

***It's a NanoWorld* Summative Study**

Brief Overview of Findings

The summative study for *It's a NanoWorld* documented the experience of 120 K-3 students, their teachers and parents as they used the exhibition at the Sciencenter in Ithaca, NY on November 13, 2003. On November 15 researchers observed and interviewed 30 children in grades 4-7 and 30 adults.

The research investigated the quality of visitors' experience and science learning. The study is divided into four research areas: use of the exhibition and exhibits; evidence of science learning; accessibility and safety and evidence of potential as a model for national dissemination. The study will be replicated at the exhibition's next venue.

Methodology

The study used five research techniques.

1. Pre and post activity-based surveys tested children acquisition of vocabulary.
2. Tracking studies and unobtrusive observation documented how the exhibit clusters were used.
3. Post-visit focus groups drew out and examined children's questions and wonderings about magnification, basic biology, scientists and nanotechnology looking for evidence of inquiry-based learning.
4. Pre and post interviews captured adult and family groups' experience and questions.
5. A signage study determined readability and clarity of content. Ten children participated.

Summative Study Brief

Initial Findings

Use of the Exhibition and Exhibits

- Visitors felt that the exhibition was attractive and inviting
- Visitors including K-3 children were able to successfully navigate all exhibits
- Tracking data indicated that all exhibit clusters were used, but some more than others. The accompanying side bar shows exhibit use in descending order.
- The signage study showed that children in grade two and higher, including slow readers, could read all signs intended for children. A sign by sign list of difficult words was compiled. There were very few difficult words. Examples are magnification, allergies, micrometer and nanometer.

Blood Drop Cell Sorter Pollen Pinball Germ Launcher Scope on a Rope Magnification Station Dust Tippy Table Giant Magnifying Glass Movie Look Closer! Can You Guess What I Am? Scale Gallery What's my Job? How Many Nanometers Tall are You? Powers of Ten Film Gateway You are Made of Cells
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Evidence of Science Learning

- The evaluators have over 25 findings regarding science learning. The second phase of the study will confirm or challenge these findings. Eight indisputable findings are listed below.
- Pre-test and post-test with 120 children showed that, after 20 minutes of playing in the exhibition children said the exhibition was about scientists, magnification, tools, small things and “your body”
- Eighty percent of children asked to ‘Draw the smallest thing they know’ drew macro objects during pre-test and micro objects during the post test
- Evaluation clearly demonstrated 25 percent of children acquired two new key vocabulary words: cells, and a rudimentary definition of nano as “very, very, very, very tiny” (Girl age 7)
- Probing children’s understanding of their new found vocabulary, (cell and nano) shows that vocabulary acquisition does not automatically imply concept acquisition
- Researchers observed several incidents of students with prior knowledge of cells or germs cueing other students

Summative Study Brief

- There were significant examples of ‘brush-by’ learning. Pre-literate children learned about cells by seeing cells while watching the movie for 15 seconds. A reading child acquired the vocabulary from quickly reading *What’s My Job* while waiting for a friend to tie her shoe.
- Unassisted, children do not seem to understand relative scale. Children's comments and post visit drawing indicated that they understood the exhibits deal with small things. However, there was little to no understanding that some small things are smaller than other small things.
- Parents and teachers have serious misconceptions and incorrect understanding of nanotechnology

Accessibility and Safety

- A deaf teacher said “I do not believe how accessible this is for my students. Powers of Ten is one of the best examples I’ve seen of a deaf accessible video exhibit.”
- A blind visitor found the exhibition inaccessible. Her sighted guide interpreted what was being shown, but there were few hands-on activities for the blind.
- Future testing is needed to determine accessibility for those in wheelchairs or with limited dexterity.
- The evaluators noted no obvious safety issues.

Potential as a Model for National Dissemination

- Interviews with middle elementary kids and their parents provide conclusive evidence that the target audience is very interested in nanobiotechnology
- The *NanoWorld* evaluation shows that middle elementary children can grasp science content needed to understand nanotechnology
- To understand nanotechnology it needs to be placed in a familiar context and use real world examples that are interesting to middle elementary children and adults

Bottom Line

- Visitors had fun, were excited, surprised and very complimentary. Two comments from parents summarize:
 - “This is the first time I’ve been here and these exhibits are just great!”
 - “My son and his friend have been at the cell sorter for 40 minutes and they just found the blood drop. I’m glad I brought a book to read while I’m waiting.”