NISE network
NANOSCALE INFORMAL SCIENCE EDUCATION

"Computing the Future" Stage Presentation

Formative Evaluation

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Acknowledgements

Without the help of many people this evaluation would not have been possible.

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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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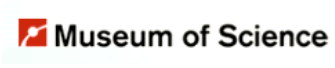

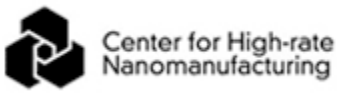

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Executive Summary

This study was completed as a part of the formative evaluation of nanotechnology programming conducted with support from the Center for High-rate Nanomanufacturing (CHN), headquartered at Northeastern University and the University of Massachusetts, Lowell as well as support from the "Science of Nanoscale Systems and their Device Applications" Nanoscale Science and Engineering Center headquartered at Harvard University. The purpose of the study was to provide Museum of Science nanotechnology education associates with visitor feedback that they could use to improve their presentations as well as to provide other potential program presenters with information that they can use to modify the presentation to fit their own needs. As a part of the study, two nanotechnology presentations were evaluated: one presentation for each education associate. This report is a formative evaluation for "Computing the Future" a presentation created by Tim Miller during his tenure as an education associate at the Museum of Science. The presentation deals with the history of computers and the ways in which nanotechnology is changing how computers are built and operated.

Fifty-four visitors were asked to provide feedback through exit surveys. These visitors were asked to rate the presentation on various factors including: their enjoyment of the program, the clarity of the content, the appropriateness of the content level, and the presentation's relevance to their lives. In addition, the visitors were asked to rank their engagement with the various presentation techniques used including communication, illustrative, audience engagement, and multimedia techniques (Chin, 2007). Visitors were also asked to answer open-ended questions about the most interesting things they learned and how we could improve the presentations. Finally, visitors were asked to answer demographic questions about their age and gender.

Results from the study indicate that:

1. Visitors found the content of the presentation appealing, clear, and relevant;
2. Visitors reported learning many specific things about computers and nanotechnology through the presentation, but two of the learning outcomes were not mentioned at all.
3. Overall, visitors rated the various presentation techniques moderately.
4. Male audience members found the content clearer than female audience members.

I. Introduction

About the Stage Presentation

There are many different stage presentations conducted at the Gordon Current Science & Technology Center Stage within the Museum of Science. These presentations allow visitors the opportunity to listen to short (15-20 minutes) lectures about current science and technology topics during their visit. The content of these presentations is usually aimed at visitors 12 years of age and older. Recently, many of these presentations have focused on the topic of nanotechnology and its applications in the real world.

Museum of Science nanotechnology stage presentations are created and delivered by two education associates with support from the Center for High-rate Nanomanufacturing (CHN), headquartered at Northeastern University and the University of Massachusetts, Lowell as well as support from the "Science of Nanoscale Systems and their Device Applications" Nanoscale Science and Engineering Center headquartered at Harvard University. These nanotechnology presentations are overseen by Carol Lynn Alpert, Director of Strategic Projects at the Museum of Science.

This evaluation focuses on one of the programs created and delivered by Tim Miller, an education associate for nanoscale science and engineering at the Museum. The title of this presentation is "Computing the Future." The presentation's content focuses on the language of computers, computer components like transistors, and the ways in which nanotechnology offers the possibility of making faster computers.

Within the "Computing the Future" presentation, Miller used a series of methods described by Chin (2007) in her "Nanotechnology Onstage at the Museum of Science" report. In this report, Chin identified several types of presentation techniques that educators used during their programs including communication, illustrative, audience engagement, and multimedia techniques. The presentation techniques that Miller used during the "Computing the Future" included the following:

- *Communication Techniques*
  - Analogies and metaphors
- *Multimedia Techniques*
  - Graphics
- *llustrative Techniques*
  - Models
- *Audience Engagement Techniques*
  - Polling the audience

Through the presentation, it was hoped that visitors would take away an understanding of some or most of the ideas included in the following outline of content provided by Tim Miller.

1. Computers are really large banks or arrays of switches, and any kind of switch can be made into a simple computer.

2. Numbers (and other types of information) can be represented by just two different positions or states. This kind of information is called binary.

