



MULTIMEDIA RESEARCH

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Talk of the Nation: Science Friday
Summative Evaluation
Study 1

Report for
Samanna Productions
National Public Radio

by
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EXECUTIVE SUMMARY OF SUMMATIVE EVALUATION
MULTIMEDIA RESEARCH
SEPTEMBER 4, 2003

Talk of the Nation: Science Friday (SF) is a weekly two-hour listener call-in talk show devoted to the understanding of complex scientific topics and methods. The series is hosted by science correspondent Ira Flatow and broadcast on National Public Radio to 180 stations nationwide as well as via satellite and the Internet. With support from the National Science Foundation, Multimedia Research presents the first study of a two-part summative evaluation on the impact of *Science Friday* on public radio listeners, focusing on the series' future increased emphasis on public understanding of basic research.

The evaluation assessed what demographic or background characteristics relate to whether or not one listens to *SF* and to frequency of listening; what effects the series has on listeners and what kind of actions the series has prompted in listeners. Questionnaires were mailed to random names drawn from member subscriber lists of public radio stations serving the areas surrounding Denver, CO, San Antonio, TX and Boston, MA. Of the 1189 questionnaires that adult public radio members received, 740 or 62% were returned for analysis. Given that 2.1 million listeners contribute to public radio according to CPB revenue report data and that there are about 21 million listeners according to Arbitron estimates, our contributor lists represent about 10% of the listening audience. Thus, we can generalize our results to all subscribers and to about 10% of the total public radio audience.

Who are Listeners of *Science Friday*?

Seven of ten respondents reported listening to *Science Friday*. Almost six of ten respondents tune into the series once per month or more often. Just 12% of respondents listen every week.

Our respondent sample is typical of a public radio member audience – more educated, better employed, older with fewer minorities compared to the general U.S. adult population. No demographic variable showed more than a weak association with listening behavior

Listeners of *Science Friday* rated themselves as significantly more interested in science generally than non-listeners. "Radio" was chosen as a major source of science news by significantly more *SF* listeners (62%) than non-listeners (28%). "Magazines/journals" and "newspapers" were also major sources of science news for both groups. Listeners agreed significantly more than non-listeners with one of eight belief statements about science research:

"It is important for me to understand the process of scientific discovery."

Listening to *Science Friday* is not related to respondents' thinking about the value of basic research. About one-fifth of the sample were not able to explain the value or importance of basic research, but those who could focused mainly on basic research as the

foundation of science (30%), as enhancing knowledge (18%), as leading to discoveries or applications (14%) and as a requirement for understanding our world (12%). Listening to *Science Friday* is not related to respondents' thinking about the barriers or obstacles that prevent scientists from doing basic research. About one-quarter of the sample were not able to describe barriers to basic research, but those who did focused mainly on the obstacles of politics (16%), the lack of reward or recognition (14%) and barriers of government policies (13%).

Appeal of *Science Friday*

Listeners rate the series as highly appealing. Nine out of 10 listeners agree or strongly agree that they "enjoy listening to the series," and 8 out of 10 agree or strongly agree that they "listen attentively" to the show. Seven out of 10 listeners agree or strongly agree with the statement that "Ira Flatow asks questions of guest scientists that I would ask." Six of ten listeners disagree or strongly disagree with the observation that "call-in questions of guest scientists detract from the value of the program."

Listening frequency and interest in science were both significantly and moderately related to listening enjoyment, as expressed by the statement "I enjoy listening to the series."

Comprehension of *Science Friday*

Listeners rate the series as highly understandable. Nine of 10 listeners disagree or strongly disagree that the "information on *Science Friday* is too technical," and 8 of 10 disagree that "the process of research as presented by guest scientists is confusing." Eight of 10 listeners felt that "the series keeps them up to date about current science research," and 7 of 10 agreed the "series has reinforced their understanding of the process of research." The series information was rated as "usually familiar" by less than a third of the listening audience, novel by more than a third and sometimes familiar and sometimes novel by the remaining third of listeners. Thus, the information on *Science Friday* is targeted at an appropriate level to reach the public radio member audience effectively.

Knowledge of science was significantly and moderately associated with ratings of the statement, "the information is too technical for me." Interest in science was significantly and moderately associated with ratings of the statements: "the information is too technical for me" and "I am usually familiar with most of the information given in the show." Listening frequency was significantly and moderately associated with the statement, "the series keeps me up to date about current science research."

Learning from *Science Friday*

Eight out of 10 listeners felt that *Science Friday* is successful or very successful at helping them understand "what research underpins significant new discoveries," "how scientists go about doing their research," and "how failures in research can be useful to achieve eventual success." Seven of 10 listeners felt the series is successful at helping them understand "what barriers must be overcome to carry out successful research" and "what length of time it takes to reach reliable conclusions." Six of 10 listeners felt

the show is successful at presenting “what role corporations, private institutions and foundations play in research.”

A significant and moderate association was found between self-reported level of science knowledge and assessment of SF’s success in showing “what research underpins significant new discoveries.”

