

“Novel Toy” Interpretation Guide

EXPLORING THE COSTS AND BENEFITS OF DIRECT INSTRUCTION VS. EXPLORATORY PLAY

Background:

Children learn new skills in many ways: through imitating their parents, teachers, or peers and also through their own exploratory play. In a study conducted by MIT, researchers observed these different learning strategies and their effectiveness. The “novel toy” activity is based on the first of two experiments performed as part of the study. In this experiment, researchers created a “novel toy.” They then presented this toy to children ages 4 to 6 years, in one of four conditions. In the **pedagogical (or teaching) condition**, the researcher intentionally revealed one of the toy’s features to participants. In the **interrupted condition**, the researcher ended the demonstration by suddenly ‘remembering’ they had forgotten to do something, and then leaving to do what they had forgotten. In the **naïve condition**, the researcher unintentionally discovered one of the toy’s features. In the **baseline condition**, the researcher did not reveal any of the toy’s features. After the demonstration, the researcher gave the child a chance to play with the toy on his or her own, recording how long s/he played with the toy and how many of the four possible features the child discovered (or three remaining features for those children who had one revealed to them during the demonstration).



‘novel toy’ from original study

Researchers Found:

1. Children played longer and discovered more features in the baseline condition than they did in the pedagogical condition. This showed that children’s exploratory play decreased after direct instruction.
2. Children are aware of the differences between a demonstration that is “intentional and complete” and a demonstration that is either “unintentional” or “incomplete”.

These results confirmed the researchers’ hypothesis that children are less likely to look for additional information when they trust educators have informed them of everything they need to know about an object. When demonstrating this activity to children in the Discovery Center we use the Baseline condition as it showcases to parents what children can discover on their own when they are allowed to explore without any direct instructions.

Why is this important?

As educators, we want to gain insight into the ways in which children learn, expanding our understanding of the best methods for educating them. Parents and educators might intuitively direct and instruct children’s play. However, this study demonstrates that (in certain cases, at least) direct instruction may limit children’s opportunity for discovery, while undirected exploratory play may encourage it. Preschool age children view the researcher (or the museum interpreter) as a knowledgeable and informed teacher who will share with them any important information about the new object – if shown “how the toy works” children conclude that the toy only has the ability demonstrated by the teacher. At the same time, although exploratory play may decrease as a result of direct instruction, a knowledgeable teacher with complete

information about an object can educate children in a more time efficient and comprehensive manner than an exploratory play experience. There are benefits to both instruction and exploration: while instruction may limit the number of hypotheses that a child develops, instruction can also act to direct and speed up the learning process. These are two teaching techniques that have to be balanced in any education setting: we must be careful to find a balance between ensuring educators guide children to learn something from what they are observing, while also allowing children to come up with their own ideas and test them out. The study also demonstrates that even young children can tell the difference between an intentional and complete demonstration (as in the pedagogical condition) and an unintentional or interrupted demonstration (as in the naïve or interrupted conditions). This illustrates that young children understand when someone is purposefully trying to teach them something.

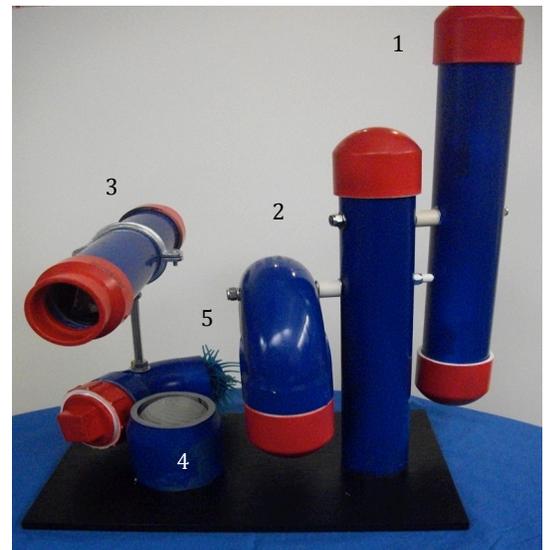
Method:

Recruiting Methods:

1. Introduce yourself to parents, explaining to them that you are demonstrating a study originally conducted by MIT that looks at how instruction influences children's exploratory play. Ask if their child would like to play.
2. Ask children if they would like to play a game with you. Point out the novel toy if they are nearby to increase their interest in playing.