3. Modern computers use electrical switches called transistors. For the last 50 years, these switches have been getting smaller and smaller. By putting more transistors on a computer chip, we've been able to make computers faster, but we are running out of room..

4. Nanotechnology offers a number of possible ways to make faster computers that can do more stuff, like:
    a. Optical computers, that use light instead of electrons
    b. Quantum computers, that use something called electron spin
    c. DNA computing, that uses DNA.

5. Making computers do cool stuff requires not just fast computers, but smart people to tell them what to do.
6. Anyone can learn to write computer code, including you!

About the Evaluation

The purpose of this evaluation was to provide visitor feedback to the nanotechnology education associates so that they could make changes to their presentations based on the needs of visitors, as well as to provide other potential program presenters with information that they can use to modify the presentation to fit their own needs. The overarching questions that the evaluation sought to address included the following:

1. What about the content of the presentation works well and what needs to be changed to make the presentation more appealing and easier to understand?
2. Which presentation methods work well and which need to be changed to make the presentation more engaging?
3. What main messages are visitors learning and not learning, and what about the presentation needs to be changed to make it more likely visitors will learn the main messages?

The education associate was given preliminary results as data collection progressed so that he could make changes to his presentation. However, this information could also be used by others who wish to present "Computing the Future" to improve and modify the presentation to best fit their own needs.

The planning for this evaluation began in March 2008. Evaluators collected data for this evaluation between May and October 2008. The final evaluation report was released in March 2009.

II. Methods

Data were collected at the only three "Computing the Future" presentations presented at the Museum of Science between May and October 2008 (Table 1). Evaluators gathered feedback from visitors who attended these presentations through exit surveys. The methods that evaluators used to select study participants, and the questions asked on the exit survey are described below.

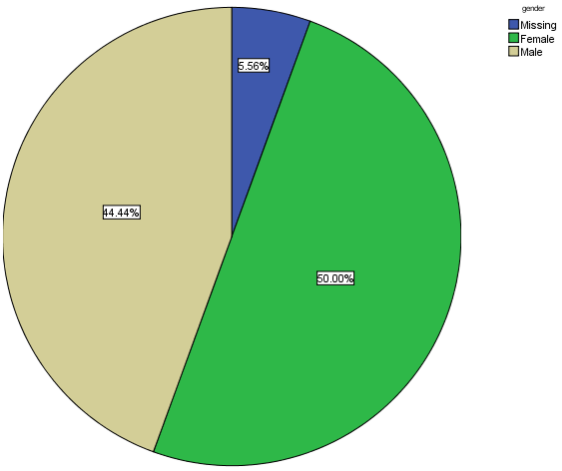
TABLE 1. Number of Surveys Collected at the "Computing the Future" Presentations.

	Number of Surveys Collected	Number of Audience Members
May 18	25	30
July 23	18	30
October 26	11	40
Total	**54**	100

Recruitment of Study Participants

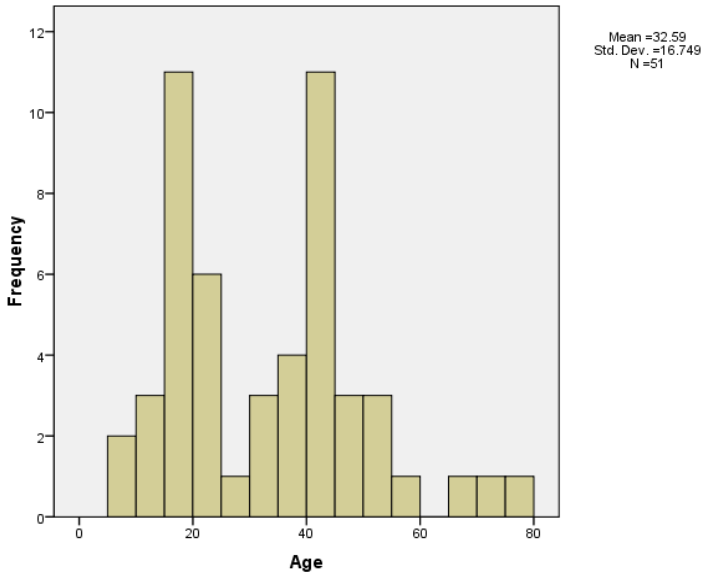
At the beginning of the "Computing the Future" presentations, exit surveys were offered to audience members who were asked if they would be willing to give the Museum feedback about the presentation. Evaluators began handing surveys out to audience members just before the show started and continued to hand surveys out to new audience members through the first two PowerPoint slides of the presentation. Exit surveys were not handed out to new audience members after this point because it was felt that these audience members did not see enough of the presentation to adequately answer the survey questions. Evaluators collected the surveys from the audience members at the end of the presentation after they had a chance to fill them out. Using these methods, 54 surveys were collected (Table 1). Half of the survey respondents (50%) were female, and the average age of the survey respondents was 33 (SD[1]=16) (Graphs 1 & 2).