Impact of *Science Friday*

The series has successfully prompted listeners to take further action. Almost all (93%) reported following up their listening with at least one action. Almost half (47%) of listeners reported carrying out three or more actions as a result of the series. The most frequent activities are discussing topics with others (87%), reading related information (58%), searching for more information about a topic (41%) and accessing a web site (30%). Other prompted activities include purchasing a book or other item related to a show topic (22%), using content in teaching (12%), and writing to *Science Friday*, a scientist, politician or other (3%). More frequent listening relates to a wider variety of actions away from the radio.

The action of accessing an Internet web site showed a significant and moderate association with use of the web and newspapers as major sources of science news. Searching for more information on a topic was significantly and moderately associated to both self-reported interest in and knowledge about science.

Conclusion

In conclusion, 70% of our public radio members listen to *Science Friday* and 58% tune in once a month or more often. Radio is identified as a significant major source of science news by listeners of *Science Friday* as compared to non-listeners. Listeners rate the series as highly appealing and understandable and indicate a high comprehension of science research issues. Additionally, the series prompts listeners to carry out a variety of actions outside of the two-hour program.

Listeners are more likely than non-listeners to feel that it is important for them to understand the process of scientific discovery. However, currently there are no other differences between listeners and non-listeners with respect to learning goals that the new NSF grant supports. *Science Friday*’s programs will emphasize these areas of interest in the next few years, and the next round of summative evaluation will compare again listeners and non-listeners.

SUMMATIVE EVALUATION OF SCIENCE FRIDAY RADIO SERIES

MULTIMEDIA RESEARCH • BELLPORT, NY
SEPTEMBER, 2003

INTRODUCTION

Talk of the Nation: Science Friday (SF) is a weekly two-hour listener call-in talk show devoted to the understanding of complex scientific topics and methods. The series is hosted by science correspondent Ira Flatow and broadcast on National Public Radio to 180 stations nationwide as well as via satellite and the Internet.

In 2003, with support of an NSF grant over the next few years, *SF* is increasing its emphasis on public understanding of contemporary research. *SF*'s goals under this NSF grant include the following:¹

- Finding the research roots at the bottom of each story;
- Exploring the cooperation among corporations, private institutions and research foundations, when appropriate, illuminating how each one plays a role in the research process;
- Following the research “bumps” in the road to illustrate that research success depends upon failures—not all research produces positive results;
- Illuminating the barriers to successful research;
- Helping listeners understand the thought process of researchers;
- Scaling the “ivory tower” by enabling listeners to question and talk directly with researchers;
- Helping listeners understand the role of basic research in policy-making.

This report presents the first study of a two-part summative evaluation on the impact of *Science Friday* on public radio listeners. The second study will occur in two years, permitting time for the expanded focus to become familiar to most listeners.

METHOD

Research Design

This study involved mailing a one-page double-sided questionnaire, return envelope and \$1 incentive to a random sample of people who are subscription members of their local public radio station. Recipients were asked to fill out the questionnaire and mail it back to the researcher. The respondents were then divided for analysis into two groups -- those who listen to *Science Friday* and those who do not.

¹ NSF Proposal Number 0206324, Award Abstract, National Public Radio's "Talk of the Nation Science Friday."

The following specific research questions were addressed in the data analyses:

- What percent of the radio member audience listens to *SF* and how frequently?
- Do demographic characteristics including age, gender, education, geographical location and occupation relate to whether a person listens to the program?
- Do self-reported background characteristics including interest in science, level of science knowledge, preferred science news sources and beliefs about science research relate to listening to *SF*?
- Does understanding the value of basic research and the barriers to doing basic research relate to whether a person listens to the program?
- How appealing is *SF* and do demographic or background variables relate to appeal?
- How understandable is *Science Friday* and do demographic or background variables relate to comprehension?
- How successful is *Science Friday* in helping listeners understand research and do demographic or background variables influence this understanding?
- Has the series prompted listeners to take further action?

Questionnaire

The questionnaire was comprised of several sections. All respondents answered sections 1 – 4. Only *Science Friday* listeners answered sections 5 – 6.

1. Demographic questions established the sample's distribution of geographical location, age, gender, ethnicity, occupational status, and highest level of education.
2. Rating questions assessed science-related background including general interest in science, perceived level of science knowledge, main sources of science news, and beliefs about scientific research.
3. Open-ended questions explored understanding of the value or importance of basic research and what obstacles or barriers prevent scientists from doing basic research.
4. Exposure questions determined whether a respondent had heard of or listened to *Science Friday* and the frequency of listening activity.
5. Appeal, comprehension and learning were addressed by 16 statements with which respondents agreed or disagreed on a five-point scale.
6. Actions taken as a result of listening to the series were assessed through a check-off list of probable activities.

Sample

In June, 2003, double-sided questionnaires with a \$1 incentive were sent to a randomly generated subset of 400 members of each of three public radio areas:²

- Colorado Public Radio, broadcasting around Denver, CO;
- Texas Public Radio, broadcasting around San Antonio, TX; and
- Boston University Public Radio, broadcasting around Boston, MA.

The 1200 questionnaires were anonymous and confidential. Recipients were asked to complete the questionnaire and mail it back. All questionnaires received within 9 weeks of mailing were included in the study analyses. Demographics of the sample are included in the results section.

Analyses

Reported percentages are rounded off in text and tables. To explore possible significant differences between listeners and non-listeners, chi-square analyses, t -tests and appropriate effect size calculations were performed. In recognition of the large sample size, only statistically significant findings at $p \leq .0001$ are reported in the text and only significant findings having at least “moderate” effect sizes are reported (e.g., Cramer’s $V \geq .20$).

