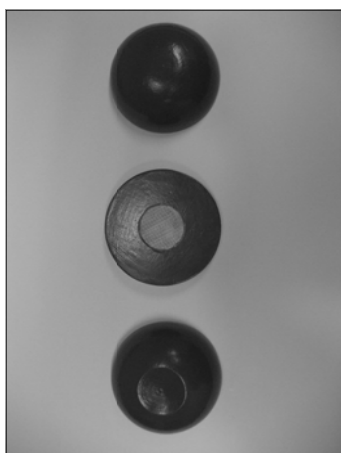
It's been a great year in the Early Development Lab, and we greatly appreciate all the parents and children who have participated in our many studies. With your help we are learning more and more about how children understand pretend play, use manipulatives in math learning, learn new vocabulary words, and other issues detailed in these pages. Our research has been recently featured in *Science*, *Science News*, *Child Development*, and other excellent journals, as well as on the WMRA program *Insight*.

Without your participation, this accumulated knowledge could not happen. We always need more volunteers, so please let your family and friends with children know about us and urge them to register so we can contact them about participating in our ongoing research. Please also let us know what we can do to better serve you.

Many thanks,  
Angeline Lillard

# Can fun toys be used as learning tools?

Children often learn to count, add, and subtract using manipulative objects such as blocks or pennies. Most teachers, parents, and researchers believe that manipulatives can be useful for children to learn with.



*Many teachers believe that manipulatives such as these can be useful learning tools.*

However, it is not clear if all concrete materials are useful learning implements or if only certain types of manipulatives are beneficial for learning. Some researchers believe that concrete materials should be plain, simple, and not distracting in any way. Is this true, or can children learn equally well using colorful, attractive toy-like objects as with simple wooden blocks?

**Tracy Nishida**, a graduate student, wanted to know if 3 year-old children learn

simple math skills at different rates depending on the type of manipulative they used. In this study children were presented with either blocks or colorful wooden fruit and vegetables that could be segmented into different pieces. Children learned a simple lesson about numbers (1-5), adding (e.g.,  $1 + 2$ ), subtracting (e.g.,  $3 - 2$ ), and greater than/less than (e.g., Is 3 more than 1?). After the lesson children were tested on the numbers and problems they had just learned.

Although this study is ongoing, our results thus far indicate that children who use the fruit/vegetable manipulatives seem to be more attentive during the lesson and are better at recognizing numerals. There appear to be no differences between groups on any of the calculation questions. These findings suggests that elaborate manipulatives do not appear to hinder children's learning of simple math concepts—in fact, they may aid children by keeping them attentive and focused on learning.

## What happens in children's minds while pretending?

Pretending is a rather odd, yet amazing, skill. When pretending a block is a cookie, children have to act as if the block is a cookie while keeping in mind that it's really a block so they don't accidentally try to eat it. How do their minds handle this situation? Over the past year, graduate student **Jennifer Van Reet** has been exploring this questions in an effort to determine how children represent pretend situations in their minds.

In one study, 8- and 9-year-olds watched a video of a child pretending with common objects, such as pretending a banana is a telephone. Then, participants completed a computer task where they decided whether various words, such as "yellow" or "rings," were associated with the objects in the video. Children were faster to respond to words that were associated with the objects than to words unrelated to these objects. This suggests that witnessing pretense may activate representations of both the real and pretend identities.

Additionally, results from a related study with 2-year-

olds suggest that children may not be inhibiting the real object in order to activate the pretend identity. In this study, children pretended with everyday objects, then were shown pictures that contained both the object's real and pretend identities. Children were asked to point to either the real or pretend object. Results indicated that children found it no easier to point to the pretend object and harder to point to the picture of the real object they had just seen and used.



*Children viewed a video of another child pretending*

One possibility is that inhibitory control plays a role in the pretense of young children but becomes less important with age. We are actively continuing work on all of these issues with a variety of ages, and we look forward to pretending with many more children this upcoming year!

# How children learn new vocabulary words

It's often said that children are like little sponges: they absorb everything they hear (and sometimes repeat it back at inopportune times!). But although it seems that children have an easier time learning new words than adults, is this really the case? **Ashley Pinkham**, a graduate student in our lab, has been investigating this issue, asking what it takes for a new word to be added to one's vocabulary.



To further investigate, we taught 4-year-olds and adults either nine novel words or nine novel facts, then later asked them to recall the new information.

Unlike the first study, here we tested comprehension (e.g., "Can you point to the koba?"). Once again, adults typically recalled all of the novel words or facts. Children similarly recalled all of the novel facts — but they typically recalled less than half of the words.