GRAPH 1. Gender of Survey Respondents. (N=54)



[1] "SD" means standard deviation.

GRAPH 2. Histogram of Survey Respondent Ages. (N=51)



Exit Survey Questions

Audience members were asked to respond to a series of questions on the exit survey in order to provide information about the presentation and to help determine what elements of the presentation worked well and what segments need to be modified. First, visitors were asked a series of Likert-like scale questions about the topic and content of the presentation including the following:

- How much they liked the presentation,
- How interesting they felt the topic was,
- How much the presentation increased their curiosity,
- Whether the content was confusing or clear,
- Whether the vocabulary used was difficult or easy,
- Whether the presentation provided too much or too little information,
- How much they learned, and
- How relevant the content was to issues that concern them or their community.

After that, visitors were asked to answer two open-ended questions: one seeking information about what interesting things visitors learned from the presentation, and the other seeking information about what could be done to improve the presentation. In order to understand what visitors thought of the presentation techniques used, visitors were asked to rate their level of engagement with the different presentation technique implementations. The presentation technique implementations used in "Computing the Future" that visitors were asked to rate were the following:

- *Communication Technique*
  - The presenter's analogies and metaphors
- *Multimedia Technique*

    - The graphics
- *Illustrative Techniques*
    - The on-off switch model
    - The personal computer model
- *Audience Engagement Technique*
    - Polling the audience

Finally, to better understand the make-up of the audience, audience members were asked to provide demographic information including their ages and genders. A copy of the exit survey can be found in Appendix A.

Data Analysis

Data collected through the exit survey were both qualitative and quantitative in nature. Quantitative data were analyzed through descriptive statistics such as percentages, counts, and means. In addition, comparative tests of significance were sometimes conducted. The level of significance was set at 0.05, and only statistically significant results are described in this report. Qualitative data were analyzed using inductive coding. Inductive coding analysis involves "immersion in the details and specifics of data to discover important patterns, themes, and interrelationships" (Patton, 2002, p.41).

III. Results and Discussion

In an email dated June 18, 2008, preliminary feedback based on 25 surveys from one presentation was provided to the educator Tim Miller (Appendix B), so that the educator could make changes to the presentation.

The following report is based on the cumulative data (N = 54) that was collected for the presentation. Based on these data, the four main findings about the "Computing the Future" presentation were the following:

1. Visitors found the content of the presentation appealing, clear, and fairly relevant.
2. A few visitors felt that the presentation might be improved by including more hands-on opportunities and easier vocabulary.
3. Visitors reported learning many specific things about computers and nanotechnology through the presentation, but two of the content areas were not mentioned in open-ended responses by any visitors.
4. Overall, visitors rated the various presentation techniques moderately.
5. Male audience members found the content clearer than female audience members.

1. Visitors found the content of the presentation appealing, clear, and relevant

On the exit survey, visitors were given pairs of phrases that allowed them to rank the appeal and clarity of the presentation on a scale of one to five. They were also asked to rank the relevance of the presentation content to issues that concern them or their communities on a four-point scale that ranged from "not at all relevant" to "very relevant." Overall, the responses from these questions indicate that visitors found "Computing the Future" appealing, clear and fairly relevant. However, a small number of visitors felt that the presentation might be improved by adding better graphics and by making the vocabulary less difficult