Demographic variables examined include age, gender, educational level and occupational status (professional, skilled, unskilled). Because of the relatively small number of minorities in this sample, results related to ethnic/racial background were not explored. Background variables examined include interest in science, self assessed knowledge of science, major sources of science news, science beliefs, understanding of basic research, listening or not listening to *Science Friday* and frequency of listening.

² Our thanks to the following public radio administrators for their cooperation and participation in this study: Sean Nethery at KVID, Colorado Public Radio; Joe Gwathmey at KSTX, Texas Public Radio, and Jane Christo at WBUR, Boston University Public Radio.

RESULTS

Return Rate

Of the 1200 surveys mailed out, 3 were returned as undeliverable, 4 were returned uncompleted and 4 were returned from high school students. Of the 1189 surveys remaining, 740 were completed and returned within a 9-week period following the mailing. This represents a very high 62% return rate. The returned questionnaires include 36% from Colorado radio members, 34% from Texas members and 30% from Massachusetts area members including adjacent states.

Listeners and Non-Listeners

I. What percent of the radio member audience listens to the series and how frequently?

Seven of ten respondents reported listening to *Science Friday*. Almost six of ten respondents tune into the series once per month or more often. Just 12% of respondents listen every week.

Respondents were asked how often they listen to the public radio series, *Talk of the Nation: Science Friday*. Of the 740 respondents, 70% (n = 521) were listeners:³

- 12% heard the series “every week;”
- 46% heard it “1-3 times per month;”
- 13% heard it “less than once per month;”
- 17% never heard it or did not hear it often enough to answer the feedback questions;
- 12% were not aware of the series.

Demographic Information

II. Do demographic characteristics including age, gender, education, geographical location and occupation relate to whether a person listens to the program?

Our respondent sample is typical of a public radio member audience – more educated, better employed, older with fewer minorities compared to the general U.S. adult population. No demographic variable showed more than a weak association with listening behavior.

³ In similar studies in earlier years, Multimedia Research found 47% of Boston, MA public radio members were *SF* listeners (1998) and 66% of Tallahassee, FL public radio members (1997) were listeners.

Table 1 presents demographic information for the whole sample as well as for the sub-groups of listeners and non-listeners. The respondent sample included few minorities (6%) and more women (55%) than men (45%). The mean age for the respondents was 54 years, with a relatively normal distribution from 22 to 92 years. Most respondents (67%) were employed, mostly at jobs considered to be in the high level of occupational status (executive and major professionals to managers and small business owners). The majority of respondents (68%) also reported having post-college education. Thus, our respondents, drawn randomly from three stations' membership lists, are more educated, better employed, older and include fewer people of color than the general U.S. adult population. However, the sample is typical of a public radio member audience; this sample's demographics are similar to random samples Multimedia Research has obtained recently from other public radio membership lists. Chi-square analyses looked at differences between listeners and non-listeners with respect to the demographic characteristics but none showed more than a weak association with listening behavior.

Table 1 Distribution of Demographic Variables (each cell = 100%)

	All Respondents N=740	Listeners n=521 (70% of sample)	Non-Listeners n=219 (30% of sample)
State: CO	36%	31%	47%
TX	34%	39%	22%
MA	30%	30%	31%
Gender: Male	45%	45%	47%
Female	55%	55%	53%
Age: Mean	54	53	57
Median	54	54	57
Range	22-92	24-85	22-92
Ethnic Status:			
White	94%	93%	95%
Minority	6%	7%	6%
Employment Status:			
Employed:	67%	71%	59%
High Status ⁴	74%	73%	78%
Medium Status	20%	20%	19%
Low Status	6%	8%	3%
Retired	25%	22%	33%
Homemaker	6%	6%	6%
Unemployed	1%	1%	<1%
Student	1%	<1%	1%
Education:			
Graduated H.S.	1%	1%	-%
Some College	7%	9%	5%
Graduated College	24%	20%	32%
Post-College	68%	70%	63%

⁴ "High" occupational status includes those with professional and managerial jobs; "medium" are technical or skilled jobs; and "low" are unskilled or menial labor.

Science Interest, Knowledge, Sources and Beliefs

III. Do background characteristics including interest in science, level of science knowledge, preferred science news sources and beliefs about science research relate to whether a person listens to the program?

Listeners of *Science Friday* rated themselves as significantly more interested in science generally than non-listeners.

“Radio” was chosen as a major source of science news by significantly more *SF* listeners (62%) than non-listeners (28%). “Magazines/journals” and “newspapers” were also major sources of science news for both groups.

