Biomimicry: Synthetic Gecko Tape Formative Evaluation

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Biomimicry: Synthetic Gecko Tape through Nanomolding (Gecko) is a hands-on activity that guides visitors in making a "synthetic Gecko tape" with micron-sized hairs that mimics the behavior of the Gecko foot. Visitors learn that this process is referred to as "nanomolding." Visitors then apply the product during the activity by testing how much weight the Gecko tape is able to hold on a wire.

After completion of the activity, surveys were distributed to fourteen visitors. The survey was designed to elicit information regarding the degree of visitor interest, enjoyment, and ease in understanding the activity. Responding visitors for this activity actually participated in a week-long program; some of their responses reflect their participation in numerous activities. The "n" value given refers to the number of visitors who responded to the particular question. Additional demographic information is available at the end of the report.

Program Topic

The *Gecko* activity had one Big Idea: "Significant amount of research is ongoing in the field of synthetic Gecko tape due to its wide variety of applications. Though the Gecko foot is an example that is used very often in talks as well as exhibits and demonstrations on nanotechnology, there is a lack of hands on activities that could demonstrate the physical properties/attributes/phenomenon. This hands on activity gives a glimpse of one of the methods used by researchers for making a synthetic gecko tape and its properties."

In order to assess whether the Big Idea was imparted to visitors through participation in the activity, visitors were asked to explain what they thought the activity was trying to show. All but one visitor answered the question, and they all referred directly to nano or nanotechnology in their answers. Nearly half of the visitors (46%) referred to the possible or potential applications of nanotechnology within society and science. Almost a third of visitors (31%) talked about the connection between nature and nanotechnology, and the final quarter (23%) shared other comments about nanoscience and nanotechnology. All of these comments highlight different aspects of the Big Idea, with nearly half sharing much of the main idea. A full list of responses from visitors follow.

What Activity is Trying to Show (n=13)

46% (6) Nano Applications

- The new advancements and technology coming out of the field of nanoscience.
- The cool and interesting potential of the application of nanotechnology.
- Basic nano structures/technologies and their applications.
- Demonstrate basic nanotechnology concepts though simple demonstrations as well as their applications.
- How geckos are able to climb on almost any surface, the scientific discovery method, and the uses of a gecko-like adhesive material.
- That nanotech developed in the lab could have many positive effects on society.

31% (4) Nano and Nature

- How nature uses nanotechnology aspects.

- Examples of nanotech in nature.
- This program was showing how nano structures worked together for the gecko and how humans are attempting to duplicate a gecko's foot material for all purposes and uses.
- How studying nano structures in nature can bring about new technologies and new understanding about things in the natural world.

23% (3) Other nanotechnology comments
- Get participants interested on a career in nanotech.
- How different forces are important into nano size.
- This program is trying to explain what the prefix nano means.

Visitor Engagement

Visitors were asked how interesting and enjoyable they found the *Gecko* activity. Just over a third of visitors rated the activity as either "very interesting" or "interesting" (36%) (see Table 1). Some visitors thought the activity was "somewhat interesting" (29%).

Table 1: Visitor Interest (n=14)

	Percent of Visitors
Very interesting	36%
Interesting	36%
Somewhat interesting	29%
Not interesting at all	0

The same number of visitors (36%) rated the activity as "very enjoyable" while a larger proportion rated it as "enjoyable" (57%) (see Table 2). Only one visitor rated *Gecko* "somewhat enjoyable" (7%).

Table 2: Visitor Enjoyment (n=14)

	Percent of Visitors
Very enjoyable	36%
Enjoyable	57%
Somewhat enjoyable	7%
Not at all enjoyable	0

Visitors were then asked to explain the reason behind their enjoyment rating. Those who rated the activity as "very enjoyable" identified the variety of activities, the use of materials, and the information as positive. Those who responded who had rated the activity as "enjoyable" expressed a few of the pieces that they did not enjoy as much. These explanations are listed below.

Why Chose Level of Enjoyment (n=10)

(4) Very enjoyable
- The information presented was extremely interesting and the examples of how the technology that was discussed could be used in application were interesting as well.
- The gecko foot sparked much interest in me because of how well their foot was structured.

- I liked the ingenious ways the robots walked and the friendliness of the graduate students.
- I was very interested in the uses of a material that can stick to all surfaces.

(6) Enjoyable
- We did fun projects, but some parts were kind of boring.
- Would have liked to see more concepts in nanotech. Most already knew of from science magazines.
- The gecko foot didn't work all that well.
- It was satisfactory.
- I felt that it was fun playing with the gecko tape but I did not get a deep enough understanding of the topic to really understand the info.
- It was very interesting to listen to but could have been compressed a bit.

Visitors were then asked how easy it was to understand the activity. The majority of visitors reported that *Gecko* was "easy" to understand (86%) (see Table 3). One visitor said it was "somewhat easy" (7%) and one said it was "somewhat difficult" (7%). When asked about what was difficult, the visitor replied, "Some of the explanations given by the tour girls of the chemistry/nanotech lab went over my head."

Table 3: Understanding of Activity (n=14)

	Percent of Visitors
Easy	86%
Somewhat easy	7%
Somewhat difficult	7%
Difficult	0

Finally, visitors were asked whether or not they had any questions about what they saw or did during the *Gecko* activity. Four visitors shared questions:

- Any other camps/opportunities? Any other resources you could direct me to?
- What is the strongest gecko material that has been made?
- Is it possible to build a tape in the program with nanometer sized holes? This would allow the tape to work better.
- Do "nano-ites" of silicon for [illegible] use. Phosphorus and boron as regular panels.

Visitor Demographics

Visitors shared that they were highly interested in science. When asked to rate their interest on a scale from 1 to 10 where 1 is "I am not at all interested in science" and 10 is "I am extremely interested in science," they all rated themselves at a 7 or higher. Additionally, most of the visitors were male (79%).

Due to their participation in a week-long program, all of the visitors were teenagers between the ages of 13 and 17, with over three quarters (79%) being age 15 (see Table 4). Nearly half of them (40%) were also at the museum alone because of the program (see Table 5). The other visitors were at the museum with tour groups (40%) or with family groups (20%).

Table 4: Age of Visitors (n=14)

	Percent of Visitors
13	7%
14	0
15	79%
16	7%
17	7%

Table 5: Museum Group (n=5)

	Percent of Visitors
Alone	40%
School or tour group	40%
Adults and children	20%

Conclusions

The Gecko activity engaged visitors well in terms of visitor interest, enjoyment, and understanding. Many visitors connected with the Big Idea, giving responses related to new applications in nanotechnology science, but many also came away from the activity with a better understanding of connections between nature and nanotechnology.

To better ensure that this program works as well on its own, it would be best to assess this program as a stand-alone program.

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THIS IS A FORMATIVE EVALUATION REPORT

Formative evaluation studies like this one often:

- **are conducted quickly**, which may mean
  - small sample sizes
  - expedited analyses
  - brief reports
- **look at an earlier version** of the exhibit/program, which may mean
  - a focus on problems and solutions, rather than successes
  - a change in form or title of the final exhibit/program

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