1.1 Visitors found "Computing the Future" enjoyable and interesting.

Visitors, who watched the "Computing the Future" presentation, rated the presentation both enjoyable and interesting. When visitors were asked how much they liked the presentation, seventy-nine percent (N=41) rated it with either a 4 or 5 while six percent (N=3) rated it with either a one or two. Similar results were found when visitors were asked if the presentation's topic was interesting. Seventy-nine percent (N=42) of visitors ranked their interest with either a 4 or 5 while nine percent (N=5) rated it with either a 1 or 2. Visitors were asked to rank whether the presentation decreased or increased their curiosity. Sixty-seven percent of visitors (N=34) provided a rating of 4 or 5, while eight percent (N=4) rated this statement with either a one or a two. Together these findings indicate that "Computing the Future" was an appealing presentation. A summary of these findings can be found in Table 1.

TABLE 1. Visitor Responses to the Quantitative Pair Questions about the Appeal of the Presentation.

	N[2]	Mean	SD	Minimum Rank	Maximum Rank
Disliked the presentation - Liked the presentation	52	4.1	0.9	1	5
Uninteresting topic - Interesting topic	53	4.0	1.0	1	5
Decreased my curiosity - Increased my curiosity	51	3.8	1.0	1	5

Visitors also found the presentation relevant to issues that concern them or their community. When asked to rank the relevance of the presentation content on a scale of "not at all relevant," "not particularly relevant," "fairly relevant," and "very relevant," the survey respondents were spread out across the four choices. When assigning numerical values to the scale so that "not at all relevant" receives a score of one, "not particularly relevant" receives a score of two, "fairly relevant" receives a score of three, and "very relevant" receives a score of four, it was found that the mean ranking visitors gave this question was 3.1 out of 4 (SD=0.7) with 33% (N=16) choosing a 4 or 5 and 15% (N=7) choosing a 1 or 2. The average ranking of this question indicates that most visitors felt the presentation content was "fairly" relevant to them or members of their community (Table 2).

TABLE 2. Visitor Responses to the Close-Ended Question: "How relevant is the presentation content to issues that concern you or your community?" (N=48)

Mean	SD	Minimum Rank	Maximum Rank
3.1	0.7	1	4

1.2 Visitors found the content generally clear.

In general, visitors found the content presented in "Computing the Future" clear. Visitors were asked to rank the content of the presentation on a five-point scale of "generally confusing" (a one on the scale) to "generally clear" (a five on the scale). The mean ranking of the participants was 3.9 out of 5 (SD=1.1), with 70% (N=37) choosing a 4 or 5 and 13% (N=7) choosing a 1 or 2. Most visitors felt that the content was generally clear. When visitors were asked to rank the vocabulary on a five-point scale where one meant that the vocabulary was "too difficult" and five meant that the vocabulary was "too easy," the mean ranking for the vocabulary was 3.6 out of 5 (SD=1.0), with 49% (N=26) choosing a 4 or 5 and 8% (N=4) choosing a 1 or 2. This average indicates that in general visitors felt that the vocabulary was somewhat easy. A summary of these results can be seen in Table 3.

[2] Number of visitors who answered the question.

TABLE 3. Visitor Responses to the Quantitative Pair Questions about the Clarity and Difficulty of the Presentation.

	N	Mean	SD	Minimum Rank	Maximum Rank
Generally confusing content - Generally clear content	53	3.9	1.1	1	5
Vocabulary too difficult - Vocabulary too easy	53	3.6	1.0	1	5

A few visitors when asked how the Museum could improve the presentation noted in their comments that "Computing the Future" should be "dummed down" for visitors or that more "basic language" could be used.

1.3 Visitors felt that the presentation contained slightly more information then they were comfortable with.

Visitors were also asked to rank on a five-point scale whether "Computing the Future" contained "too little" or "too much" information. The mean ranking of the participants was 3.6 out of 5 (SD=0.9), with 54% (N=29) choosing a 4 or 5 and 4% (N=2) choosing a 1 or 2 (Table 4). This suggests that on average, visitors felt there was somewhat or slightly more information than they were comfortable with.

TABLE 4. Visitor Responses to the Quantitative Pair Questions about the Amount of Information in the Presentation (N=54).