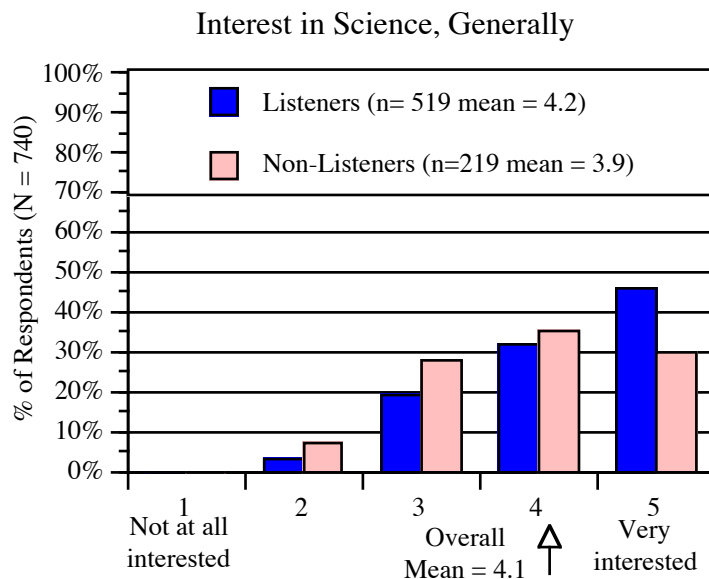
Listeners agreed significantly more than non-listeners with one of eight belief statements about science research:

“It is important for me to understand the process of scientific discovery.”

Science Interest

Respondents were asked how interested they are in science, generally speaking. They responded using a five-point scale from not at all interested (1) to very interested (5). Of the sample as a whole, 74% were either interested or very interested (4, 5) in science. The average rating (M) for the sample was 4.1 with a standard deviation (SD) of .9. These results are equivalent to other recent studies of public radio members.

As shown in the chart to the right, listeners are more interested in science than non-listeners. On average, listeners report a significantly higher interest in science (M = 4.2, SD = .9) than non-listeners (M = 3.9, SD = .9).⁵ Interest in science is a small but significant predictor of listening to *Science Friday*, accounting for 2.5% (R^2) of the variance in listening/non-listening.⁶

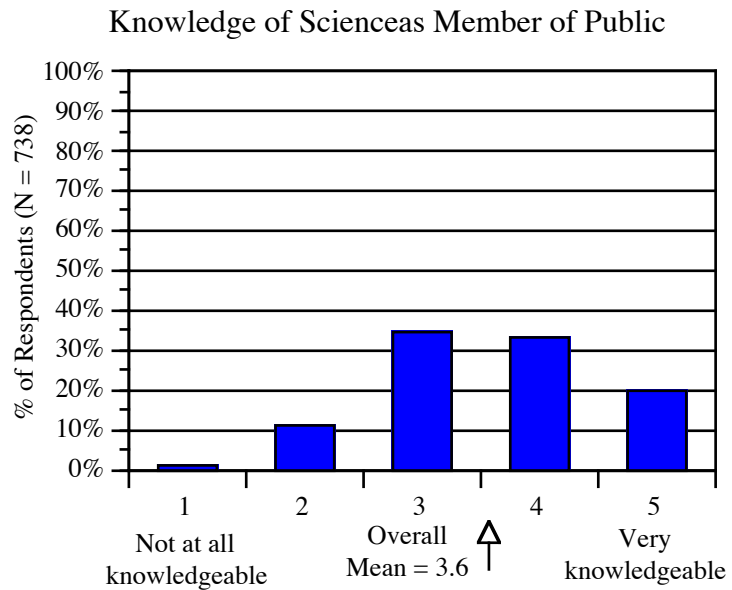


⁵ $t(385)=4.36, p \leq .0001, \text{Cohen's } d = .36.$

⁶ $F(1, 736) = 20.1, p \leq .0001, R^2 = 2.7, R^2 \text{ adjusted} = 2.5$

Science Knowledge

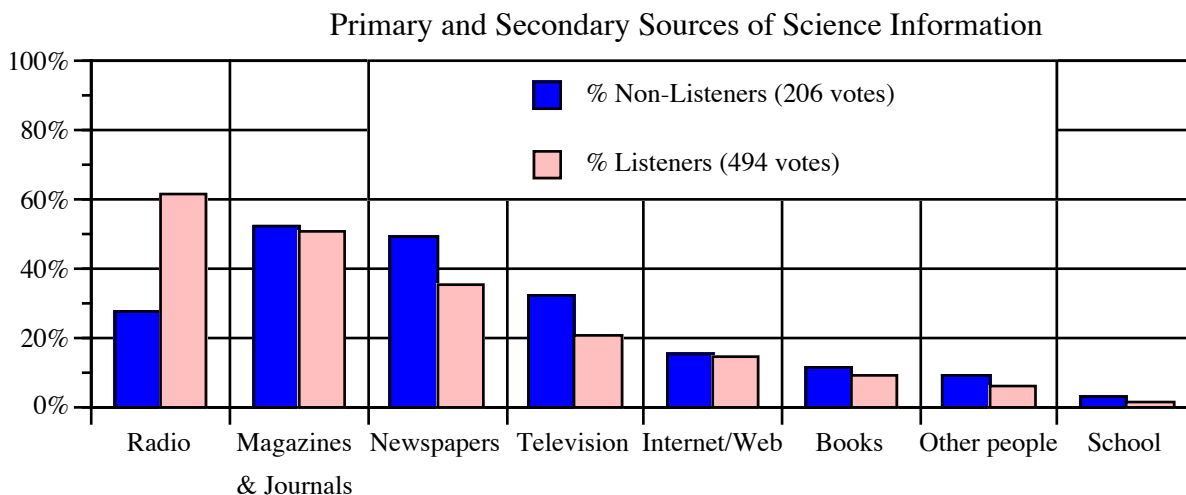
Respondents rated their level of science knowledge as a member of the general public, using a five-point scale from not at all knowledgeable (1) to very knowledgeable (5). Of the sample as a whole, 53% ranked themselves as knowledgeable or very knowledgeable (4, 5, see chart). This is similar to percentages obtained in other public radio member studies. The average rating for the sample was 3.6 with a standard deviation of 1.0. Listeners did not differ significantly from non-listeners in their self-reported knowledge of science.