In one study, 4-year-olds and adults played a game about measuring. During the game, they heard both a novel word ("koba") and novel fact ("my uncle gave me this") in regards to two separate unfamiliar objects. Minutes later, they were asked to identify the new word and fact. Although adults had no difficulty labeling both the word and fact, 4-year-olds overwhelmingly recalled the fact but not the word. These results suggest that (a) adults may actually learn new words more rapidly than young children, and (b) facts may be learned more rapidly than words.

*Participants learn new names and facts for novel objects*

Why is there this discrepancy between learning new words and facts for 4-year-olds? We think it might be because words are cultural universals; lots of people could tell them the name for an object. But facts are not; maybe this is the only time they'll hear that your uncle gave you that object. Perhaps children devote more attention or cognitive resources to quickly learning the information they may not be taught again. Ongoing research is investigating this possibility.

# Discriminating between reality and pretense

To distinguish between pretense and reality, children can be directly told, infer from a pretender's cues, or infer from incorrect contents (like someone pretending to eat a block). Graduate student **Lili Ma** has been investigating whether preschoolers can make a pretend-real distinction based on behavioral cues alone.



*Toddlers watched adults either pretending or really eating, then were asked to find the real food*

In this study, recently published in *Child Development*, 2 through 3-year-olds watched videos of adults either pretending or really eating. They were then asked to indicate where the real food was located.

If children can identify pretense's behavioral cues, such as sound effects and exaggerated smiling, we would expect that they

would correctly choose the person who really ate. Overall, 2.5- and 3-year-olds correctly chose the container used for real eating. Although 2-year-olds failed to correctly indicate where the real food was, their spontaneous reactions, such as swallowing and lip licking, suggested that they discriminated between the pretend and real events at a rudimentary level. Watching someone pretend to eat did not elicit such responses.

This line of research extends previous findings on when and how young children make sense of the distinction between real and pretend behavior. It is the first attempt to examine whether toddlers can distinguish between pretend and real actions based on behavioral cues alone. Overall, our research suggests an emerging ability to make explicit pretend-real contrasts based on behavioral cues by 2.5 years of age, and an implicit understanding of the distinction in the absence of content cues by age 2.



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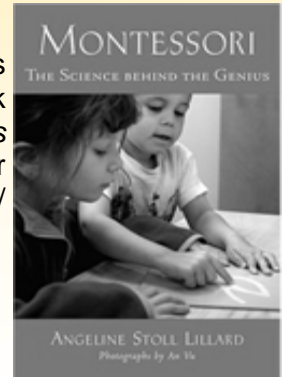


*Member of the Child  
Development  
Laboratories at the  
University of  
Virginia*

## Help spread the word about our research!

Because our research is entirely conducted by using volunteers from the Charlottesville community, the Early Development Lab is always in need of new families. If you have friends with children from birth through 12 years of age and think they may be interested in participating, please pass along this newsletter and encourage them to visit our website ([www.people.virginia.edu/~asl2h/EDL/EDLFrames.htm](http://www.people.virginia.edu/~asl2h/EDL/EDLFrames.htm)). We can be contacted through our website or called M-F 9AM-5PM.

For more information about Professor Lillard's research, including her recent book *Montessori: The Science Behind the Genius* and its accompanying DVD, please visit her website at <http://www.people.virginia.edu/~asl2h/home.html>.



## Transferring knowledge across different formats

In most classrooms, children are presented with material in many formats, such as handwritten on a chalkboard, projected onto a screen, or formatted as a page in a textbook. Children are commonly expected to transfer between different forms as they learn new concepts. For example, they may learn long division by watching their teacher decipher an equation on the board, then have to solve problems on their own using a worksheet and later complete homework from their textbook. Are children easily able to transfer across different formats when their knowledge is limited and fragile? **Tracy Nishida** investigated children's abilities to learn simple fraction problems using same or different formats. She predicted that children who were required to switch formats would not perform as well as children who used a single format for learning.

Children ranging in age from 6 to 7 years of age were taught a 15-minute lesson about fractions. Following the lesson, they were given a short post-test to determine how much they learned from the lesson. There were three different conditions: 1/3 of the

children used worksheets for both the lesson and the post-test; 1/3 used flashcards for both the lesson and the post-test; and 1/3 used flashcards for the lesson but then used worksheets during the post-test.

On the post-test, children that used only one type of format outperformed their peers who were tested using a different format than they had learned with. There were no differences between using only flashcards or worksheets. This suggests that children may have problems learning new material when they are asked to switch between different formats.



*Graduate student Tracy Nishida teaches a lesson about fractions*