	Mean	SD	Minimum Rank	Maximum Rank
Too little information - Too much information	3.6	0.9	1	5

1.4 Visitors suggestions for presentation improvement.

When asked in an open-ended question how the presentation could be improved, 44% of the visitors gave suggestions. Visitor responses fell into six categories as presented in Table 5. The improvement that 9% of visitors suggested was to improve the graphics of the presentation. Visitors' comments were mainly that there could have been "better" graphics or that the graphics that were portrayed could have been "improved" upon. The second highest category that appeared was that the presentation should be more interactive (7%). Since visitors' responses did not go any deeper than that, researchers can only speculate that given that this presentation was in a lecture format, these visitors were seeking an experience that allowed them to be more physically involved in the presentation. Both "hold the presentation in a quieter space" and "make the presentation more understandable" were the third frequently mentioned area of improvement (6%). Since the Museum can do very little to control the ambient noise at the stage, the question of a quieter space is really not worth dwelling upon. "Make the presentation more understandable" related to the vocabulary of the presentation and was mentioned in section 1.2. The least frequent categories were "add more real life examples" and "change the presentation to a different/better topic" which were both mentioned by two (4%) visitors. Once again, since visitors did not elaborate on these answers it is hard to say with any degree of certainty what they were referring to.

TABLE 5. Visitor Responses to the Open-Ended Question: "How could we improve the presentation to make it more appealing or clearer to you?" (N=19)

	Number of Visitors	% of Visitors (N = 54)	
Improve the graphics	5	9%	"More images, better pictures."
Make the presentation more interactive	4	7%	"More audience Participation."
Hold the presentation in a quieter space	3	6%	"Have less noise around."
Make the presentation more understandable	3	6%	"Possibly make it a bit more understandable; some of the info was a little hard to understand."
Change the presentation to a different/better topic	2	4%	"Better Topic."
Add more real life examples	2	4%	"More real life examples."

2. Visitors reported learning many specific things about computers and nanotechnology. Visitors noted learning information from four of the presentation content categories, while two were not mentioned at all.

The presentation "Computing the Future" had a series of six content messages associated with it, which were as follows:

1) Computers are really large banks or arrays of switches, and any kind of switch can be made into a simple computer.

2) Numbers (and other types of information) can be represented by just two different positions or states. This kind of information is called binary.

3) Modern computers use electrical switches called transistors. For the last 50 years, these switches have been getting smaller and smaller. By putting more transistors on a computer chip, we've been able to make computers faster, but we are running out of room.

4) Nanotechnology offers a number of possible ways to make faster computers that can do more stuff, like:

   a) Optical computers, that use light instead of electrons
   b) Quantum computers, that use something called electron spin
   c) DNA computing, that uses DNA.

5) Making computers do cool stuff requires not just fast computers, but smart people to tell them what to do.
6) Anyone can learn to write computer code, including you!

Results of the visitor survey showed that visitors felt they learned a fair amount from the presentation; however, this learning did not necessarily match content outline. As a result, at least two of the items in the content outline were not mentioned.

2.1 Overall, visitors reported moderate learning outcomes from the presentation.

Visitors were asked to rank how much they learned on a five-point scale where one meant they "learned nothing" and five meant they "learned a lot." The mean ranking of this question was 3.9 out of 5 (SD=0.9) with 70% (N=38) choosing a 4 or 5 and 7% (N=4) choosing a 1 or 2 (Table 6). These data suggest that many visitors felt they had a moderate learning experience from the presentation.

TABLE 6. Visitor Responses to the Quantitative Pair Questions about Whether They "Learned Nothing" or "Learned A Lot."

	N	Mean	SD	Minimum Ranking	Maximum Ranking
Learned nothing - Learned a lot	54	3.9	0.9	1	5

2.2 The majority of visitors reported learning specific facts from the presentation that related to the six learning outcomes.

Fifty-six percent (N=30) of visitors responded to the open-ended learning question, "What was the most interesting thing you learned from this presentation?" These responses were coded into categories related to the six learning outcomes (Table 7). As Table 7 indicates, almost one-third (16, 30%) of the sample report learning facts directly related to learning outcome number four that "Nanotechnology offers a number of possible ways to make faster computers that can do more stuff". Examples of visitors' responses are as follows:

> *"That optical fibers transfer light which is converted to electricity for the computer to read."*
>
> *"Quantum computing."*
>
> *"The function of computer. DNA computing."*

Since the bulk of Miller's presentation was based around the topic explored in message 5, it is not surprising that visitors were able to report back some of these specific content. Approximately 1/3 of all PowerPoint slides in the presentation deal with this idea.