Science News Sources

Respondents were asked to indicate their primary and secondary source of science news, given eight possible sources. The largest percentage of both listeners and non-listeners reported that “magazines/journals” were their primary source of science news: Listeners (35%); Non-Listeners (37%). This result is consistent with previous Multimedia Research studies of public radio audiences. Respondents also identified their secondary source of science information from the same list. Listeners of *Science Friday* indicated “radio” as their most frequent secondary choice (35%), whereas the most frequent secondary choice for non-listeners was “newspapers” (25%).

The chart below combines the votes for primary and secondary sources of science news and gives an overall picture of where the public radio members feel they obtain most of their science news.



Combining primary and secondary responses, half of public radio members said their primary or secondary source of science news was “radio” (52%) and half said “magazines/journals” (51%). Newspapers were a major source of science news for 39% of all member respondents and television for 24%.

Listeners of *Science Friday* considered their major sources of science news to be “radio” (62%), “magazines/journals” (51%), “newspapers” (35%) and “television” (21%). Non-listeners indicated their major sources of science news as “magazines/journals” (52%), “newspapers” (49%), “television” (32%) and “radio” (28%). Listeners were significantly more likely than non-listeners to list “radio” as one of their two sources of science news. Choosing radio as a major source of science news is a small but significant predictor of listening or not listening to *Science Friday* ($R^2 = 9.7\%$).⁷

Beliefs about Science Research

Beliefs about science research were assessed by asking respondents to rate their agreement or disagreement with a randomly presented series of four positive and four negative statements, using a 5-point scale where (1) indicates strongly disagree and (5) indicates strongly agree. Mean agreement for each statement is presented in Table 3, with non-listeners’ means in brackets. Listeners believed more strongly than non-listeners that “it is important to understand the process of scientific discovery;” a significant and moderate association was found.⁸

Table 3 Beliefs about Science Research:

Belief Statements	Strongly Disagree					Strongly Agree				
	1	2	3	4	5					
Positive Statements	[Non-Listener Mean]					Listener Mean				
Failures are as important as successes in learning the truth in science.						[4.3] 4.5				
It is important for me to understand the process of scientific discovery.						[3.9] 4.3				
Basic scientific research is tedious and time-consuming.						[3.8] 3.8				
Scientists are open to new evidence even when it conflicts with findings that have stood through many tests.						[3.6] 3.6				
Negative Statements										
Significant new discoveries need not be replicated by independent researchers to be accepted.	1.8 [1.9]									
Science research should have no role in government policy-making.	1.9 [2.1]									
Breakthroughs in science typically involve a brilliant person working alone.	2.1 [2.2]									
Really important research discoveries are made accidentally.	2.6 [2.7]									

⁷ $F(1, 698) = 74.6, p \leq .0001, R^2 = 9.7, R^2 \text{ adjusted} = 9.5$

⁸ $\chi^2(4, N = 737) = 34.91, p \leq .0001, \text{Cramer's } V = 0.22.$

Understanding of Basic Research

IV. Does understanding the value of and barriers to doing basic research relate to whether a person listens to the program?

Listening to *Science Friday* is not related to respondents' thinking about the value of basic research. About one-fifth of the sample were not able to explain the value or importance of basic research, but those who could focused mainly on basic research as the foundation of science (30%), as enhancing knowledge (18%), as leading to discoveries or applications (14%) and as a requirement for understanding our world (12%).

Listening to *Science Friday* is not related to respondents' thinking about the barriers or obstacles that prevent scientists from doing basic research. About one-quarter of the sample were not able to describe barriers to basic research, but those who did focused mainly on the obstacles of politics (16%), the lack of reward or recognition (14%) and barriers of government policies (13%).

Understanding the Value or Importance of Basic Research

The following open-ended question was presented to all respondents:

Basic science research can be defined as research that has no immediate applied or commercial value. What, if anything, do you see as the value or importance of basic research?

One-fifth (21%) of the sample did not provide an answer to this question. Those with graduate education were significantly more likely to give an answer as to the value of basic research compared with those who had a college degree or less education (83% vs. 70%), although this is a weak association.⁹

Every answer was coded by keyword or keyphrase and combined into logical categories. For example, all answers mentioning foundation, fundamental, basis, building block, starting point, groundwork or springboard were coded under the category of "foundation of science." Categories receiving more than 5% of respondents' interest are presented in Table 4 with example answers; whereas those categories receiving 2% - 5% are bulleted briefly after Table 4. Listeners did not differ from non-listeners in the tallies for any category, nor did listening frequency relate to frequency of response categories.

Basic research was valued mainly because it is the foundation of science (30%), enhances knowledge (18%), leads to discoveries or applications (14%) or increases our understanding of the world (12%).