Important Modifications:

- The 'novel toy' used in the original study had four features. For this museum activity, we created a 'novel toy' with five features for kids to discover:
 1. stick noisemaker
 2. curved Noisemaker
 3. kaleidoscope
 4. strobe light ball
 5. squishy tactile pouch
- Video clips of an interpreter presenting children with our novel toy in the "baseline", "pedagogical" and "naïve" conditions is available as a training tool (visit www.livinglab.org, or email livinglab@mos.org for access).



Discovery Center's "novel toy"

Activity Instructions (the "study method")

****Please reference the procedure for the Baseline condition in Experiment 1 of the original study (Bonawitz et al., 2011)****

In this activity we demonstrate the Baseline condition:

1. Ask children, "Do you want to play with this cool toy I have?" and show them the toy, turning it around so they can see it from all sides. The toy should be placed with the button of the strobe light facing toward the child.
2. Continue looking at the toy and rotating it for a few seconds, while saying, "Wow, see this toy? Look at this!"

3. Push the toy toward the child and say, “Wow isn’t that cool! I’m going to let you play with this toy now and figure out how it works. Let me know when you are done.”
4. After the child is done playing or after s/he has found all five features, explain to parents what the researchers were studying and what their results tell us about the way children learn.
5. If possible, demonstrate or describe one or more of the other conditions for parents, to illustrate the experimental design of the original study and aid in your interpretive conversations.

Activity Tips:

Help Parents Observe:

- How many features do children discover?
- How long do children play with the toy? How long do children play with each feature?
- Do children find a new way to use a particular feature (e.g. pretending the curved noisemaker is a telephone)?

Keeping Kids Interested:

- Sometimes children will ask for instructions or say something along the lines of, “I have no idea what I’m doing, what am I supposed to do?” In this case, simply encourage further exploration by directing the child’s attention back to the toy; “Why don’t you play around some more and see if you can figure out what the toy can do?”
- If the child has discovered all of the features, see how well they have learned causal relationships by asking them, “Can you show me how to make a jingling sound?” or “Can you show me how to make the toy light up?”
- Ask the child to tell you about their favorite part of the toy.

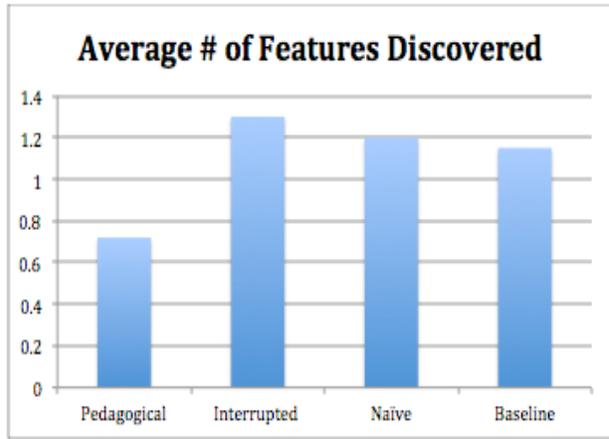
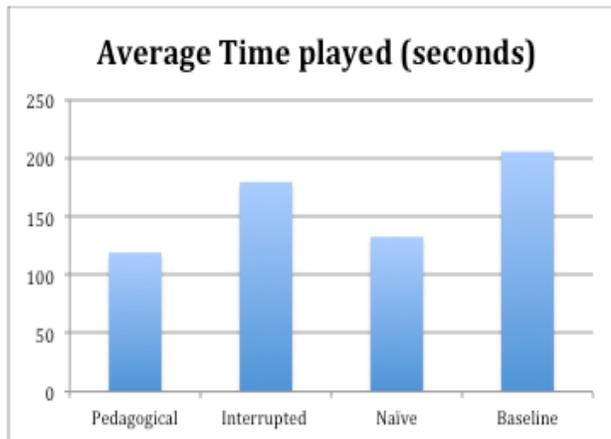
Talking to Parents:

Describe or demonstrate for parents the different conditions that the researchers used in the original study. In the study, only some children were presented with the baseline condition described above. Other children were presented with one of the following three conditions:

- Pedagogical Condition: the researcher intentionally revealed one of the toy’s features.
 - “I’m going to show you how my toy works. Watch this!”
- Naïve Condition: the researcher accidentally discovered one of the toy’s features.
 - “I just found this toy. See this toy?” Then after the ‘accidental’ discovery, “Huh! Did you see that? Let me try to do that.”
- Interrupted Condition: the researcher suddenly left to do something that they had “forgotten” to do earlier (note: we do not demonstrate this condition in the Discovery Center).

Results of the Original Study:

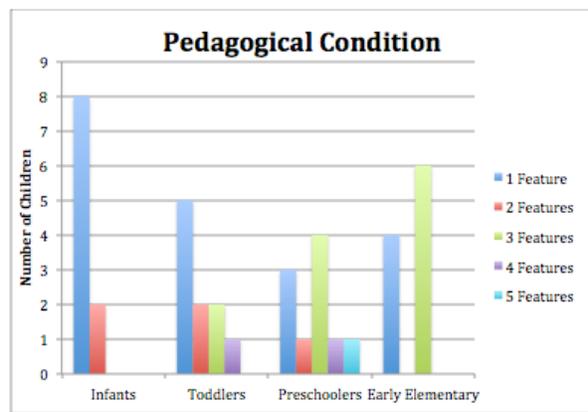
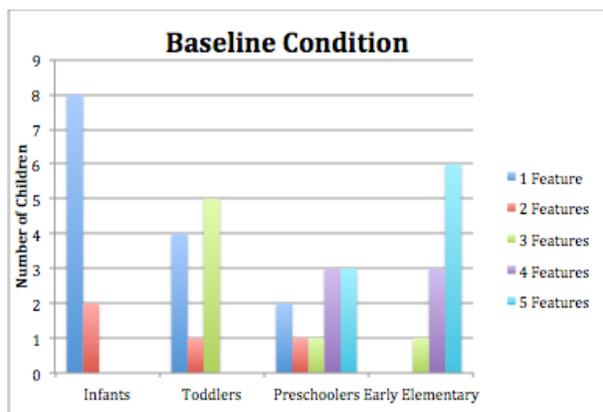
This study found that children spent the least amount of time playing, and discovered the least number of features, in the pedagogical condition. This is illustrated in the two graphs below. The left-hand graph shows the amount of time, on average, children played with the toy in each condition. The right-hand graph shows the number of features discovered, on average, by children in each condition. The data confirmed the researchers’ hypothesis that children are more likely to assume that there are no additional features to discover when they believe that a knowledgeable teacher is instructing them. *See Appendix A for larger graphs.*



Prototyping the Activity in the Discovery Center:

While the original study looked at 4-6 year old children, we invite children of all ages participate in Discovery Center activities. We therefore wanted to see how children of different ages would respond to this activity, so that we could play with *any* child, allowing us to educate *all* parents and caregivers about cognitive research and how it relates to their lives and their children’s lives. Through demonstrations of this study, and the discussions that follow, we are able to introduce adult visitors to the costs and benefits of direct instruction and exploratory play. After building our very own novel toy, we presented the toy to children from each of four different age groups (infants, toddlers, preschoolers, and early elementary schoolers) in either the pedagogical condition or baseline condition. While the original study observed several aspects of children’s play with the novel toy, we only looked at the number of features discovered by children. While this prototyping was *not* a controlled study, it did provide insight into how children of other ages might respond in the study situation.

