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NOVA scienceNOW: Final Season One Report, Programs One and Two

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INTRODUCTION

In 2005, WGBH contracted Goodman Research Group, Inc. (GRG), a research firm specializing in the evaluation of educational programs, materials, and services, to conduct a summative evaluation of the NOVA scienceNOW series and outreach.

NOVA scienceNOW is a science news and magazine show developed by WGBH, the producers of NOVA. Slated to air five times a year, NOVA scienceNOW highlights the latest developments in science by featuring several short science segments per episode. The series is hosted by Robert Krulwich who plays an active role in introducing, summarizing, and in some cases reporting on, each story.

With funding from the National Science Foundation, NOVA scienceNOW aims to (a) increase public awareness and understanding of cutting edge science content, and (b) increase public engagement in science-related activities. To date, the first and second episodes have aired (in January and April, 2005), with the third installment scheduled for July 26, 2005.

The purpose of GRG's evaluation of the NOVA scienceNOW series is to:

- provide the production team with additional feedback about the series,
- measure the effectiveness of NOVA scienceNOW at increasing viewers' understanding of cutting edge science topics, and
- measure the effectiveness of the series at increasing viewers' engagement with science-related activities.

NOVA scienceNOW also has an outreach campaign, the NOVA scienceNOW Science Cafés. NOVA scienceNOW Science Cafés are hosted around the country and based on Café Scientifique which began in the UK in 1998 and consists of gathering groups of people to discuss the latest developments in science in non-academic environments such as a local bar or café. Each NOVA scienceNOW Science Café features a local scientist presenting information on their latest work. The specific goals of the Science Cafés include:

- Increasing awareness about and viewership for NOVA scienceNOW
- Reaching a new, diverse audience (particularly people aged 18-35)
- Fostering and extending understanding about the cutting-edge research topics presented in NOVA scienceNOW
- Engaging the public and scientists in a dialog about current research
- Inspiring attendees to stay involved in current science

Formative evaluation, conducted by Multimedia Research, indicated that the Science Café was a good fit for the NOVA scienceNOW project. Existing Science Cafés were found to be very popular with their local communities, and drew a large number of young (age 18-35) and female attendees who are traditionally not involved in these types of science activities. Further, Science Café attendees tend to include both those who work or study in science-related fields, as well as those who do not. This research also suggests that Science Café audiences watch NOVA *seldom* or *never* and thus potentially represent new viewers.

The purpose of GRG's summative evaluation of the NOVA scienceNOW Science Cafés was to:

- Gather additional feedback about events for the outreach teams
- Describe those who attended the events,
- Assess the extent to which the Science Café experience and content were new to participants, and
- Assess the extent to which the Science Café motivated attendees to continue to engage in science-related activities.

INSTRUMENTS AND PROCEDURES

To assess the influence of NOVA scienceNOW on the public, GRG collected survey data from Science Café attendees and conducted a Viewer Study. Surveys and their administration procedures are described below.

NOVA SCIENCENOW SCIENCE CAFÉS

Science Café Feedback Survey

The Science Café Feedback Survey was developed by GRG to learn about the characteristics of attendees and to gather feedback about the Café and its perceived influence on participants. The survey included 12 closed-ended and three open-ended questions (see Appendix A). At the conclusion of the survey, attendees were given the opportunity to provide their email address in order to participate in a one-time Follow-Up Survey.

Feedback Surveys were administered by GRG at three Science Café events during the Winter of 2005 (the specific events are described later in this report). Surveys were completed at the conclusion of each event. Participants who returned a completed survey were entered into a drawing to win a free thumb drive. A total of 131 attendees completed the Science Café Feedback Survey.

Science Café Follow-Up Survey

The Science Café Follow-Up Survey, developed by GRG, consisted of a Web-based survey designed to assess the longer-term influence of the Science Café on attendees. The Follow-Up Survey consisted of 12 closed-ended and two open-ended questions. Questions were designed to measure attendees' recall of the Science Café event and their level of science engagement since attending the event. Because some survey questions focused specifically on the content of each Science Café presentation, surveys were modified to include language specific to the presentation topic (a sample survey, from the Massachusetts Science Café, is provided in Appendix B).

Approximately half of the Science Café attendees (54%; n=71) who completed the Feedback Survey (described above) provided their contact information to participate in the Follow-Up Survey. These attendees were invited, via email, to

complete the Follow-Up Survey two to three months after attending their Science Café event. Thirty one attendees (44% of those who provided contact information and 24% of Science Café participants) completed the Follow-Up Survey.

THE NOVA SCIENCENOW SERIES

To assess the influence of the NOVA scienceNOW series, GRG conducted a Viewer Study. Thirty-three NOVA viewers (defined as people who watch NOVA once a month or more) were recruited to participate. As part of their participation, viewers agreed to complete a Pre- and Post-Program Survey, watch one NOVA scienceNOW episode once a week for two weeks, and complete a Feedback Survey after watching each episode.

Participants had the option of viewing the NOVA scienceNOW episodes on DVD or VHS. WGBH provided copies of the show and GRG mailed the appropriate version to participants. Episodes One and Two from the first season were used; the order in which participants watched the two episodes was counterbalanced to control for any possible effects of viewing order.

Pre-Program Survey

Upon agreeing to participate in the Viewer Study, each participant was required to complete a Web-based Pre-Program Survey. Pre-Program Surveys were completed mid-April 2005. All participants completed the survey prior to watching their first episode of NOVA scienceNOW.

The Pre-Program Survey included demographic questions, as well as questions designed to learn about participants' engagement in science-related activities during the month prior to the study. Thirteen multiple choice and one short answer question were also included to assess viewers' prior knowledge of the content covered in the two episodes (see Appendix C).

Feedback Surveys

Prior to beginning the Viewer Study, each participant provided GRG with a tentative schedule for when they planned to view each episode of NOVA scienceNOW. GRG used this schedule to send the appropriate Feedback Survey to each participant one to two days before they planned to watch the show. Participants were asked to complete the Feedback Surveys within 24 hours of watching each episode.

The Feedback Surveys included ten closed-ended and two open-ended questions to gather feedback about the episode overall and the individual stories included in the show. Participants also reported on whether they had any prior learning experiences with each story topic and their perceptions of how much they learned from each story (see Appendix D and Appendix E).

Post-Program Survey

Two weeks after watching the second episode of NOVA scienceNOW, participants were contacted by GRG and provided with the Web link for the Post-Program Survey. Post-Program Surveys were completed during late May and early June 2005.

The Post-Program Survey included questions to measure participants' engagement in science-related activities during the month-long Viewer Study. Participants were also asked to write one thing they learned from each NOVA scienceNOW story, provided additional feedback on their impressions of the series as a whole, and answered the 14 content questions from the Pre-Program Survey (see Appendix F).

Twenty-nine participants completed the Viewer Study. Each received a $75 stipend for their participation. Of the four participants who did not complete the Viewer Survey, three dropped out during the two-week viewing period and the fourth did not complete the Post-Program Survey.

The remainder of this report presents the results from GRG's evaluation of NOVA scienceNOW. Results are organized into two sections: one to describe the results from the NOVA scienceNOW Science Cafés and the other to describe the results from the evaluation of two of the five Season One episodes.[1] Conclusions and recommendations are provided at the end of each section.

RESULTS: SCIENCE CAFÉS

GRG observed and collected survey data at three NOVA scienceNOW Science Cafés.

As previously stated, GRG observed and collected survey data at three NOVA scienceNOW Science Cafés in the Winter of 2005. Each of the events observed focused on a different topic from the first episode of NOVA scienceNOW.

- Event One was held in Cambridge, Massachusetts and featured engineer James McLurkin. Dr. McLurkin presented on the topic of decentralized systems and used the robots featured in the show as part of his demonstration. This event was hosted by WGBH.
- Event Two was held in San Diego, California and was hosted by Sigma Xi, the international honor society of research scientists and engineers. Lindsay Shenk, a graduate student featured in Episode One, presented data to describe the possible relation between mirror neurons and autism.
- Event Three, in Seattle, Washington, featured Dr. William Calvin. Dr. Calvin provided a presentation and demonstration of climate change and discussed the threat of hurricanes. This event was hosted by Science on Tap, a Seattle-based Science Café.

Although the events focused on different topic areas, they also had several commonalities. Each event was hosted in a casual atmosphere such as a bar or café. Each Science Café featured the work of a local scientist and used clips from Episode One to either supplement or set the stage for the presentation.

[1] In addition to the Viewer Study, the series evaluation included a summary of comments provided by NOVA viewers on the NOVA scienceNOW Web site.

Events also included a Question and Answer session with the speaker, and provided attendees with a list of suggestions for how to become more engaged in science-related activities.

There were also a few notable differences across the Science Cafés. The Massachusetts Science Café included a trivia game which was not part of either the California or Washington events. Also, the presentations made at both the Massachusetts and Washington Science Cafés included a demonstration or simulation of the scientific phenomenon being discussed, while the California event did not.

Attendees learned about the NOVA scienceNOW Science Cafés through a number of sources (see Table 1). The two primary vehicles were word of mouth and email/list serves. Almost half of the California attendees (49%) learned of the event through email or a list serve mailing; these mailings came from the UCSD chapter of Psi Chi (the national honor society in Psychology), the Shenk lab at UCSD, and from Sigma Xi. Email and list serve notices were also used for the other events, with Massachusetts attendees learning of their event from Café Scientifique and New Scientist, and Washington attendees being notified of the event through Science on Tap.

Table 1
Ways Attendees Learned of the NOVA scienceNOW Science Cafés, by Location

	MA	CA	WA
Word of mouth	55%	35%	40%
Bulletin	0%	0%	9%
Patron of hosting establishment	0%	0%	7%
Email/listserve	35%	49%	22%
Web site	4%	5%	16%
Newspaper	4%	0%	4%

N=131

Half of the attendees at NOVA scienceNOW Science Cafés were 35 and under.

A Description of NOVA scienceNOW Attendees

A total of 131 attendees completed the Science Café Feedback Survey at the conclusion of their Science Café event. Based on the demographic information provided on their surveys, NOVA scienceNOW Science Cafés reached a broad audience (see Table 2).