⁹ $\chi^2(1, N = 740) = 14.53, p \leq .0001, \text{Cramer's } V = 0.14.$

Table 4 Distribution of Categories Coded for Value of Basic Research

Categories Code words and Phrases Example answers of value or importance of basic research	All N= 740	Listeners n=521	Non Listeners n=219
Foundation of Science Foundation, fundamental, basis, building block, starting point, groundwork, springboard "Foundation for all other research into applied or commercial uses." "Fundamental understanding is essential to provide basis for applied research." "It lays the basis for future applied research." "The building block upon which all research depends."	33%	25%	30%
Enhances Knowledge Enhances/further/increases/advances/expands Knowledge "Expanding one's knowledge for the sole purpose of learning." "Furthers knowledge." "Increases knowledge." "Advances knowledge."	17%	21%	18%
Leads to Discoveries or Applications Leads to discoveries/breakthroughs/advances Leads to applied research/applications/useful findings "Can lead to discoveries that have important applications." "It leads to more comprehensive studies that could have such value." "Basic science discoveries can lead to technological advances." "Spawns the ideas that lead to useful, real-world applications."	14%	13%	14%
Increases Understanding of the World Increases/further/advances Understanding of the world/universe/us/basic laws/natural processes "To understand the world around us, it is necessary to explore it scientifically. Without science, we would still be in the dark ages." "Pushing the envelope on our basic understanding of the universe is essential to scientific advancement. Paradigm shifts are impossible without basic research."	12%	11%	12%
May have Application in the Future May have impact/application/applied value/utility/progress in the future/eventually/ultimately/long-term/later "May improve lives eventually." "Long-term utility." "Important for future development." "Could have impact in the future."	6%	5%	6%
Value in Accidental Results or Discoveries Accidental, unknown, unintended, unexpected You never know, Not looking "Source of accidental discoveries." "Unexpected results are valuable." "Often scientists may "stumble over" the answer to a second unrelated question which may be useful." "You never know what you may find until you do the research." "Commercially valuable findings may just happen when one is not looking specifically for it."	6%	5%	6%

- 2% of respondents described basic research as that which "opens new doors / areas / options / frontiers / avenues / roads / vistas."

Understanding the Obstacles or Barriers that Prevent Basic Research

The following open-ended question was presented to all respondents:

What obstacles or barriers, besides money, do you think prevent scientists from doing basic research?

One-quarter (23%) of the sample did not provide an answer to this question. Every answer was coded by keyword or keyphrase and combined into logical categories. For example, all answers mentioning politics, politicians, political, public policy or lobbyists were coded under the category of "politics." Categories receiving more than 5% of respondents' interest are presented in Table 5 with example answers; whereas those categories receiving 2% - 5% are bulleted briefly after Table 5. Listeners did not differ from non-listeners in the tallies for any category, nor did listening frequency relate to frequency of response categories.

The main barriers mentioned were politics (16%); lack of reward or recognition (14%); and government policies (13%).

Table 5 Distribution of Categories of Obstacles Preventing Basic Research

Categories Code words and Phrases Example answers of obstacles or barriers preventing scientists from doing basic research	All N= 740	Listeners n=521	Non Listeners n=219
Politics Politics, politicians, political, public policy, lobbyists "Interference by politicians," "Lobbyists could have a stultifying effect." "Political ideologies that place certain topics off limits."	16%	16%	16%
Lack of Reward or Recognition Lack of reward/status/recognition/prestige/glamour Won't help with career advancement "Lack of recognition, lack of appreciation." "Less glory, less chances to advance up the career ladder." "Likelihood of laboring in obscurity without much in the way of honors and adulation."	14%	15%	14%
Government Policy Government policy/restraints/restrictions/intervention Government laws/regulations "Government regulations (e.g., stem cell research)" "Government intervention, laws and regulations." "Government policies that don't support unsexy research."	12% 3% noted stem cell research as example	13%	8%
Religion Religious groups/beliefs/views/ideology/customs/bias "Perceived religious dogma" "Anti-intellectual religious bias in US." "Religious leaders uncomfortable with science that contradicts or challenges religious ideas."	9%	9%	9%
Lack of Immediate Value or Profit Lack of immediate value/utility/reward/profit/payback "Lack of immediate commercial reward potential." "Funding process demands immediate, headline-making results." "Lack of understanding that no immediate value does not mean no value at all."	9%	9%	6%
Lack of Time Time, distractions "Lack of time." "Distractions that require them to be doing things related to re- search, but not research itself, i.e., grant writing." "Time constraints (i.e., needing to do financially productive work over explorative work).	7%	6%	9%
Lack of Education Education, schools, training, qualified "Science training is no longer a priority in public schools." "Lack of trained individuals." "Lack of qualified researchers."	6%	7%	4%
Lack of Public Understanding Public understanding, ignorance "No public awareness or understanding." "Public ignorance of its importance."	5%	6%	4%
Cultural Prejudice Cultural prejudice/bias/values "Cultural biases."	5%	5%	5%

- 4% of respondents suggested that obstacles to basic research included conventional thinking, scientific orthodoxy, a lack of imagination or resistance to new ideas.
- 3% listed moral beliefs or conflicts or ethical issues as barriers to basic research.
- 3% mentioned the barrier of politics within academics or companies or politics among scientists, as distinct from governmental politics.
- 2% felt obstacles were raised by public opinion, public lack of respect or appreciation, public lack of interest or support of basic research.
- 2% thought basic research was restrained by limited employment and academic positions.
- 2% wrote of fear of change or fear of research conclusions as an inhibiting factor.
- 2% noted the lack of proper equipment or facilities as obstacles.