We observed 80 Discovery Center visitors in total (with 10 visitors per age group presented with the baseline situation and 10 visitors per age group presented with the pedagogical situation). The graphs below show our findings, with children divided into four age groups: infants (0 -18 months), toddlers (18 months - 3 years), preschoolers (4 - 5 years), and early elementary schoolers (6 - 8 years). *See Appendix B for larger graphs.*



The graph on the left shows the number of children in each age group who found 1 feature, 2 features, (etc.) in the **baseline** condition during activity piloting.

The graph on the right shows the number of children (in each age group) who discovered 1 feature, 2 features, (etc.) in the **pedagogical** condition during piloting.

Similar to the original study: toddlers, preschoolers, and early elementary schoolers discovered more novel toy features in the baseline situation than in the pedagogical situation. However:

- The difference was not large among toddlers, and infants showed no differences between conditions. In fact, we found that infants usually required a demonstration with direct instruction in order to guide their play with the object in either situation.
- In contrast, early elementary school aged children showed very clear differences between conditions. In the baseline situation, all children of this age found three or more of the features; however, in the pedagogical situation, many children in the same age range often found only one, and at most three, of the toy's features.

Questions Parents May Ask:

What age does my child have to be in order to participate?

- The original study looked at children between the ages of 4 and 6; however, since this is just a demonstration of the research study, children of any age are welcome to participate.

Are you saying that I should never give my children the answers?

- No. The study shows that children will look toward teachers for information about a novel object, and will assume that that teacher is telling them everything they need to know about the object. This is something to consider when determining how best to educate children.

Why does it matter whether or not I tell my child what the features are?

- This activity is a great way to show parents what their children can discover when given the chance to explore a new toy without any instruction. Telling children that there is something to discover, but not specifying what there is to discover, encourages them to explore and learn on their own.

Did my child "pass"?

- There is no right or wrong way to play with the toy. This activity is meant to investigate how children naturally interact with a novel toy and how they might learn from those interactions.

Where can I learn more about this?

- Give parents the insert for this study, which has ideas for exploring related concepts in the museum and at home. Direct parents to our website: mos.org/discoverycenter/livinglab, for more details about the researcher and her more recent research.

Activities for Parents to Try at the Museum:

- *Physical Science Area:* Gather up a number of loads in the electricity area. Create a circuit with one of the loads. Now let your child play with the electricity pieces. How long do they play with the first load before trying another one? Do they try any other loads at all?
- *Geology Field Station:* Gather the graphite (which writes), the magnetite (which is magnetic), and the sulfur (which smells). Does your child play with the rocks to figure out what any of them can do? Does s/he come up with other ways to play with the rocks? If you show him/her what one of the rocks does, will s/he then only play with that rock, or will s/he then try other things to determine the uses of the other rocks?
- *Infant Area:* Try touching one of the causal learning pads a few times while your infant observes, and then allow your child to play on his/her own. Does your infant only touch the pad that you touched, or does s/he also try the other pads? If you now touch a different pad, does your infant imitate this new action?