- The ages of Science Café attendees ranged from 17 to 87, with an average age of 40. Of particular interest, half were in the target age range of 35 and under.
- Four out of ten attendees were women, and most participants were White.
- Science Café attendees were highly educated, with over four in ten (44%) holding college degrees and an additional four in ten holding graduate degrees (45%).
- Events served both frequent NOVA viewers as well as those who do not watch the show.
- Over three-quarters were attending a Science Café event for the first time.

Table 2
Profile of Science Café Attendees

		% Respondents
Age	35 and under	50%
	36 – 50 years old	21%
	51 – 75 years old	26%
	76 and older	3%
Race	African American	3%
	American Indian	2%
	Asian	6%
	Hispanic/Latino	3%
	White	88%
Gender	Male	58%
	Female	42%
Highest Level of Education	Some high school	2%
	High school diploma	6%
	2-year college degree	1%
	Some college	1%
	4-year college degree	45%
	Master's Degree	22%
	Graduate/Professional Degree	23%
NOVA Viewing Habits	Never	25%
	Once a year	19%
	A few times a year	35%
	Once a month	16%
	Once a week	5%
First-time Science Café Attendees	Yes	77%
	No	23%

Number of respondents ranges from 121-131 across questions.

Attendees reported using a number of resources to stay informed about current scientific research. The number ranged from one to five, with the average attendee using 2.7 resources. Academic journals, print media (such as newspapers and magazines), and online articles were the top three choices. Three attendees indicated that they do not use any resources to stay current on scientific research. Table 3 shows the percentage of attendees who reported using each resource.

Table 3
Resources Used by Science Café Attendees to Stay Current on Scientific Research

	% respondents
Science programming on TV	48%
Science programming on the radio	43%
Online articles	52%
Academic journals	65%
Print media	60%

N=126

The Science Cafés served a scientifically-driven group of people. Six out of ten (60%) attendees reported that they were currently studying or working in a science-related field. Although this represents the majority of attendees, it is important to note that four in ten attendees were not scientists. This confirmed formative evaluation findings that the Science Café is an effective way to reach scientists and non-scientists alike.

FEEDBACK ABOUT THE NOVA SCIENCENOW SCIENCE CAFÉS

Feedback about each event was gathered by asking participants to describe, in their own words, the best part of the Science Café. GRG coded these written responses based on theme; seven codes were used (see Appendix G for a description of each code).

Sixty percent of the respondents indicated that the best part of the Science Cafe was the presentation. These comments focused on the slides, demonstrations, and simulations used during the event, the speaker, or the content of the event. Others appreciated the setting of the Science Cafés (18%), commenting on the casual atmosphere and their interactions with other attendees. Representative quotes included:

> [Demonstration, by the lecturer, of] *robots singing.*
>
> *The talk – Ms. Shenk's slide show.*
>
> *The science lecture on weather and climate flipping.*
>
> *Meeting people & seeing who shows up to a science café.*
>
> *Surrounded by people with scientific approach to life.*
>
> *The ability to interact with people actively at work in scientific research.*

Participants were also given the opportunity to suggest changes for future science café events. Eighty-three percent of respondents made suggestions; many (43%)

focused on the need to change specific characteristics of the Science Café setting to make it more user-friendly for attendees.

Better sound system.

More seating for large groups.

Better A-V equipment.

Larger screen, chairs, popcorn, etc.

A room with fewer distractions.

Approximately one-quarter of attendees (22%) suggested a change to the format of the Science Cafés such as adding/modifying trivia games or more group interaction; these comments seemed to be based on individual preferences rather than on an overall consensus for a specific area in need of change.

NOVA scienceNOW Science Café Topics

At the conclusion of the evening's event, participants rated their interest in the evening's topic on a scale from 1 (*Not at All*) to 5 (*Extremely*). Over three-quarters of participants (79%) indicated that they were *very* or *extremely interested* in the topic discussed at their Science Café, the two highest ratings on the scale.

Approximately one-third of Science Café attendees were learning, for the first time, about the topic presented at the Café.

Participants who completed the Follow-Up Survey also provided information about their level of familiarity with the topic prior to attending the event. In most cases, the Science Cafés either provided new content to attendees or provided attendees with the first opportunity to hear a scientist speak on the topic covered:

- 32% of participants learned about the featured topic for the first time as a result of attending the Science Café,
- 52% were familiar with the topic featured prior to attending the event, but had not heard a scientist present on the topic, and
- 16% were familiar with the topic presented and had attended a scientist's presentation on the topic in the past.

Although most attendees were learning about the topic or attending a scientist's talk about the topic for the first time, the majority (94%) also reported that the Science Café was not the first time they had attended a scientist's talk. Attendees who were studying or working in science-related fields were equally likely to be attending a scientist's talk for the first time as those not studying or working in science.

Comparisons to Other Science Cafés

The sub-set of attendees (23%) who had attended prior Science Café events were asked to compare their past experiences with those of the NOVA scienceNOW Science Café. Sixty-two percent indicated that the NOVA scienceNOW event

was comparable to events they had attended in the past. Twenty-one percent indicated that they preferred other Science Cafés and 16% indicated a preference for the NOVA scienceNOW Science Café. Comments included:

As informative as earlier events.

Both good.

More fun, less info.

Not very good - couldn't hear or see - little material presented - not so well organized.

LEARNING ASSOCIATED WITH THE NOVA SCIENCENOW SCIENCE CAFÉ EVENTS

Learning associated with the Science Cafés was measured by asking attendees to write two things they learned about science as a result of attending the Science Café. A significant number of participants (18%) did not respond to this question or provided one rather than two responses (50%).[2]

The majority of participants who did respond (76%), wrote a topic that they learned about rather than a specific fact that was learned. A total of 99 topic responses were listed. Topics were coded based on theme. Table 4 shows the themes coded for each event and the percentage of attendees who mentioned each.

Table 4
Learning Reported from Science Cafés by Theme

		% Respondents
MA Science Café n=43	Decentralized Systems	70%
	Robots	14%
	Emergent Behavior	12%
	System patterns	5%
CA Science Café n=30	Mirror Neurons	50%
	Autism	40%
	EEG	10%
WA Science Café n=26	The Gulf Stream	23%
	New Orleans	8%
	Hurricanes	8%
	Climate	62%

[2] Note that this lack of response is likely a result of the open-ended nature of the question and/or the fact that surveys were completed as people were leaving the event, rather than an indication that people did not learn anything new at the Science Cafés.

Approximately one-quarter of respondents wrote a specific fact that they learned while attending the Science Café. Examples of the statements from each Café are provided below in Table 5.

Table 5
Learning Statements from Each Science Café

MA Science Café Topics n=7	▪ Decentralized systems can be used to program robots ▪ Individual robots can perform larger task together with only individual tasks allotted to them ▪ Emergent behavior - exist in many places in nature
CA Science Café Topics n=10	▪ Mirror neurons could help explain empathy for animals ▪ EEG can be used to rate brain activity. ▪ Autism is more prevalent in white males.
WA Science Café Topics n=23	▪ The Gulf Stream keeps Europe warmer than Canada. ▪ Hurricane strength is harder to predict than direction. ▪ That cold/dry periods are also windy and dusty (in the cyclic climate flips).

THE SCIENCE CAFÉ FOLLOW-UP SURVEY

Thirty-one Science Café attendees completed the Follow-Up Survey. This self-selected group varied slightly from the overall sample of Science Café attendees. More Follow-Up Survey participants were female than male, and a greater portion identified as White compared to the entire sample. Age, education level, and past Science Cafés attendance were similar across both samples (for a full side-by-side comparison, see Appendix H).

Results are presented below to describe participants' memory of the event as well as their engagement with different types of science-related activities since attending the Science Café.

Participants' Recall of the Science Café Two to Three Months Later

As described earlier in this section, Science Cafés were fairly similar across sites in the components they included, with some variation in whether the event included a trivia game and/or a demonstration as part of the presentation. To assess their memory of the specific components included in their event, GRG asked Follow-Up Survey participants to select from a list of nine components those that were included in the Science Café they attended. Components included:

- Presentation of a science topic
- Demonstration/simulation of scientific research
- Question and Answer session with a scientist
- Group discussion of a topic
- Trivia game
- Viewing a video clip from NOVA scienceNOW
- Eating food/having drinks or coffee
- Receiving a handout on how to get involved in science
- Introduction/discussion of NOVA

GRG calculated the total number of events identified by each participant as a measure of recall. Participants' memories of their Science Café were quite accurate. Participants correctly recalled 7.5 event components out of 9 on average, with recall scores ranging from four to nine.

- All participants (100%) correctly recalled that their event included a presentation and most (90%) recalled the Question and Answer session.
- Most attendees from the Massachusetts and Washington events (92%) correctly recalled that a demonstration/simulation was included as part of the presentation.
- The majority of participants correctly recalled either seeing a clip from NOVA scienceNOW (87%) as well as the discussion of NOVA as part of their event (81%).
- All Massachusetts attendees (100%) recalled the trivia game.
- Fewer participants, but still a majority (74%), recalled receiving the handout.

Two to three months after attending the event, attendees were quite accurate in their memories of the Science Café components.

Two to three months after attending the Science Café event, participants provided summary statements to describe their memory of the content presented at their Café. Most participants could still summarize the content from the Science Café they attended two to three months later (see Table 6).

- 16 of the Massachusetts attendees provided a summary statement; one stated that he/she could not remember, and the other listed the topics covered instead of a summary.
- All five California attendees provided summary statements.
- Six of the Washington attendees provided a summary statement. Of the two remaining, both chose to provide personal commentary rather than a summary statement.

Over one-third of participants had shared their Science Café experiences with friends, family, and colleagues.