The second content piece that visitors spoke to was that "Computers are really large banks or arrays of switches, and any kind of switch can be made into a simple computer." Five (9%) visitors provided answers that fell into this category as illustrated by the following quote:

> *"The first computer was massive."*

The content message of "Modern computers use electrical switches called transistors" was reported by three (6%) visitors. A representative quote from this content area is illustrated below:

> *"[The most interesting thing I learned was] that eventually the chips in the computer will get too small and they won't be able to go smaller. I also now know why my friend's laptop got so hot."*

The final content area that visitors' open-ended responses spoke to was "Numbers (and other types of information) can be represented by just two different positions or states." One visitor (2%) mentioned this learning idea.

It should be noted that most visitors gave short responses to this question which meant that very few if any visitors articulated a full educational message. This may have been a limitation of the data collection instrument. It is possible that if visitors had been interviewed instead of surveyed that through follow-up questions and probing, evaluators would have been able to draw visitors' responses out beyond more than the one or two word answers that were seen on this survey.

There were two areas of the content outline whose information was not salient enough to be noted as "most interesting." Those were "Making computers do cool stuff requires not just fast computers, but smart people to tell them what to do" and "Anyone can learn to write computer code, including you!" It should be noted that a lack of visitor response does not indicate that visitors did not learn anything about those topics during the presentation. It is just that visitors did not find those topics the "most" interesting of all that they did learn. These two outcomes also did not have specific powerpoint slides attached to them; they were just talking points during the presentation. If these messages are important for the visitors to recall, the presentation should make them more salient.

TABLE 7. Categories of Visitor Responses to the Open-Ended Question: "What are the most interesting things that you learned from this presentation?" (N=54)

Outline Content	N	%	Quotes
Nanotechnology offers a number of possible ways to make faster computers that can do more stuff, like: a. Optical computers, that use light instead of electrons b. Quantum computers, that use something called electron spin c. DNA computing, that uses DNA.	16	30%	"Quantum Computing."
Computers are really large banks or arrays of switches, and any kind of switch can be made into a simple computer	5	6%	"The first computer was massive."
Modern computers use electrical switches called transistors. For the last 50 years, these switches have been getting smaller and smaller. By putting more transistors on a computer chip, we've been able to make computers faster, but we are running out of room.	3	9%	"That eventually the chips in the computer will get too small and they won't be able to go smaller."
Numbers (and other types of information) can be represented by just two different positions or states. This kind of information is called binary.	1	2%	"Binary code."
Making computers do cool stuff requires not just fast computers, but smart people to tell them what to do.	0	0%	
Anyone can learn to write computer code, including you!	0	0%	

3. Overall, visitors rated the various presentation techniques as engaging.

In Elissa Chin's 2007 report "Nanotechnology Onstage at the Museum of Science," it was determined that there were a series of presentation techniques that were used by educators to explain their presentation content. The technique categories described included communication, multimedia, illustrative, and audience engagement. "Computing the Future" implemented all four of these techniques during the presentation. As part of the visitor survey, visitors were asked to rank how engaging they found many of the specific technique implementations found in the presentation on a four-point scale of "not at all engaging," "somewhat engaging," "engaging," and "very engaging." In order to create average engagement rankings for all the techniques, "not at all engaging" was given a score of one, "somewhat engaging" was given a score of two, "engaging" was given a score of three, and "very engaging" was given a score of four. Results from these questions showed that visitors ranked all of the presentation techniques (communication, multimedia, illustrative, and audience engagement) in the moderate range.