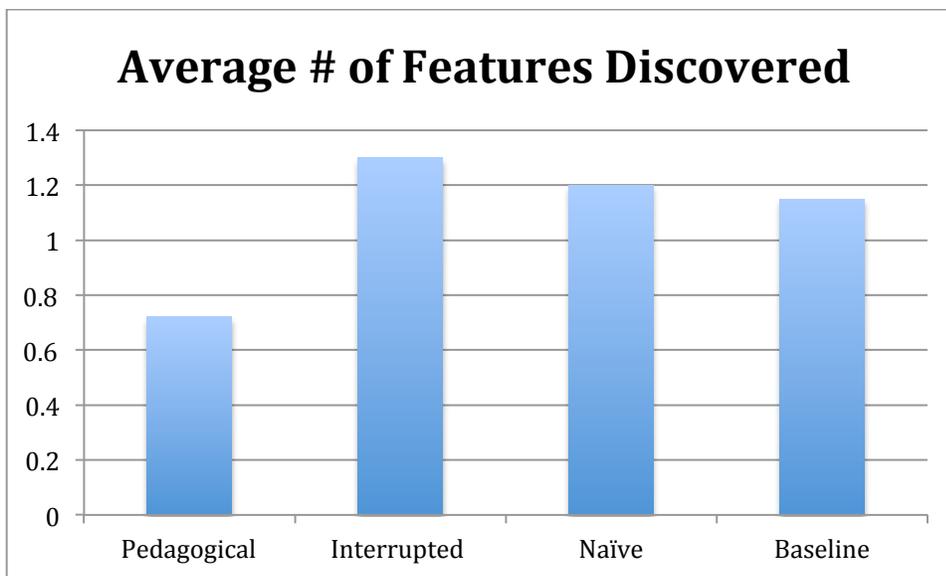
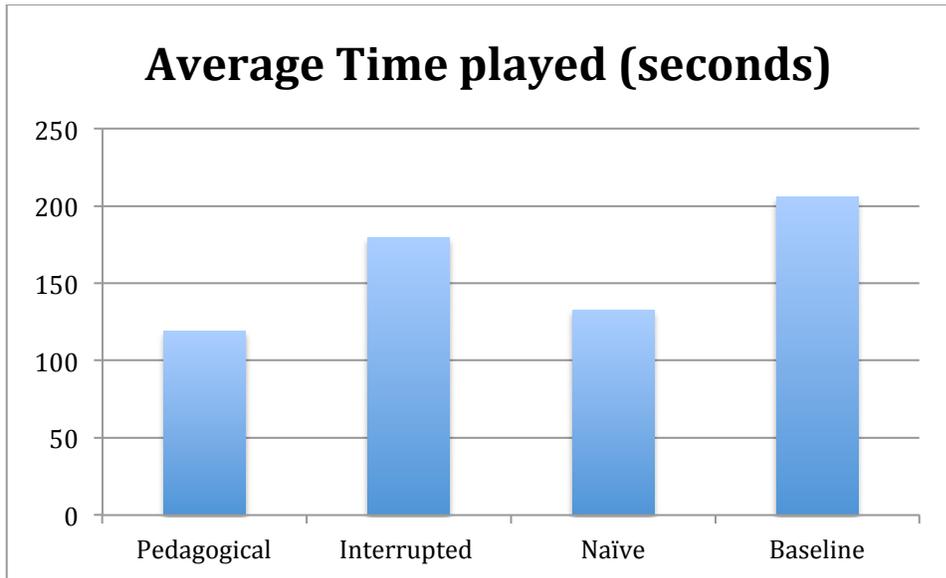
Activities for Parents to Try At Home:

- Give your child some playdoh to play with. What does s/he do? If you give your child a couple of ideas about objects s/he can create, does s/he make one of the objects you suggested or does s/he choose to make something else?
- Introduce your child to a toy s/he has never seen before and observe how many different ways s/he uses this toy. After allowing him/her to explore the toy independently, show your child a new way to play with the toy. Does your child imitate your actions, or continue to play with the toy in other ways?

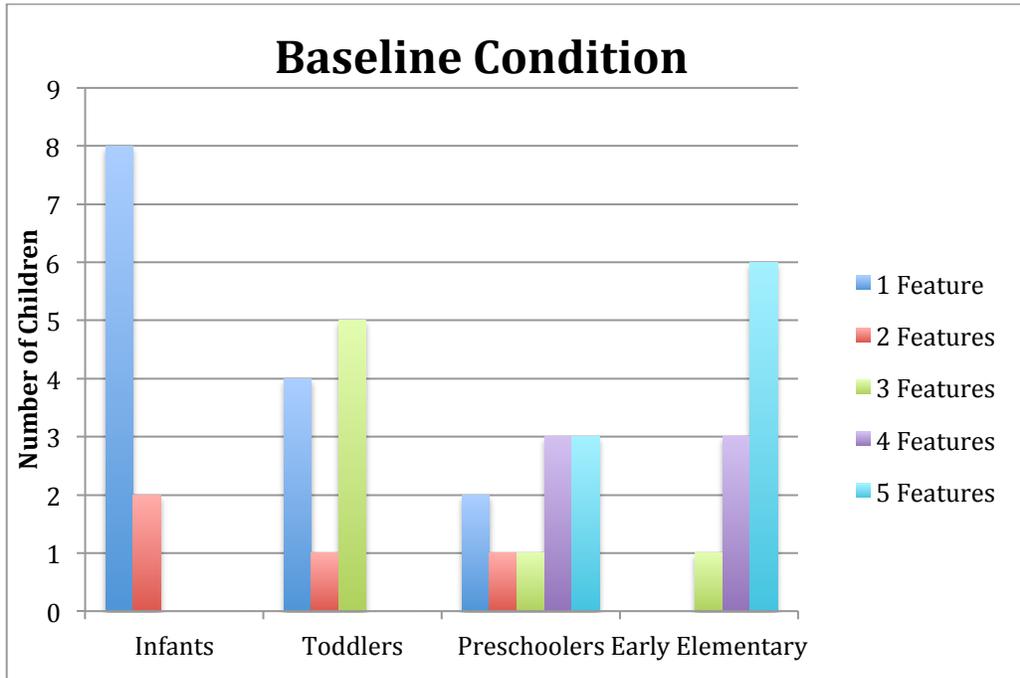
Sources & Resources:

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N.D., Spelke, E., & Schultz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition*, *120*, 322-330. doi: 10.106/j.cognition.2010.10.001

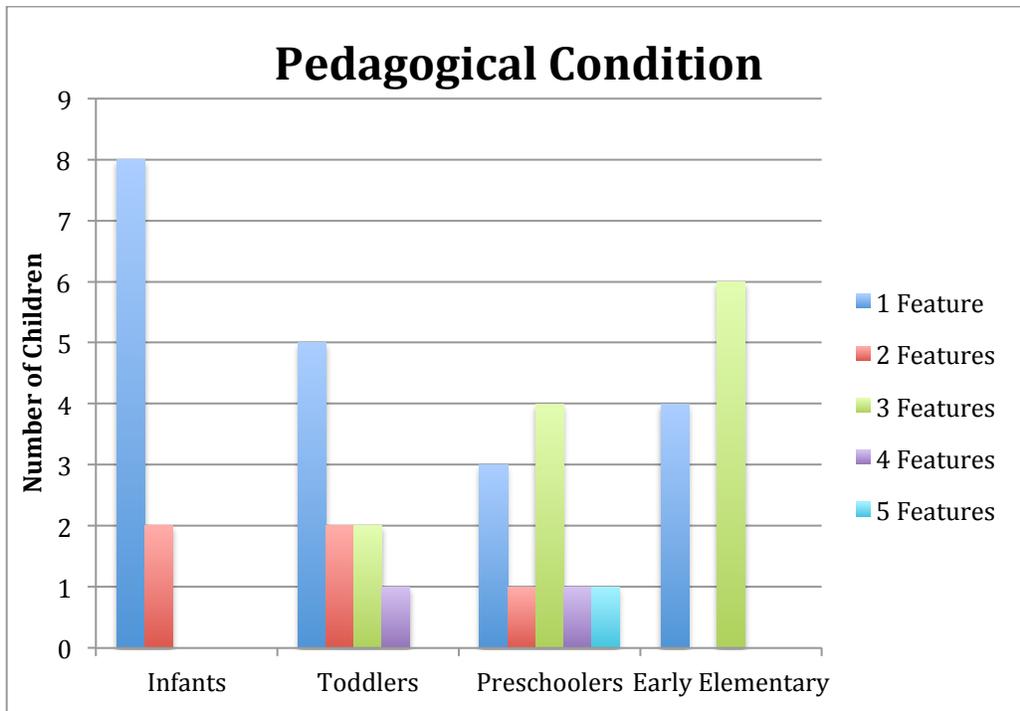
Appendix A:



Appendix B:



This graph shows the number of children in each age group who found 1 feature, 2 features, (etc.) in the **baseline** condition during activity piloting in the Discovery Center.



This graph shows the number of children in each age group who found 1 feature, 2 features, (etc.) in the **pedagogical** condition during activity piloting in the Discovery Center.