Table 6
Sample Summary Statements from Science Café Attendees

MA Science Café Topics n=18	▪ Very complex patterns can arise from large groups of seemingly unintelligent entities. ▪ Emergent patterns are a tool for programming many actors identically and allowing the actors to decide at runtime amongst themselves who does which subtasks. Such actors are more tolerant of faults and of unusual environments. ▪ He demonstrated how individual robots could communicate and cooperate to perform a collaborative goal.
CA Science Café Topics n=5	▪ When a person watches somebody else performing an action, the brain of the observer activates in the same areas as needed to perform the task. This has been proposed to account for human empathy and understanding in emotion. ▪ The effects of mirror neurons appear to be real as seen in the present research, but whether mirror neurons can be fully associated to autism as a means of overcoming the disability must be more fully demonstrated before the community can feel more relieved. ▪ The [mirror neurons] involved in action recognition, imitation, ToM, etc. Autistics may have an abnormal [mirror neurons] which may have caused their condition.
WA Science Café Topics n=8	▪ Ongoing research about climate change is impacting how hurricanes are forecast. There was also discussion of what the impact of a hurricane would be on New Orleans. ▪ Climate change can be abrupt: a tipping point can usher in an era of very different climate. ▪ My understanding was that climate change is actually pretty common and that extremes flip flop around relatively often. Also that a strong hurricane could end up causing New Orleans to become a lake.

N=27

Over one-third (39%) of the participants reported that they had shared what they learned or experienced at the Science Café with friends, colleagues, or family. Most reported sharing something they had learned rather than something about other aspects of their experience.

A sub-set of Follow-Up Survey respondents (16%) also indicated that they had noticed the topic from their Science Café being covered in other media events since attending the Café:

- One Massachusetts participant (out of 18) attended a seminar on emergent patterns, architecture, and biology.
- Two of the five California Follow-Up respondents had noticed other coverage of mirror neurons: one read a story on the BBC Web site and the other read both an online article as well as journal articles about the subject.
- Four of the eight Washington attendees reported that they had read or heard about hurricanes and/or climate change. Sources included a story

on public radio, information from the NOAA listserve, journal articles, and textbooks.

THE INFLUENCE OF SCIENCE CAFÉS ON ATTENDEES' ENGAGEMENT WITH SCIENCE-RELATED ACTIVITIES

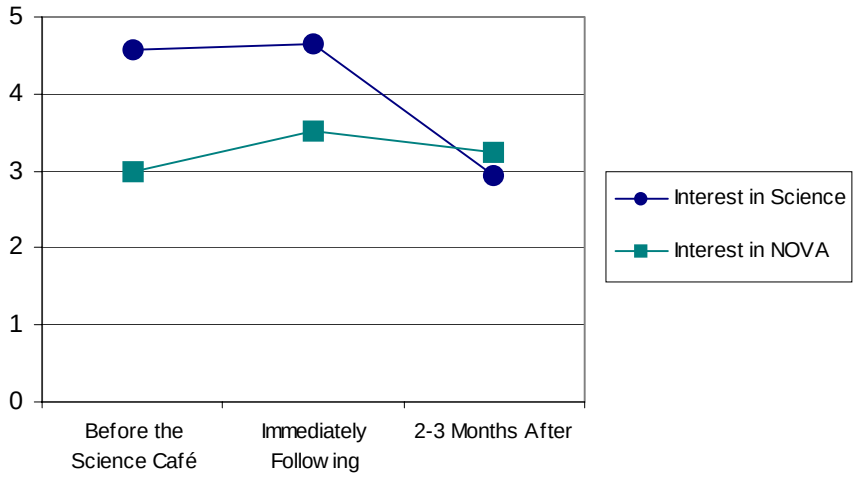
Projected Changes in Interest in Science and Watching NOVA as a Result of the Science Cafe

On both the survey completed at the end of the Science Café and the Follow-Up Survey, GRG asked participants to indicate the extent to which the Café increased their interest in science and their interest in watching NOVA.

At the end of the Science Café, attendees reflected on their interest prior to the event and their interest now that the event was over using a pair of retrospective-pre questions. Ratings for the retrospective-pre questions and the questions on the Follow-Up Survey were made on a scale of 1 (*Not at All*) to 5 (*Extremely*). For both questions, participants reported that they were more interested immediately after attending the event that they reflected they had been prior to the event. Two to three months later, when participants completed these questions again, ratings had decreased (see Figure 1). Paired-samples t tests indicated that:

- Attendees' interest in science increased slightly as a result of attending the event. Ratings of the event on science interest two to three months later indicated that the perceived influence had decreased significantly.
- Attendees interest in watching NOVA was significantly increased as a result of attending the Science Café (from 3.00 to 3.52; $p<.01$). Two to three months later, ratings had decreased slightly. Ratings were still higher than participants' initial interest, though not at a statistically significant level.[3]

Figure 1
Immediate and Longer-Term Influence of Science Cafés



[3] See Evaluator's Note at the end of this report for further discussion of these data.

Reported NOVA and NOVA scienceNOW Viewing

As reported earlier, Science Café participants ranged from those who never watch NOVA to those who watch on a weekly basis. Over half (57%) of the participants reported that they watch NOVA a few times a year or more.

Based on the viewing behavior they reported prior to attending the Science Café, most participants seemed to be watching NOVA at the same rate or more after attending the event.

- 52% participants seem to be watching at the same rate as before the Science Café,
- 29% seem to be watching more NOVA than they were watching prior to attending the Café, and
- 19% seem to be watching less frequently than before attending the Café.

Participants also reported whether they had watched NOVA scienceNOW. Thirteen participants had watched at least one of the two episodes, with nine reporting that they had watched one episode and four reporting that they had seen both. Twelve of the thirteen also reported watching NOVA. With the exception of one, all had watched the program in its entirety on television. The remaining participant had watched a portion of the show online.

Projected and Reported Engagement with Science-Related Activities

At the conclusion of the Science Café, participants projected how likely they were to engage in a number of science-related activities as a result of attending the Science Café. As seen in Table 7, participants rated that they were most likely to attend future Science Café events and recommend similar events to a friend.

Table 7
Likelihood of Engaging in Future Science-Related Activities as Reported at the Conclusion of the Science Cafe

	Not at All 1	A Little 2	Somewhat 3	Very 4	Extremely 5
Attend another Science Café in the future mean=4.20	3%	0	13%	41%	43%
Recommend a similar event to others mean=4.10	2%	3%	14%	43%	38%
Watch NOVA scienceNOW on TV mean=3.41	11%	8%	24%	42%	15%
Watch NOVA on TV mean=3.29	10%	11%	29%	39%	11%
Sign up for a science headlines newsletter mean=2.79	20%	21%	30%	20%	9%
Participate in a distributed computing project[4] mean=2.56	28%	21%	26%	18%	7%

Number of respondents ranges from 119 to 128 across questions

Two to three months after the event, 61% of Science Café attendees had completed at least one activity from the Science Café handout.

As part of each Science Café, attendees received a handout of suggestions for how they could become more engaged in science, including some of the activities from the table above. To learn whether Science Café attendees took advantage of these suggestions, GRG asked participants to indicate which of four science activities they had already completed, as well as those they planned to complete.

Sixty-one percent of the attendees had taken advantage of at least one suggestion for becoming more engaged in science activities, with the number of activities completed ranging from one to four (out of four). Many had attended events similar to the Science Café in the months following the event. Fewer attendees had signed up for a science newsletter or participated in a distributed computing project. In addition to completed activities, just over one-third (35%) of the attendees indicated that they had plans to complete an activity (see Table 8).

Table 8
Engagement in Science Activities Suggested on the NOVA scienceNOW Handout

	# who have done this activity	# who plan to do this activity
Attended similar science-related events	14	7
Visited the NOVA scienceNOW Web site	11	2
Signed up for a science headlines newsletter	3	4
Joined a distributed computed research project	1	0

N=31

[4] A distributed computing project is a way for lay people to get involved with real research by donating their computer's idle time to crunch scientific data. Participants download software from the internet that allows a research project's mainframe to use the participant's computer to analyze data.

The success of NOVA scienceNOW Science Cafés at encouraging future participation in similar events was also indicated through the final question on the Follow-Up Survey. All 31 participants (100%) indicated that they would attend another Science Café event:

- 16 indicated that they would attend another event if they were interested in the topic,
- 7 indicated that they would probably attend another Café, regardless of the topic, and
- 8 indicated that they would definitely attend another Café, regardless of the topic.

Follow-Up Survey participants were also given the opportunity to provide additional feedback at the end of the survey; 15 of the 31 participants did so. Most provided additional positive feedback about the Café and indicated an interest in future events. Representative quotes included:

All NOVA scienceNOW Science Café participants were interested in attending future Science Café events.

> *I think it is a great service for non-scientists in the community to speak with professionals about what they are reading/hearing and to have it put into some sort of context that is often not available in news stories in the paper or on 20-second clips on TV.*
>
> *…I think the Science Café is an excellent idea.*
>
> *I felt it was a very good way to convey scientific information. The presentation was good and not too complicated for a lay person, but got into enough detail for someone more interested in the specific science of what was going on. I recommend doing it more often.*
>
> *Please facilitate their* [Science Cafés] *spread throughout the country.*

CONCLUSIONS: SCIENCE CAFÉS

The NOVA scienceNOW Science Cafés are an effective way to reach participants who traditionally do not attend science events.

Formative evaluation indicated that the Science Cafés would be an effective way to engage audiences who do not typically have the opportunity to interact directly with scientists and presentations of their work. The summative evaluation confirmed these findings. Specifically, the summative evaluation demonstrated that the NOVA scienceNOW Science Cafés served a diverse audience including those aged 35 and under, women, and non-scientists.

NOVA scienceNOW Science Cafés covered topics that were appealing to attendees.

Science Café attendees indicated that the topics covered were of high interest, with the majority of attendees from each Café reporting that the content was *very* to *extremely interesting*. Interest in the topics was also indicated by the fact that over one-third of the attendees reported sharing what they learned at the Science Café with friends, family, or colleagues.

Science Cafés were effective at providing attendees with new science-related experiences.

The majority of Science Café attendees reported that this was their first Science Café experience. In addition, the Science Café was either the first time most attendees had learned about the topic being presented, or it was the first time they had heard a scientist speak about the topic. Attendees also appreciated the casual setting of the Café, with approximately one in five stated that this aspect was what they liked most about the event.

The Science Cafés were effective at encouraging attendees to continue engaging in science-related activities.

All attendees reported that they would attend another Science Café event. Over half reported they had completed an activity from the Science Café handout and just over one third had plans to complete activities.