As part of "Computing the Future," the implementations that correlated to the presentation techniques are as follows:

- *Communication Techniques*
  - The presenter's analogies and metaphors
- *Multimedia Techniques*
  - The graphics
- *Illustrative Techniques*
  - The on-off switch model
  - The personal computer model
- *Audience Engagement Techniques*
  - Polling the audience
  -

The overall mean technique ranks for all the presentation techniques were engaging. The multimedia technique implementation (the graphics) were given a mean rating of as 2.9 out of 4 (SD=0.8) with 23% (N=11) choosing a 4 or 5 and 25% (N=12) choosing a 1 or 2. The audience engagement technique of polling the audience had a mean of 2.7 out of 4 (SD=0.9) with 22% (N=10) choosing a 4 or 5 and 35% (N=16) choosing a 1 or 2. Visitors also gave the two illustrative technique implementations moderate ranks: the on-off switch model was given an average ranking of 2.7 out of 4 (SD=0.9) with 20% (N=9) choosing a 4 or 5 and 33% (N=15) choosing a 1 or 2; and the personal computing model was given a mean ranking of 2.9 out of 4 (SD=0.7) with 21% (N=10) choosing a 4 or 5 and 25% (N=12) choosing a 1 or 2. Finally, the communication technique (the presenter's analogies and metaphors received a mean score of 2.9 out of 4 (SD=0.7) with 26% (N=13) choosing a 4 or 5 and 26% (N=13) choosing a 1 or 2. These moderate rankings indicate that on the whole most visitors felt very similarly about the different presentation techniques and felt that they were all "engaging." A summary of the mean technique

TABLE 8. Mean Visitor Responses to the Question about Presentation Technique Implementations Used by the Educator.

Presentation Technique	N	Overall Mean Technique Rank	SD
Multimedia (graphics)	48	2.9	0.8
Illustrative (On-off switch model)	45	2.7	0.9
(personal computing model)	48	2.9	0.7
Communication (analogies, metaphors)	50	2.9	0.7
Audience Engagement (polling the audience)	46	2.7	0.9

4. Male audience members found the content clearer than female audience members.

4.1 Male audience members found the content clearer than female audience members.

When examining the data to see if there were differences in the way that the visitors rated various aspects about the presentation (whether they enjoyed the presentation, the topic, the content, the vocabulary, the amount of information, whether the presentation increased their curiosity and whether they felt they learned something), the sample was split by gender. When the mean rankings of how visitors felt about these questions were split by gender, it was seen that males and females felt similarly about the presentation. The only difference was seen when the content question was split by gender. Males (N=23, M=4.3 , SD=.8) found the content significantly more clear than females (N=27 , M=3.5 , SD=1.3) (N=50, t(44.4)=-2.46, p=0.018) (Table 9).

TABLE 9. Visitor Responses to the Close-Ended Question: "How do you feel about the presentation. Scale 1-5.

	Gender	N	Mean	SD	Minimum Rank	Maximum Rank
The content	Male	23	4.3	0.8	2	5
	Female	27	3.5	1.3	1	5

It is unclear why males found the content significantly more clear than the females which may be due to a limitation of the data collection instrument. It is possible that if visitors had been interviewed instead of surveyed that evaluators could have asked follow-up questions which may have provide more rationale for why males found the content clearer.

IV. Conclusion

Overall the data show that visitors enjoyed the "Computing the Future" presentation. Most visitors found the presentation to be engaging, interesting, and relevant to their lives. Visitors also found the presentation contained an acceptable amount of information and that the vocabulary used was appropriate. In addition, visitors found that the various presentation techniques were moderately engaging and they felt they learned something from the presentation.

Data shows that many visitors learned at least some of the desired outcomes that Miller had proposed. In fact, of the six educational messages, only two outcomes were not mentioned by any visitors. The part of the presentation that visitors were most likely to articulate learning about related to the topic of nanotechnology and computers. Over 50% of visitors stated learning outcomes related to the topics under nanotechnology like quantum computing, DNA computing, and optical computers. This area seemed to be of interest to the majority of visitors during the presentation.

There was a difference discovered between the males and females who attended this presentation. It was found that males felt the content of the presentation was clearer and that females found the content more confusing. This may be a reaction to the topic in general. Some females indicated that they would have preferred a better or different topic was presented.

Visitors had several suggestions for ways in which the presentation could be improved. The most suggested improvement was for better graphics to be used within the presentation. This seems to be an area where there could be some easy and inexpensive improvements made to the presentation that would make it more engaging for visitors. Visitors also wanted the presentation to be more interactive, a suggestion that could be accomplished by including more audience participation. Even though one of the presentation techniques used during the "Computing the Future" presentation was the audience engagement technique of polling the audience, this implementation did not score highly with visitors which suggests that visitors are seeking more than polling within the presentation.