Appeal of Science Friday

V. How appealing is *Science Friday* and do demographic or background variables relate to appeal?

Listeners rate the series as highly appealing. Nine out of 10 listeners agree or strongly agree that they “enjoy listening to the series,” and 8 out of 10 agree or strongly agree that they “listen attentively” to the show. Seven out of 10 listeners agree or strongly agree with the statement that “Ira Flatow asks questions of guest scientists that I would ask.” Six of ten listeners disagree or strongly disagree with the observation that “call-in questions of guest scientists detract from the value of the program.”

Listening frequency and interest in science were both significantly and moderately related to listening enjoyment, as expressed by the statement “I enjoy listening to the series.”

Listeners responded to statements reflecting feelings about the series using a 5-point scale from strongly disagree (1) to strongly agree (5). Four statements relating to appeal appear in Table 6 with their mean ratings.

Almost all listeners agree or strongly agree that they “enjoy listening to the series, *Science Friday*. Significant and moderately strong associations were found between listening enjoyment and listening frequency¹⁰ and between listening enjoyment and interest in science.¹¹

Table 6. Agreement with Statements on Appeal of *Science Friday*

Means	% who “agree” or “strongly agree”	Statements
4.4	96%	I enjoy listening to the series, <i>Science Friday</i>
4.0	80%	I listen attentively when I hear the series come on the radio.
3.8	74%	Ira Flatow asks questions of guest scientists that I would ask.
	% who “disagree” or “strongly disagree”	
2.4	59%	The call-in questions from listeners detract from the value of the program.

¹⁰ $\chi^2(4, N = 521) = 67.87, p \leq .0001$, Cramer’s V = 0.26.

¹¹ $\chi^2(6, N = 519) = 71.30, p \leq .0001$, Cramer’s V = 0.26.

Comprehension of *Science Friday*

VI. How understandable is *Science Friday* and do demographic or background variables relate to comprehension?

Listeners rate the series as highly understandable. Nine of 10 listeners disagree or strongly disagree that the “information on *Science Friday* is too technical,” and 8 of 10 disagree that “the process of research as presented by guest scientists is confusing.” Eight of 10 listeners felt that “the series keeps them up to date about current science research,” and 7 of 10 agreed the “series has reinforced their understanding of the process of research.” The series information was rated as “usually familiar” by less than a third of the listening audience, novel by more than a third and sometimes familiar and sometimes novel by the remaining third of listeners. Thus, the information on *Science Friday* is targeted at an appropriate level to reach the public radio member audience effectively.

Knowledge of science was significantly and moderately associated with ratings of the statement, “the information is too technical for me.” Interest in science was significantly and moderately associated with ratings of the statements: “the information is too technical for me” and “I am usually familiar with most of the information given in the show.” Listening frequency was significantly and moderately associated with the statement, “the series keeps me up to date about current science research.”

Listeners responded to statements reflecting comprehension of the series using a 5-point scale from strongly disagree (1) to strongly agree (5). Five statements relating to clarity and comprehension appear in Table 7 with their mean ratings.

Table 7. Agreement with Statements on Comprehension of *Science Friday*

Means	% who “agree” or “strongly agree”	Statements
3.9	80%	The series keeps me up to date about current science research.
3.8	71%	The series has reinforced my understanding of the process of research.
	% who “disagree” or “strongly disagree”	
1.9	87%	The information on <i>Science Friday</i> is too technical for me.
2.1	82%	The process of research as presented by the guest scientists is confusing.
2.9	35%	I am usually familiar with most of the information given in the series.

- 87% disagreed or strongly disagreed with the statement that “the information on *Science Friday* is too technical for me.”¹² Ratings of this statement were correlated with self-assessed knowledge of science ($R_s = -.38$) and interest in science ($R_s = -.39$) As the audience members’ knowledge of science increases and interest in science increases, so does their disagreement with the description that “the information is too technical.” Knowledge and interest were significantly and moderately associated with ratings of the statement.¹³
- 82% disagreed or strongly disagreed with the statement that “the process of research as presented by the guest scientists is confusing.”¹⁴
- 80% agreed or strongly agreed that “the series keeps me up to date about current science research.” A significant but moderate association was found between agreement with this statement and listening frequency.¹⁵
- 71% agreed or strongly agreed that “the series has reinforced their understanding of the process of research.”
- In response to the statement “I am usually familiar with most of the information given in the show,” 28% of listeners agreed, 37% were neutral, and 35% disagreed. This distribution indicates that the information is targeted at a level to reach the mass radio audience effectively – the information is usually familiar to less than a third, novel to more than a third and sometimes familiar and sometimes novel to the remaining third of the audience. Ratings of this statement were significantly and moderately associated with interest in science.¹⁶

¹² This statement may be reconsidered in the following way: 87% of listeners agree that the information on *Science Friday* is not too technical for them.

¹³ Knowledge $\chi^2(16, N = 518) = 140.4, p \leq .0001$, Cramer’s V = 0.26. Interest $\chi^2(12, N = 517) = 94.07, p \leq .0001$, Cramer’s V = 0.25.