RECOMMENDATIONS: SCIENCE CAFÉS

Based on the sample of three Science Cafés observed for the evaluation, WGBH's first season of Science Cafés was a success. The Science Cafés served a diverse audience, including populations of particular interest to the outreach team, and provided new content and/or learning experiences for the majority of attendees. GRG recommends that the WGBH proceed with the current Science Café formula in its next season.

We also recommend that WGBH provide additional guidance to groups, sites, and speakers that will host future NOVA scienceNOW Science Café events

about the special circumstances of hosting an event in informal environments such as bars and cafes. Several attendees mentioned that they could not see or hear the presentation or that there was a lack of adequate seating available.

We suggest that WGBH find ways to help hosts be proactive in responding to these challenges. For example, future hosts should visit a new Science Café site prior to the event in order to determine the presentation space, technology, and seating needed. Speakers should be notified of the space and resources available so they can plan their presentations accordingly. If audio-visual equipment is not available, WGBH may be able to connect hosts with their local PBS station to borrow the necessary equipment for the event. Finding ways to combat these challenges will increase the likelihood that attendees have a positive learning experience as well as the likelihood that they come back for future NOVA scienceNOW Science Café events.

RESULTS: THE SERIES

GRG's summative evaluation of the NOVA scienceNOW series included a Viewer Study and a review of the comments provided by viewers on the NOVA scienceNOW Web site. Results from each are described below.

NOVA SCIENCENOW VIEWER STUDY

Profile of Respondents

When recruiting participants for the Viewer Study, GRG used a number of criteria to match the sample to that of regular NOVA viewers. Regular NOVA viewers were defined as those who watch NOVA at least once a month. Potential participants who met the viewing criteria were then selected to match (as best as possible) the NOVA viewing population based on age, race, and gender. Participation in the study was denied to those who had seen either the January or April 2005 episodes of NOVA scienceNOW.[5]

Twenty-nine participants completed the Viewer Study. All reported watching NOVA on a regular basis, either once per month (55%) or two to three times per month (45%). As with typical NOVA views, slightly more participants were men than women; most participants were White, with a small percentage of African American and Asian viewers (see Table 9). Viewer Study participants were younger than the NOVA viewing population overall, with most Viewer Study participants between the ages of 35 and 64; a slightly greater number of Viewer Study participants were minorities compared to the NOVA population.

Table 9
Comparison of Viewer Study Participants to the NOVA Viewing Population

		% Respondents	% NOVA Viewers
Age	18 – 34 years old	17%	13%
	35 – 49 years old	31%	22%
	50 – 64 years old	35%	27%
	65 and older	17%	31%
Race	African American	3%	6%
	Hispanic/Latino	14%	9%
	White	83%	85%
Gender	Male	62%	56%
	Female	38%	39%

N=29

GRG also gathered data from participants to learn their educational level and their annual household income. As seen in Table 10, participants in the Viewer Study were from a wide range of educational and socio-economic backgrounds.

[5] This criterion eliminated NOVA viewers who watch every week, because they would have already seen NOVA scienceNOW prior to participating in the Viewer Study.

Table 10
Education and Household Income Levels of Viewer Study Participants

Highest Level of Education Completed	High school degree	14%
	Some college/trade school	38%
	College degree	21%
	Some graduate/professional school	17%
	Graduate/professional degree	10%
Annual Household Income	Less than $30,000	24%
	Between $30,000 and $49,999	24%
	Between $50,000 and $69,999	14%
	More than $70,000	38%

N=29

Finally, participants were asked if they were scientists, by profession. Three participants responded in the affirmative (10%), including a Physicist, an Aerospace Engineer, and an Electrical Engineer.

Participants' Science Viewing Habits and Related Understanding of Current Events in Science

In addition to NOVA, participants also reported watching other science related programming on a regular basis.

- 52% of participants had watched Scientific American Frontiers at least once in the past month,
- 69% had watched Nature once or more in the past month,
- 69% reported watching the Discovery Channel in the past month, and
- 59% of participants had watched National Geographic at least once in the past month.

Given these data, it is not surprising that 48% of respondents reported that they rely mostly on science documentaries and programs to get information on the latest advancements in science. And additional 28% reported getting their science information from the local newspaper, and 10% reported getting science information from a national news broadcast.

Approximately two-thirds (62%) of the sample believed that, compared to the average person, they were more interested in science; 35% believed that they were no more or less interested than the average person.

Although participants reported high interest in science and watched science programming on a regular basis, only one-third reported that they felt more knowledgeable than the average person about the latest developments in science.

- 17% reported that they were *less knowledgeable* than average,
- 48% reported that they were *no more or less knowledgeable* than average, and
- 35% reported that they were *more knowledgeable* than average.

THE APPEAL OF NOVA SCIENCENOW SERIES

As previously reported, GRG counterbalanced the order in which participants watched the two episodes of NOVA scienceNOW to control for a possible effect of viewing order. Preliminary analysis indicated that viewers' feedback did not vary based on which episode they watched first. Additional preliminary analysis indicated that there were also no differences between the feedback provided by male and female viewers. Results are presented to describe the sample as a whole.

Viewers rated the NOVA scienceNOW series very positively.

Respondents were asked to (a) rate each episode directly after viewing it, and (b) rate the series as a whole at the end of the Viewer Study. Ratings were provided on a scale of 1 (*Poor*) to 5 (*Excellent*).

- Both episodes were rated positively and with almost identical ratings, between *very good* (a score of 4) and *excellent* (a 5). Episode One received a mean rating of 4.23, while Episode Two received an average rating of 4.20.
- Positive ratings were also provided for the series as a whole. All participants rated the show as *good*, *very good*, or *excellent*; the mean rating was a 4.38 out of 5.

Viewers also found the show's host appealing. Robert Krulwich received an average rating of 4.17 for Episode One and 4.37 for Episode Two.

The majority of viewers indicated that they would like to see NOVA scienceNOW air 10 times a year rather than the current five.

Interest in the show was also expressed when viewers were asked to select from five viewing schedules to indicate how often they would like to see NOVA scienceNOW. The majority of viewers (93%) indicated that they would like to see the show 10 rather than five times a year. Over half of the respondents (55%) indicated that they would like to see NOVA scienceNOW on the first Tuesday of every month for 10 months in a row.

Visual Appeal

Participants rated the visual appeal of each episode as a whole as well as the individual stories within each episode, on a scale from 0 (*Not at all*) to 4 (*Extremely*).

Viewers rated Episode One as *very visually appealing* overall, with a mean episode rating of 3.07. Two individual stories (mirror neurons and hurricanes in New Orleans) received higher ratings, between *very* and *extremely* visually appealing (see Table 11). The remaining three stories were rated as *generally* to *very visually appealing*.

Table 11
Visual Appeal of Stories from Episode One

		Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Mirror neurons	mean=3.27	0	1	4	11	14
Hurricanes in New Orleans	mean=3.37	0	0	1	17	12
Profile of engineer, James McLurkin	mean=2.70	2	0	12	7	9
Booming Sands	mean=2.90	0	1	9	12	8
Kinetic Sculpture	mean=2.60	1	4	7	12	6

N=30

Overall, participants rated the visual appeal of Episode Two higher than that of Episode One. Episode Two was rated as *very* to *extremely visually appealing* (mean rating=3.23). The story on embryonic stem cell research received the highest ratings for visual appeal, while the profile of Naomi Halas and the story on aging Tyrannosaurs receiving the lowest ratings (between *generally* and *very visually appealing*; see Table 12).

Table 12
Visual Appeal of Stories from Episode Two

		Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Little people of Flores	mean=3.03	1	1	2	18	8
Techniques used to age Tyrannosaurs	mean=2.80	1	2	3	20	4
Profile on nanotechnologist and physicist, Naomi Halas	mean=2.63	0	3	9	14	4
Embryonic stem cell research	mean=3.40	0	1	3	9	17
Frozen frogs	mean=3.00	0	3	3	15	9

N=30

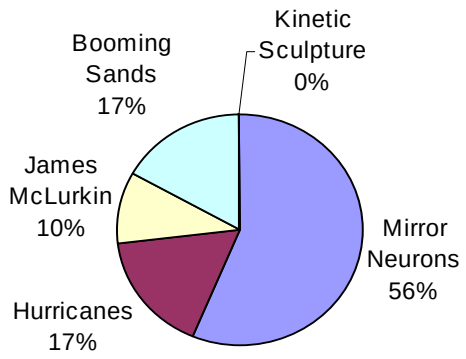
Favorite and Least Favorite NOVA scienceNOW Stories

After watching each episode, participants were asked to select their favorite and least favorite stories, and explain why they had made each selection. Results are presented below, by episode.

Episode One

For Episode One, over half of the viewers selected the story on mirror neurons as their favorite story (see Figure 2). Nearly one-fifth chose the stories on hurricanes in New Orleans and the story on booming sands as their favorites.

Figure 2
Favorite Story Selections - Episode One



Viewers' favorite story from Episode One was that on mirror neurons. Their least favorites were the story about kinetic sculpture and the profile of James McLurkin.

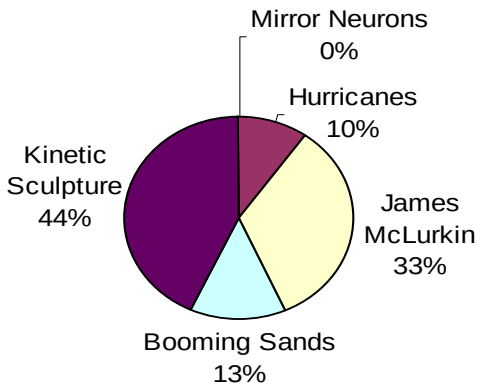
Regardless of which story they chose as their favorite, stories were chosen for two primary reasons: because the viewer made a personal connection to the topic, or because the story built on an existing interest. For example, when asked why they picked their favorite story, viewers commented:

> *I think because* [the story on mirror neurons] *held a possible explanation for something I've long felt about myself. I've always been very empathetic – crying at movies and plays, "feeling other people's pain."*
>
> *I have a fascination with animals/people and how we interact with one another. This notion of a section of the brain devoted to identification with another's actions on a "personal" level is quite enlightening.*
>
> *I've always been interested in hurricanes.*
>
> *Because my son is an engineer and it helps me to understand how he must think.*

Viewers' least favorite stories from Episode One were the story on kinetic sculpture (43% said this was their least favorite) and the profile on James McLurkin (33%; see Figure 3).