In addition to these changes, the visitors also had some other suggestions. Some visitors felt that though the vocabulary was appropriate it could be improved if it was slightly less difficult. Other visitors felt that the presentation would be improved if it was presented in a quieter space. Since the Museum educator does not have control over the ambient noise that is in the Current Science and Technology presentation space, it is not possible to try to rectify this situation.

References

Chin, E. (2007). *Nanotechnology onstage at the Museum of Science* (Report No. 2007-14). Boston: Museum of Science.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publications, Inc.

Appendix A: Exit Survey

Date: _____

CHN "Computing the Future" Presentation Survey

Help the Museum of Science improve future presentations by providing us with feedback.

What is your gender? ❑ Male ❑ Female **What is your age?** _____

How do you feel about this presentation? Circle one number on the scale of 1 to 5 for each pair of descriptions below. Read the opposite descriptions carefully.

Disliked the presentation	1	2	3	4	5	Liked the presentation
Uninteresting topic	1	2	3	4	5	Interesting topic
Decreased my curiosity	1	2	3	4	5	Increased my curiosity
Generally confusing content	1	2	3	4	5	Generally clear content
Vocabulary too difficult	1	2	3	4	5	Vocabulary too easy
Too little information	1	2	3	4	5	Too much information
Learned nothing	1	2	3	4	5	Learned a lot

How relevant is the presentation content to issues that concern you or your community?

❑ Very relevant ❑ Fairly relevant ❑ Not particularly relevant ❑ Not at all relevant

What are the most interesting things that you learned from this presentation?

How could we improve the presentation to make it more appealing or clearer to you?

How engaging were the following methods used by the presenter?

	Not at all Engaging	Somewhat Engaging	Engaging	Very Engaging
The presenter's analogies and metaphors	❑	❑	❑	❑
The graphics	❑	❑	❑	❑
The on-off switch model	❑	❑	❑	❑
The personal computer model	❑	❑	❑	❑
Polling the audience	❑	❑	❑	❑

On the back of this survey, please tell us any questions you still have about the content, or share any additional comments. Thank you!

(OVER➔)

Appendix B

-----Original Message-----
From: "ekollmann" <ekollmann@mos.org>
To: tmiller@mos.org
Cc: calpert@mos.org,creich@mos.org
Date: Thu, 12 Jun 2008 15:48:59 -0400
Subject: Computing the Future Data

Tim-- Here is the "Computing the Future" data that we've collected so far. We've collected 25 surveys, and overall, I would say that people are ranking the presentation highly. The mean amount that participants liked the presentation was 4.33 out of 5. Their mean interest in the topic was 4.28 out of 5, and their mean learning was 4.08 out of 5. These visitors also agreed (92%) that the content was at least fairly relevant to issues that concern them or their community. In addition, the average ranking of the vocabulary was 3.68 out of 5 indicating that people felt that the vocabulary is at a good level.

When asked, participants mentioned learning many different things from your presentation. Most people said that they learned about future directions for computing. Some of these people mentioend learning about quantum computing, DNA computing, and fiber optics computing. Only one person mentioned nanotechnology. People also said they learned about how computers function, why they generate heat, about different computer hardware, and the history of computers. None of these responses mentioned nanotechnology.

There were very few things that visitors seemed to think needed to be changed about the presentation. Visitors indicated that there may be a little too much information in the presentation (mean ranking 3.8 out of 5). In addition, some visitors requested changes to the graphics including adding more animations and more graphics. Others asked you to make the content more "kid friendly" or add more real world examples. In addition, one person wanted more interactivity.

I have attached the data so that you can look it over. I have also attached the survey to help you better understand the data sheet. If you have any questions or concerns, please let me know. I was not sure what your messages were, so I could not compare the learning responses to your messages. Please send me those messages when they are finalized so that I can compare the data to them for the final report.

I would still like to collect 25 more surveys. Please let me know when you will be presenting this program again. Please also let me know if you are changing the presentation in any way that may affect the survey so that I may change it.