¹⁴ This negative statement may be reconsidered in the positive as follows: 82% of listeners agree that the process of research as presented by the guest scientists is clear.

¹⁵ $\chi^2(8, N = 516) = 75.45, p \leq .0001$, Cramer’s V = 0.27.

¹⁶ $\chi^2(12, N = 517) = 65.24, p \leq .0001$, Cramer’s V = 0.21.

Learning from *Science Friday*

VII. How successful is *Science Friday* in helping listeners understand research and do demographic or background variables influence this understanding?

Eight out of 10 listeners felt that *Science Friday* is successful or very successful at helping them understand “what research underpins significant new discoveries,” “how scientists go about doing their research,” and “how failures in research can be useful to achieve eventual success.” Seven of 10 listeners felt the series is successful at helping them understand “what barriers must be overcome to carry out successful research” and “what length of time it takes to reach reliable conclusions.” Six of 10 listeners felt the show is successful at presenting “what role corporations, private institutions and foundations play in research.”

A significant and moderate association was found between self-reported level of science knowledge and assessment of *SF*'s success in showing “what research underpins significant new discoveries.”

Using a 5-point scale from not at all successful (1) to very successful (5), listeners rated statements about the success of *Science Friday* in helping them understand a research story. Five statements relating to *SF*'s success at presenting a research story appear in Table 8 with respondents' mean ratings.

Table 8. Agreement with Statements on Success of *SF* in presenting a research story

Means	% choosing “successful” or “very successful”	Statements about <i>SF</i> 's success in helping listener understand the following about a research story
3.96	81%	what research underpins significant new discoveries
3.92	79%	how scientists go about doing their research
3.91	78%	how failures in research can be useful to achieve eventual success
3.79	70%	what barriers must be overcome to carry out successful research
3.74	68%	what length of time it takes to reach reliable conclusions
3.60	58%	what role corporations, private institutions and foundations play in research
3.49	53%	what role research plays in government policy-making

A significant but moderate association was found between self-reported level of science knowledge and assessment of *SF*'s success in showing "what research underpins significant new discoveries."¹⁷

VIII. Has the series prompted listeners to take further action?

The series has successfully prompted listeners to take further action. Almost all (93%) reported following up their listening with at least one action. Almost half (47%) of listeners reported carrying out three or more actions as a result of the series. The most frequent activities are discussing topics with others (87%), reading related information (58%), searching for more information about a topic (41%) and accessing a web site (30%).

Those who hear the show more frequently were more likely to report that the show had prompted them to a wider variety of actions.

The action of accessing an Internet web site showed a significant and moderate association with use of the web and newspapers as major sources of science news. Searching for more information on a topic was significantly and moderately associated to both self-reported interest in and knowledge about science.

Respondents were asked whether listening to *Science Friday* had ever prompted them to take any of seven further actions, as shown in Table 9. Those who hear the show weekly reported an average of 3.1 actions; those who hear the show 1-3 times per month reported an average of 2.6 actions; and those hearing the show fewer times reported doing an average of 1.8 actions. More frequent listening relates to a wider variety of actions away from the radio.

Table 9. Actions Prompted by Listening to *Science Friday*

Has listening to <i>Science Friday</i> ever prompted you to . . .	Listeners (n = 521)
discuss the topics with others	87%
read related information in books, magazines, newspapers	58%
search for more information about a topic	41%
access an Internet web site, including <i>Science Friday</i> 's	30%
purchase a book or other item related to a show topic	22%
use content in teaching	12%
write to <i>Science Friday</i> , a scientist, politician or other	3%

¹⁷ $\chi^2(16, N = 515) = 87.83, p \leq .0001, \text{Cramer's } V = 0.21.$

Table 9 shows that 30% of listeners have accessed “an Internet web site, including *Science Friday’s*”. Choice of this activity showed significant and moderate relationships with use of the web¹⁸ and use of newspapers¹⁹ as a primary or secondary source of science news. Also, the activity of “searching for more information on a topic” was moderately and significantly associated to both self-reported interest in²⁰ and knowledge of science.²¹

Respondents were encouraged to describe other unlisted actions that have been prompted by their listening to *Science Friday*. A small but varied set of actions were elicited, including:

Think. (4 respondents)

Reflect on state of human existence.

Change the way I saw something.

After hearing piece on snakes, I embarked on personal project to “like” them, watching in yard, desensitizing my fear/loathing.

Changed diet, exercise.

Found some biochemists to team up with to research treatments for my own muscle disease.

Yell at people who oppose the use of embryonic cell lines in stem cell research.

Developed an activity related to the topic to share the knowledge with my children.

Encourage others to listen.

Ordered tapes of *Science Friday*.

Used telescope.

¹⁸ $\chi^2(1, N = 490) = 34.13, p \leq .0001, \text{Cramer's } V = 0.26.$

¹⁹ $\chi^2(1, N = 490) = 25.82, p \leq .0001, \text{Cramer's } V = 0.23.$

²⁰ $\chi^2(3, N = 513) = 27.40, p \leq .0001, \text{Cramer's } V = 0.23.$

²¹ $\chi^2(4, N = 513) = 24.72, p \leq .0001, \text{Cramer's } V = 0.22.$