- Many of those who chose the kinetic sculpture piece as their least favorite did so *because it is not a subject that* [they] *care about*, or because it was *more of an art subject than science related*.
- Those who picked the profile on James McLurkin stated that the story seemed *disjointed*, that it *did not fit well with the other stories*, or that his story was *the same as many people*.

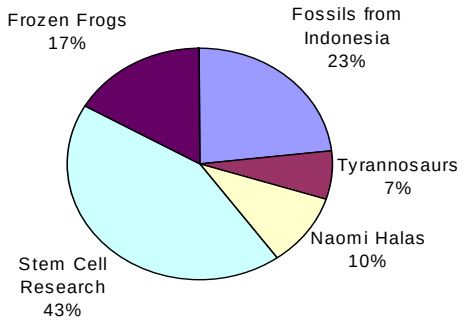
Figure 3
Least Favorite Story Selections - Episode One



Episode Two

For Episode Two, the story selected most often as favorite was on embryonic stem cell research (43% chose this story as their favorite). The story about the human fossils discovered in Indonesia was selected as the favorite story by 23% of participants (see Figure 4).

Figure 4
Favorite Story Selection - Episode Two



Viewers indicated that they selected the embryonic stem cell story because it was balanced in its presentation of the issue and/or because it taught them something about the issue. Those who chose the story of the human fossils reported that

they were fascinated by the questions it brought up, including whether these little humans could still be alive. Representative quotes included:

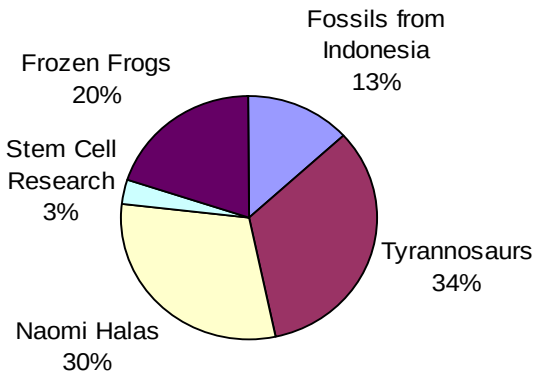
Viewers' favorite story from Episode Two was the piece on embryonic stem cell research. Least favorites included the story on aging Tyrannosaurs and the profile of Naomi Halas.

> *I believe* [the producers] *did an excellent job of blending science, politics, and human interest in a fairly balanced way.*
>
> *In addition to surveying the potential stem cell research it clarified the scientific details of how stem cells are created, giving me a better understanding so I can better judge the process…*
>
> *Because of the possibility that they* [the little people from Flores] *existed just 18,000 years ago and they might still be out there.*
>
> *The location of the fossils found and the questions it brought up.*

Viewers' least favorite stories from Episode Two were those about aging tyrannosaurs and the profile of Naomi Halas (33% and 30%, respectively, chose these stories as their least favorite; see Figure 5).

- Viewers selected the story about tyrannosaurs as their least favorite because they *just never had much interest in Tyrannosaurs*, or because it seemed the least relevant to life today (e.g., *T-Rex is old news*).
- Viewers chose the profile of Naomi Halas because they were more interested in learning about her work than about her personal life (e.g., *It talked to much about Naomi's personal life rather than* [as a] *nanotechnologist* and *However interesting it was to be told her story, I wish the episode focused more on her research with less background info*).

Figure 5
Least Favorite Story Selections - Episode Two



Stories Viewers Believed to be of Particular Significance

In addition to providing information on their favorite and least favorite stories, viewers were also asked which story (if any) was particularly significant to them, and why. Twenty-six participants (90%) indicated a story that they felt was particularly significant; the remaining three indicated that none were particularly significant to them.

Stories of particular significance were selected from both episodes, with more viewers selecting a story from Episode Two than from Episode One. Half of those who responded (50%) selected the story on embryonic stem cell research. (see Table 13). Approximately one in five respondents selected the story on mirror neurons.

Table 13
Stories of Particular Significance to Viewers

		% Respondents
Episode One	Mirror Neurons	19%
	Hurricanes in New Orleans	15%
	Booming Sands	8%
Episode Two	Embryonic Stem Cell Research	50%
	Little people of Flores	8%

N=26

When asked why the story they chose was significant to them, those who selected the embryonic stem cell story cited both the political timeliness or importance of the topic and personal motivations for wanting to learn more about the topic. For example, responses included:

> *Because this topic is of such current political interest.*
>
> *It's an area of research with strong political, moral, and ethical implications. This NOVA scienceNOW storey gave me a deeper understanding of the science of stem cell research, which helps in finding my moral and ethical position on the topic.*
>
> *Possible cure for diabetes. I have a good friend who is diabetic.*
>
> *It was significant to me because I know several people who could benefit from it and it helped me to form my own opinion on this topic.*

The remaining stories selected as particularly significant were chosen because viewers had a personal connection to or interest in the topic. Representative responses included:

> *The mirror neuron story provided a possible explanation for phenomena that I've been aware of for some time through my own observations. The extension of the story to connect it to a possible cause/explanation of autism interested me even more, as I've been interested in autism for some time.*

Since I live in Florida and we had 4 hurricanes last year, it is very motivating for me to learn more about hurricanes, i.e., why they happen, how they start, and what advancements are there on science to predict them and help with necessary preparations.

This was the most interesting thing I have ever seen. I never knew that the sands could make that kind of sound from sliding down.

As a pastor, I often discuss the different theories of creation (evolution, creation, both). This story [little people of Flores], *and others like it, help me to stay in touch with what the secular world is learning and believing regarding our roots.*

The Appeal of Episode-Specific Features

WGBH was particularly interested in learning viewers' opinions about the appropriateness of including a story that demonstrated the marriage between art and science, such as the piece on Arthur Ganson included in Episode One. Participants rated the appropriateness of this piece on a scale of 0 (*Not at All*) to 4 (*Extremely*).

Results were mixed, with some viewers rating that it was *a little* appropriate and others rating that it was *very* appropriate; the average rating (2.3 out of 4) indicated that, as a group, viewers believed it was *moderately appropriate* to include this piece in the show.

Participants also rated the appeal of The Conundrum, a new feature added to Episode Two. Appeal was rated on a scale of 1 (*Poor*) to 5 (*Excellent*). The average rating (mean=3.63 out of 5) indicated that viewers found this segment as *good* or *very good*.

Correspondents received slightly lower ratings than the show's host, but were still rated positively with average ratings between *good* and *very good*.

- Peter Standring, New Orleans correspondent from Episode One, received an average rating of 3.97 out of 5,
- Chad Cohen, correspondent for the piece on aging Tyrannosaurs, received an average rating of 3.83, and
- Patty Kim, correspondent for the piece on embryonic stem cell research, received an average rating of 3.93.

Clarity of NOVA scienceNOW Content

Participants rated both the overall clarity of each episode and the clarity of the individual stories included in each episode. Ratings were made on a scale of 0 (*Not at All*) and 4 (*Extremely*).

Viewers rated the overall clarity of Episode One between *very* and *extremely* clear with an average rating of 3.17 out of 4. As seen in Table 14, the stories on

mirror neurons, hurricanes in New Orleans, and booming sands were each rated as *very* to *extremely* clear. The profile on James McLurkin and story on kinetic sculpture received lower ratings but were still rated as *generally* to *very* clear.

Table 14
Clarity Ratings for Episode One

	Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Mirror neurons mean=3.43	0	0	3	11	16
Hurricanes in New Orleans mean=3.23	0	0	4	15	11
Profile of engineer, James McLurkin mean=2.87	0	1	10	11	8
Booming Sands mean=3.17	0	1	3	16	10
Kinetic Sculpture mean=2.60	0	4	8	14	4

N=30

Participants rated the clarity of Episode Two positively and with a slightly higher clarity rating than that provided for Episode One (mean rating for Episode Two = 3.3 out of 4). As shown in Table 15, each individual story was also rated positively. Four out of the five individual stories were rated between *very* and *extremely* clear, with the story on embryonic stem cell research receiving the highest rating. The profile of Naomi Halas was rated the lowest, with a rating between *generally* and *very* clear.

Table 15
Clarity Ratings for Episode Two

	Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Little people of Flores mean=3.07	0	0	5	18	7
Techniques used to age Tyrannosaurs mean=3.20	0	2	3	12	13
Profile on nanotechnologist and physicist, Naomi Halas mean=2.70	1	1	8	16	4
Embryonic stem cell research mean=3.37	0	1	1	14	14
Frozen frogs mean=3.13	0	0	6	14	10

N=30

A final measure of clarity was collected on the Post-Viewing Survey. Participants were asked to rate how difficult or easy it was to understand the content presented in the series.

- 55% of participants indicated that the series content *was very easy to understand*,
- 38% indicated that *it was fairly easy to understand* the content, and
- 7% indicated that *it was neither easy nor difficult to understand* the content in NOVA scienceNOW.
- None of the participants indicated that the content was either *fairly difficult* or *very difficult* to understand.

Sustaining Viewer Interest

Viewers used the same five-point scale described above to rate the effectiveness of each episode at sustaining their interest. Viewers indicated that Episode One was between *very* and *extremely* effective at sustaining their interest throughout the show, with an average rating of 3.13. The stories on hurricanes in New Orleans and mirror neurons received the highest ratings for sustaining interest (see Table 16).

Table 16
Effectiveness of Episode One at Sustaining Viewer Interest

		Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Mirror neurons	mean=3.23	1	2	3	7	17
Hurricanes in New Orleans	mean=3.30	0	3	1	10	16
Profile of engineer, James McLurkin	mean=2.53	3	4	6	8	9
Booming Sands	mean=3.00	1	2	3	14	10
Kinetic Sculpture	mean=2.33	1	5	11	9	4

N=30

Participants also reported that Episode Two was *very* to *extremely* effective at sustaining their interest throughout (mean =3.37). The stories on the little people from Flores, embryonic stem cell research, and frozen frogs were also each rated as very to extremely effective at sustaining interest; the profile of Naomi Halas and the story on aging Tyrannosaurs were rated as *generally* to *very* effective as sustaining interest (see Table 17).

Table 17
Effectiveness of Episode Two Stories at Sustaining Viewer Interest

		Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Little people from Flores	mean=3.23	0	0	6	11	13
Techniques used to age Tyrannosaurs	mean=2.93	1	2	5	12	10
Profile on nanotechnologist and physicist, Naomi Halas	mean=2.60	2	3	6	13	6
Embryonic stem cell research	mean=3.60	1	0	0	8	21
Frozen frogs	mean=3.27	1	1	2	11	15

N=30

The Perceived Purpose of NOVA scienceNOW

At the conclusion of the Viewer Study, participants were asked to indicate their perception of NOVA scienceNOW's purpose. Participants were provided with a list of six purpose statements and asked to select the two they would use to

describe the show to someone who had never seen it. As seen in Table 18, the majority of participants indicated the purpose of NOVA scienceNOW was *to make science approachable for all viewers* and *to introduce viewers to cutting edge science topics*.

Table 18
The Perceived Purpose of NOVA scienceNOW

	% Respondents
To make science approachable for all viewers	75%
To introduce viewers to cutting edge science topics	68%
To encourage viewers to engage with science	36%
To demonstrate the various implications of science	18%
To demonstrate the importance of staying current about science topics	14%
To combat negative stereotypes about scientists	4%

N=28

SCIENCE ENGAGEMENT ASSOCIATED WITH NOVA SCIENCENOW

Projected Influence of the NOVA scienceNOW series on Science Engagement

At the conclusion of the Viewer Study, participants were asked to indicate how effective the series was at increasing their engagement with science in two areas:

- Participants rated the series as *generally* to *very effective* at increasing their interest in science and at motivating them to learn more about current events in science.
- The series was rated, on average, as *generally effective* at increasing the extent to which participants had sought out science-related experiences (see Table 19).[6]

Table 19
Perceived Effectiveness of NOVA scienceNOW at Increasing Engagement with Science

	Not at All 0	A Little 1	Generally 2	Very 3	Extremely 4
Increasing your interest in science mean=2.38	1	5	10	8	5
Increasing how motivated you have felt to learn more about current events in science mean=2.34	1	3	14	7	4
Increasing the extent to which you have sought out science-related learning experiences mean=1.90	3	9	8	6	3

N=29

[6] See Evaluator's Note at the end of this report for further discussion of these data.

Reported Engagement with Science

Over two-thirds of viewers had continued to engage with NOVA scienceNOW content during and/or after the Viewer Study.

Participants reported their additional engagement with content related to the series by indicated which activities from a list they had completed and which they planed to complete in the future (see Table 20). The majority of participants (69%) had completed at least one activity related to NOVA scienceNOW content during the month of the Viewer Study. The majority of these had either read a newspaper article about content from the show or visited a Web site to learn more about NOVA scienceNOW content. An even greater number of participants (86%) indicated that they planned to engage further with NOVA scienceNOW content in the future.

Table 20
Additional Engagement with NOVA scienceNOW Content

	# who have done this activity	# who plan to do this activity
Read a book/part of a book about a topic from NOVA scienceNOW	2	14
Read a science magazine article about a topic from NOVA scienceNOW	4	11
Read a newspaper article about a NOVA scienceNOW topic	14	6
Visited a Web site to learn about a NOVA scienceNOW topic	11	14
Attended a science lecture or presentation about a NOVA scienceNOW topic	1	5

N=29

All Viewer Study participants had participated in at least one conversation with a friend or family member about NOVA scienceNOW content after viewing the show.

Participants also reported that they had shared the content from the NOVA scienceNOW with a friend or family member while participating in the Viewer Study. All participants (n=29) reported that they had participated in at least one conversation about series content. Participants reported having conversations about four different NOVA scienceNOW topics, on average.[7]

Interestingly, the specific topics that participants discussed varied slightly from those they identified as the most likely to discuss at the beginning of the study. The comparisons for likelihood of discussing each story and the stories actually discussed are presented in Table 21. As seen below:

- Participants correctly predicted that they would discuss embryonic stem cell research and the little people of Flores.
- Compared to their own predictions about which topics they would be likely to discuss, many more participants discussed mirror neurons and booming sands with friends and family.

[7] Note that the participants were not asked if they had engaged in conversation about either profile piece.

Table 21
Predicted Versus Action Discussion of NOVA scienceNOW Content

	% who predicted they might discuss	% who did discuss
Mirror neurons	21%	63%
Advancements in hurricane research	72%	44%
Booming sands	41%	63%
Kinetic sculpture	31%	22%
Little people of Flores	62%	67%
Aging Tyrannosaurs	59%	30%
Embryonic stem cell research	90%	78%
Frozen frogs	38%	44%

N=29

The number of participants who visited a NOVA Web site also increased during the month of the Viewer Study. Approximately one-quarter (24%) of participants reported visiting the NOVA Web site during the month prior to the study. During the month of the Viewer Study, the percentage who visited the NOVA scienceNOW Web site was 35%.

The majority of viewers learned about eight of the 10 NOVA scienceNOW topics for the first time as a result of watching the show.

LEARNING ASSOCIATED WITH NOVA SCIENCENOW

Learning Experiences with NOVA scienceNOW Content Prior to Viewing

In order to assess the effectiveness of the NOVA scienceNOW series at presenting viewers with new science content, GRG asked participants to describe their prior learning experiences with each series topic. As seen in Table 22, with the exception of the story on hurricanes in New Orleans, over two-thirds of the viewers learned about each topic in Episode One for the first time while watching NOVA scienceNOW.

Table 22
Previous Learning Experiences with Episode One Content

	This was the first time I learned about this topic.	I had some knowledge about this topic, but this was the first time I watched a program on the subject.	I had watched a program on this topic before.
Mirror neurons	24	5	1
Hurricanes in New Orleans	11	11	8
Profile of engineer, James McLurkin	27	3	0
Booming Sands	21	8	1
Kinetic Sculpture	21	7	2

N=30

A similar pattern was found for Episode Two. As seen in Table 23, most participants learned about four of the five Episode Two topics for the first time by watching NOVA scienceNOW. Participants were familiar with the topic of embryonic stem cell research; most viewers reported that they had some knowledge of the topic and several had watched other programs on the subject.

Table 23
Previous Learning Experiences with Episode Two Content

	This was the first time I learned about this topic.	**I had some knowledge about this topic, but this was the first time I watched a program on the subject.**	**I had watched a program on this topic before.**
Little people of Flores	19	9	2
Techniques used to age Tyrannosaurs	18	10	2
Profile on nanotechnologist and physicist, Naomi Halas	25	4	1
Embryonic stem cell research	3	18	9
Frozen frogs	22	6	2

N=30

Perceived Knowledge Gains from Watching NOVA scienceNOW

Perceived increases in knowledge were measured on a scale of 0 (*Not at All*) to 4 (*A Great Deal*) for each of the stories included in the two episodes (see Table 24 for Episode One). Viewers reported that they learned *quite a bit* to *a great deal* from the stories on mirror neurons and booming sands. Lower knowledge gains were reported for the remaining three stories, with participants indicating that they learned *a moderate amount* to *quite a bit* from these stories.

Table 24
Perceived Knowledge Gains Associated with Stories from Episode One

	Not at All 0	**A Little 1**	**A Moderate Amount 2**	**Quite a Bit 3**	**A Great Deal 4**
Mirror neurons mean=3.27	0	4	1	8	17
Hurricanes in New Orleans mean=2.93	0	2	8	10	10
Profile of engineer, James McLurkin mean=2.83	1	4	6	7	12
Booming Sands mean=3.20	0	3	3	9	15
Kinetic Sculpture mean=2.57	2	4	6	11	7

N=30

Average ratings indicated that participants felt they had learned *quite a bit* from four of the five stories from Episode Two (see Table 25). Participants felt they learned the most from the story on frozen frogs and least from the profile on Naomi Halas.

Table 25
Perceived Knowledge Gains Associated with Stories from Episode Two

	Not at All 0	A Little 1	A Moderate Amount 2	Quite a Bit 3	A Great Deal 4
Little people of Flores mean=3.07	0	1	10	5	14
Techniques used to age Tyrannosaurs mean=3.03	1	1	7	8	13
Profile on nanotechnologist and physicist, Naomi Halas mean=2.73	2	3	6	9	10
Embryonic stem cell research mean=3.03	1	4	3	7	15
Frozen frogs mean=3.23	0	3	1	12	14

N=30

Recall of NOVA scienceNOW Stories

Participants were asked to report the one thing they remembered most from several of the NOVA scienceNOW stories. The majority of participants provided an example of the content they learned from each story, rather than other story features they remembered. Tables 26 and 27, below, provide examples of the learning statements provided for each story.

Table 26
Sample Statements of What People Remembered Most from Episode One Stories

Mirror Neurons n=21	▪ The way that we are programmed to feel others pain and joy by just watching them. ▪ How the human brain shows the same activity when a person is watching something and when they are doing the action themselves. ▪ How they were discovered and that those who are autistic do not have mirror neurons that work properly.
Advancements in the study of hurricanes n=22	▪ That we can go inside of the storm and hopefully predict with more accuracy the path a storm will take. ▪ Hurricane mapping from space may help meteorologist better judge the severity of hurricanes, providing earlier advance warnings to places like New Orleans where evacuation can be difficult. ▪ Detailed data is the answer to dealing with problems. The hurricane data is great if it is quick and can be used to prevent deaths.
Deserts with singing sand n=19	▪ The size and uniformity of sand grains are a factor in the resonate frequency of singing sand. ▪ Due to the size of the and grains and elevation sand dunes can make a sound in the G,E,F notes. ▪ I recall that researchers are testing hypotheses that the singing sand phenomenon is caused by sand particles of quite similar size passing over a layer of wetter, more solid sand beneath.
Kinetic sculpture n=13	▪ How this man would take these pieces of metal and form them into different sculptures to make them move. ▪ Kinetic energy seems to go on indefinitely. ▪ Kinetic sculpture is a type of art combined with mechanical engineering.

N=29

Table 27
Sample Statements of What People Remembered Most from Episode Two Stories

Little people of Flores n=12	▪ The tools found with these small human-like fossils may indicate that smaller brains are also capable of higher-order functions that most anthropologists had believed were associated with larger brains. ▪ That it was determined these fossils were not of children or diseased people, but a separate type of human-like being. ▪ That the average height of them was only about 3 ft. when they grew up.
Techniques used to age Tyrannosaurs n=23	▪ Just like trees, certain bones in their body are built in annual layers that can be counted. ▪ That using present day reptiles we can look back and determine how their "ancestors" lived. ▪ They determine the age by the rings (like a tree) that are inside the ribs.
Embryonic stem cell research n=22	▪ The controversial research of Stem Cells, how its done and who it affects. ▪ Embryonic stem cell research is a rising conflict, because of the debate about whether it's human or not. ▪ I recall that the proposed method for obtaining stem cells involves replacing the nucleus of an embryo with the nucleus of some other cell, and that researchers would like to study disease pathology in this way.
Frozen frogs n=23	▪ North American wood frogs hibernate through the winter in a process that involves their life sign to practically cease to be detectable, then revive when the spring comes. ▪ The frog completely freezes and comes back to life thawing from the inside out. ▪ How they, amazingly, appear to "die," without any sign of life and then, when conditions are right, become alive again.

N=29

Assessment of Knowledge Gains

Knowledge gains were assessed two ways: (a) by asking participants to report what they learned from each segment of both Episode One and Episode Two of the series, (b) by having participants answer content-based assessment questions. Thirteen content-based multiple-choice questions were used, including two questions to assess each of six stories from the first two episodes of NOVA scienceNOW. In addition, one multiple-choice and one open-ended question were also included to assess understanding of the story on embryonic stem cell research.

Participants' scores on the multiple choice questions prior to watching the series confirmed that they were not familiar with many of the topics included in the series. Of the 13 multiple choice questions related to the content of the series, participants correctly answered 4.8 on average, with a range of one to nine.

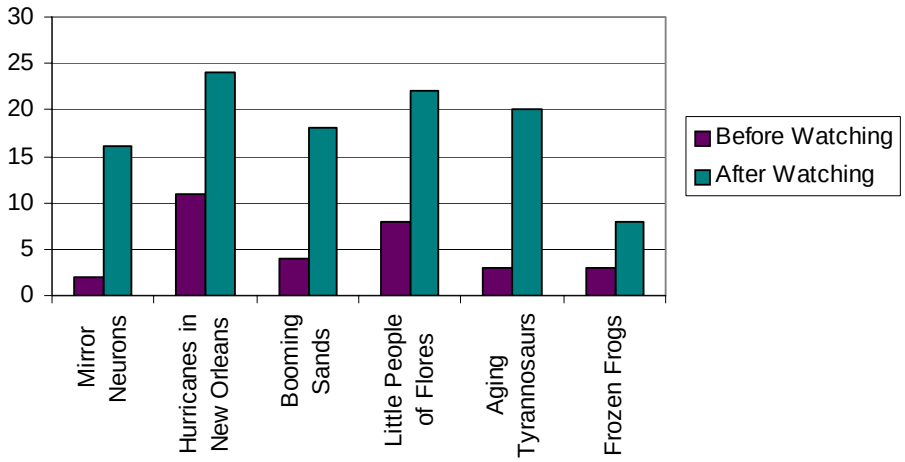
Two weeks after watching the second episode in the series (approximately one month after the pre-assessment), participants were asked to complete the content questions again. After watching the series, the average number of questions that participants answered correctly had doubled to 9.9, with a range of three to 13 correct answers. Both a descriptive and statistical representation of the gains made are presented below.

To provide a descriptive illustration of the learning associated with each story, GRG totaled the number of participants who answered both content questions correctly before and after watching NOVA scienceNOW. As seen in Figure 6, very few participants correctly answered both questions prior to viewing the show. In contrast, after watching NOVA scienceNOW, the majority of participants correctly answered both questions for five of the six stories.

Few viewers could correctly answer both multiple choice assessment questions prior to watching NOVA scienceNOW. After watching, the majority of viewers correctly answered both questions for five out of the six stories assessed.

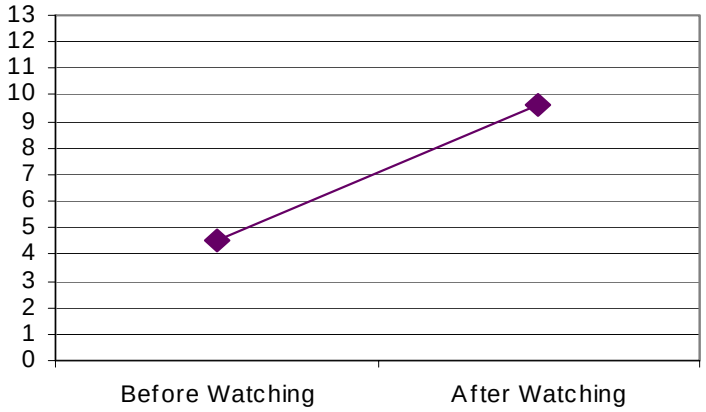
A different pattern of results was found for the multiple choice question used to assess participants' understanding of embryonic stem cell research. The majority of participants correctly answered this question both before and after watching the show (20 before and 22 after).

Figure 6
Participants who Correctly Answered Both Multiple Choice Questions from Each Story Before and After Watching NOVA scienceNOW



GRG also assessed the overall gains in knowledge associated with watching NOVA scienceNOW. The total number of correct responses provided before and after watching the show was calculated for each participant. These overall content scores were then compared using a paired-samples t test. Results indicated a statistically significant increase in content knowledge after watching NOVA scienceNOW ($p<.001$; see Figure 7).

Figure 7
Average Number of Correct Content Questions Answered Before and After Viewing NOVA scienceNOW



Viewers demonstrated statistically significant increases in their knowledge of NOVA scienceNOW content as a result of watching the show.

In addition to the multiple-choice questions, participants were also asked to describe the two sides of the debate about embryonic stem cell research. GRG coded responses in one of three ways: (a) those that provided a stronger description of the debate before watching NOVA scienceNOW, (b) those who provided a stronger description after watching, and (c) those who provided similar statements before and after watching (see Table 28).

- Four participants reported that they could not describe the debate prior to watching NOVA scienceNOW. After watching, three of the four could describe the debate or voiced their opinion about the side of the debate with which they agreed.
- Four participants provided stronger statements prior to watching NOVA scienceNOW.
- Eleven participants provided stronger statements after watching NOVA scienceNOW. These statements described the debate more thoroughly after watching the show.
- Eleven participants provided statements that were conceptually similar both before and after viewing.

Table 28
Sample Statements of Viewers' Description of the Embryonic Stem Cell Debate Before and After Watching NOVA scienceNOW

	Before Watching	After Watching
Stronger Statement Before Watching (n=4)	▪ Pre-born human cells may be needed to be able to continue the embryonic stem cells research. vs. medicine and scientific advancement could be achieved by using embryonic stem cells.	▪ Some people favor the use of embryonic stem cells for science advancement and this fact is used by others to justify abortions in order to be able to use the human cells for the scientific studies.
	▪ Side 1, Embryonic stem research can further science by helping create useful body parts. Side 2, It is playing God and we should leave well enough alone, even if it means someone's life.	▪ Stem cells could be used to help people, while it could also be used as a way to create full humans
Stronger Statement After Watching (n=11)	▪ Hard to explain…just beginning to learn more.	▪ People against stem cell research believe that we are killing potential human beings, while those for it see it as saving someone else's life.
	▪ I think that if embryonic stem cells can be used to save a life, they should be used, but should not be used for cloning	▪ PRO: Embryonic stem cells can be used to cure disease. CON: Since embryonic stem cells can be used to create any cell in the human body it is essentially a clone and in order to use these cells scientists would essentially be taking a life
	▪ On the "pro" side, there is the potential for progress against key disease and deterioration processes, such as diabetes and cancers. On the "con" side, replicating cells of any kind can be considered unnatural and unethical, and feared as a pathway toward cloning humans.	▪ Proponents advocate research to determine how to develop disease cures from stem cells, which can be developed into cells of any function in the body. Opponents describe stem cells as fetal life and describe the cloning of an entire human as the inevitable outcome of this research.
Similar Statements Before and After Watching (n=11)	▪ One side thinks that it is wrong and is killing a human. The other side seems to think that it can cure Parkinson's disease and other neurological disorders.	▪ One way its wrong because it is taking a life. One the other hand it is saving many lives.
	▪ Those who are for embryonic stem cell research believe it is possible such cells could be used to cure various illnesses or to hear certain types of injury. There are those who oppose such research because it is contrary to their religious beliefs and others whose opposition may be based on the propriety of "harvesting" human cells for research of any type.	▪ For: The research could provide invaluable help or treatment for serious injuries or disease damage to various parts of the body, thus being of tremendous benefit to the medical profession. Against: Science should not be involved in creating human cells for any reason.
	▪ Pro: They have the potential to cure a wide range of diseases through the growing of various types of cells that could potentially replace those destroyed by disease. Con: Stem cells represent the potential for human life, therefore religious factions see their destruction as a sin. They also believe that stem cells can be harvested from other sources such as umbilical cord blood or adult stem cells.	▪ One side is based on moral religious grounds states that the use of embryos to produce stem cells is killing potential human life. The other side states that these are cells that would likely be disposed of anyway and that they have the potential to save or improve the lives of many living human beings.

VIEWER COMMENTS FROM THE NOVA SCIENCENOW WEB SITE

At the conclusion of each of the first two episodes of NOVA scienceNOW, Robert Krulwich invited viewers to visit the show's Web site to provide feedback. GRG obtained from WGBH the comments provided by viewers in the week following the broadcast of Episodes One and Two. GRG then coded the comments to learn the number of respondents who provided different kinds of feedback (positive, negative, or mixed) and the specific characteristics of the episodes mentioned.

Note that these comments come from a self-selected group of NOVA viewers who went to the Web site to provide their feedback about the show. While these comments provide useful information about NOVA viewers' reactions to the new series and its content, it is unclear whether this feedback generalizes to the overall NOVA viewing population.

Episode One

In the week following episode one, 669 viewers provided comments about the show on the NOVA scienceNOW site. Of those, the majority provided positive feedback. An equally small number of viewers provided either negative or mixed feedback.

- 564 visitors (84%) provided positive feedback
- 50 (7%) provided negative feedback
- 55 (8%) provided mixed feedback

Most feedback provided by viewers on the NOVA scienceNOW Web site after watching Episode One was positive, with the highest number of positive comments being made about Robert Krulwich and the story on mirror neurons.

GRG used 10 different macro-level codes to quantify the content included in viewers' comments. One code was created for each story included in the episode. A code was also created to capture comments about the show's host, Robert Krulwich. Finally, five additional codes were created to quantify themes mentioned by multiple viewers.

Of the 564 positive comments received, 268 (48%) were general positive statements and thus were not coded for additional content. These comments included:

> *Wonderful start for a promising new collection of programs! I enjoyed each segment very much.*
>
> *Wow! I thought tonight's program was great. I really liked how it talked about things that are still being researched rather than things that have been already proven, and it really added an edge to the program. I'm really looking forward to the next one!*
>
> *I love it. Keep up the good work. ScienceNOW is on my list of things to watch.*

Marvelous work, do not stop, your selection of topics and diverse group of scientists and engineers working their chosen fields was best example of role models for young people interested in science could have.

I just saw the first episode and enjoyed it very much. What a fresh idea! Thanks, and keep up the good work.

The remaining 296 comments were about specific segments from the show, the host, or one of the additional five themes. Each comment could receive multiple codes for mentioning multiple content categories. As seen in Table 29, the largest number of positive comments was provided in relation to the host; the story on mirror neurons also received much positive commentary.

The story that received the highest number of negative comments was the profile of James McLurkin. Robert Krulwich also received some negative feedback. A small group of viewers also expressed their dissatisfaction of the new format by making a negative comparison to Scientific American Frontiers. It should be noted, however, that the number of negative comments in each category was quite small in comparison to the positive feedback received for each category.

Table 29
Number and Type of Viewer Comments by Category – Episode One

	# of Positive Comments	**# of Negative Comments**	**# of Mixed Comments**
Mirror neurons, autism, empathy	78	3	1
Hurricanes, New Orleans	31	2	1
James McLurkin, robots	44	23	0
Booming sands	35	7	1
Kinetic Sculpture, Arthur Ganson	43	3	1
Robert Krulwich	80	15	1
Watching the episode with children	41	0	0
Mention of being a long-time NOVA viewer	32	2	0
Comparison of the show to Scientific American Frontiers	12	11	1

In addition to the nine codes displayed above, a tenth code was used to indicate responses that compared NOVA scienceNOW to the traditional NOVA format. These comments were often multi-layered and could not easily be divided into comments that were positive, negative, or mixed.

Because these comments were provided by NOVA viewers who were experiencing the new format for the first time, GRG believed it important to parse the different types of comparisons being made. To accomplish this, GRG

used a secondary coding scheme to capture the variety of comparisons made between the two series.

Many viewers compared NOVA scienceNOW with the traditional format of NOVA in their Episode One comments.

A total of 113 comments included a comparison between NOVA scienceNOW and NOVA (see Table 30). Approximately half of those (56%) included positive feedback about the new format, but not in lieu of NOVA; the remaining comments expressed disappointment or a preference for NOVA in its traditional form.

Table 30
Comparative Comments Made Between NOVA scienceNOW and NOVA

	# of Comments
Stated that they preferred NOVA to NOVA scienceNOW	42
Provided positive feedback about both NOVA scienceNOW and NOVA	32
Stated that they preferred NOVA scienceNOW to NOVA	12
Provided positive feedback about NOVA scienceNOW, but do not want it to replace NOVA	12
Provided negative feedback about NOVA scienceNOW, and do not want it to replace NOVA	12
Stated that NOVA scienceNOW was a good addition to the traditional NOVA	6

n=110; Three additional comments could not be coded using the above categories

Episode Two

Episode Two received fewer comments on the NOVA scienceNOW Web site compared to Episode One. Most of the comments received were positive.

Compared to Episode One, one-tenth of the number of viewers provided feedback in the week following the second episode of NOVA scienceNOW (n=63). As with the first episode, the majority of the feedback provided was positive (70%); 17% provided negative feedback about the episode and 3% provided mixed commentary.

As seen in Table 31, the highest number of both positive and negative comments were made in response to the story on embryonic stem cell research. Positive comments about embryonic stem cell research focused on an appreciation of the how the topic was presented; the majority of negative comments came from viewers opposed to stem cell research.

Table 31
Number and Type of Viewer Comments by Category – Episode Two

	# of Positive Comments	# of Negative Comments	# of Mixed Comments
The little people of Indonesia	3	1	1
Determining the age of tyrannosaurs	0	0	0
Profile on Naomi Halas	6	2	1
Embryonic stem cell research	8	5	2
North American Wood Frogs, freezing frogs	1	3	0
The Conundrum	0	1	0
Robert Krulwich	0	1	0
Watching the episode with children	6	0	0
Mention of being a long-time NOVA viewer	3	0	0
Comparison of the show to Scientific American Frontiers	8	5	0

Similar to the comments received for Episode One, several viewers made comparisons between NOVA scienceNOW and traditional NOVA (n=13; see Table 32). Most (8 out of 13) provided positive feedback about the new format.

Table 32
Comparative Comments Made Between NOVA scienceNOW and NOVA

	# of Comments
Stated that they preferred NOVA to NOVA scienceNOW	4
Provided positive feedback about both NOVA scienceNOW and NOVA	4
Stated that they preferred NOVA scienceNOW to NOVA	0
Provided positive feedback about NOVA scienceNOW, but do not want it to replace NOVA	2
Provided negative feedback about NOVA scienceNOW, and do not want it to replace NOVA	1
Stated that NOVA scienceNOW was a good addition to the traditional NOVA	2

N=13

CONCLUSIONS: THE SERIES

Viewers responded positively to NOVA scienceNOW.

Participants in the Viewer Study rated the series as *very good* to *excellent* overall, and indicated that the show was *very* to *extremely* visually appealing. Positive ratings were also provided for the show's host and for all guest correspondents. Similarly, the majority of viewers who visited the NOVA scienceNOW Web site to write comments on the new show provided enthusiastic support for the new series.

Viewers believed that the content in NOVA scienceNOW was presented clearly.

Viewer Study participants indicated that they found each story from NOVA scienceNOW either *generally* or *very* clear in its presentation. Overall, the majority of participants indicated that the series was *very easy to understand*.

Compared to other stories, viewers had less positive reactions to the profile segments.

Across the different ratings provided, viewers consistently rated the two profile pieces lower than other stories in the same episode. These stories were also picked often as viewers' least favorite. Similarly, the profile on James McLurkin received the highest number of negative comments from viewers who submitted feedback on the Web site. In both cases, viewers wanted more information about McLurkin and Halas' science and less on their personal life.

NOVA scienceNOW features science topics that are new to viewers.

The majority of participants learned about eight of the ten topics covered in Episodes One and Two for the first time as a result of watching NOVA scienceNOW. Viewers' low scores on the multiple-choice content questions from the Pre-Survey confirmed that they were not familiar with the topics covered in the show.

Viewers' knowledge about cutting edge science topics increased as a result of watching NOVA scienceNOW.

At the conclusion of the Viewer Survey, the majority of participants correctly answered both multiple choice questions from each story, and over one-third were better able to describe the debate about embryonic stem cell research. Further, participants' overall performance on the multiple-choice questions increased significantly from pre to post.

NOVA scienceNOW was effective at encouraging viewers to seek out additional learning experiences.

Two weeks after watching their second episode of NOVA scienceNOW, over two-thirds of the participants had engaged further with NOVA scienceNOW content. An even greater percentage of participants (86%) had plans to continue their engagement with NOVA scienceNOW topics.

RECOMMENDATIONS: THE SERIES

GRG's summative evaluation of the NOVA scienceNOW series indicated that viewers responded positively to the new format, that the series was effective at providing viewers with knowledge about cutting edge science content, and that it encouraged viewers to continue engaging in science-related activities. As such, we recommend that NOVA scienceNOW continue with its current formula in Season Two. Based on viewer feedback, we further recommend that if the show can be expanded to include additional episodes, that the series should include 10 episodes per year, airing on the first Tuesday of each month.

We also recommend that WGBH consider balancing the content featured in future profile segments to focus equally on the personal and professional aspects of the scientists featured. While we recognize the importance of the profile pieces in helping combat the viewing public's stereotypical impression of scientists, viewers indicated that they wanted more information about the scientists' professional work. Some viewers also indicated that they wanted connections made between how the personal information presented influenced their scientific endeavors. This idea may be a nice entry point to use when connecting professional and personal information throughout future profile segments.

We also recommend that WGBH communicate with NOVA viewers about the new series. There is some concern and confusion among long-time NOVA viewers about NOVA scienceNOW. Many viewers who submitted comments on the Web site expressed their concern that this new format would be replacing the traditional NOVA format. While some of these concerns were balanced with positive feedback about NOVA scienceNOW, others stated that they would not seek out future NOVA programming. A note from the producers to viewers on the NOVA and/or NOVA scienceNOW Web site or a statement by Robert Krulwich at the beginning of future episodes would likely be appreciated by NOVA viewers who are confused about the new series' format and its implications for NOVA overall.

EVALUATOR'S NOTE

GRG's evaluation of both the Science Cafés and series asked participants to indicate the effect of each offering on their interest in science. In both cases, ratings were moderate and in the case of the Science Cafés it appeared that participants became less interested over time.

Participants were also asked to report on the science-related activities with which they had engaged following their NOVA scienceNOW experience. Across multiple questions focused on science engagement (e.g., the extent to which they viewed NOVA and/or NOVA scienceNOW, whether they completed any activities from the Science Café handout, whether they sought out additional learning experiences with NOVA scienceNOW content), these data indicated that engagement with science had increased or remained constant. Because the ratings scale questions were more subjective than those that recorded behavior, and because multiple behavior-based questions provided a similar pattern of results, we feel that these are a more accurate reflection of participants' interest in science and have based our results on these findings.