Life Sciences Communication
UNIVERSITY OF WISCONSIN–MADISON

Public Engagement with Basic Science: A Systematic Review

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Overview

1. Public opinion trends on federal funding for basic science research

2. Review of public engagement research in STEM journals

Funding for basic science remains high

Agency	2017 (Millions $)		2018 (Millions $)		% change	
	Basic	Applied	Basic	Applied	Basic	Applied
All	33,265	36,376	33,711	37,550	1.3	3.2
USDA	965	1,251	1,006	1,335	4.3	6.7
DOD	2,110	5,068	2,261	5,429	7.2	7.1
DOE	4,494	4,861	4,930	6,451	9.7	32.7
DHHS	16,700	16,977	16,733	16,720	0.2	-1.5
NASA	3,425	2,319	3,712	2,521	8.4	8.7
NSF	4,739	778	4,279	670	-9.7	-13.8

Source: National Science Foundation

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Source: National Science Foundation

# US public overwhelmingly supports basic science funding

"Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government."

— Agree or strongly agree   — Disagree or strongly disagree
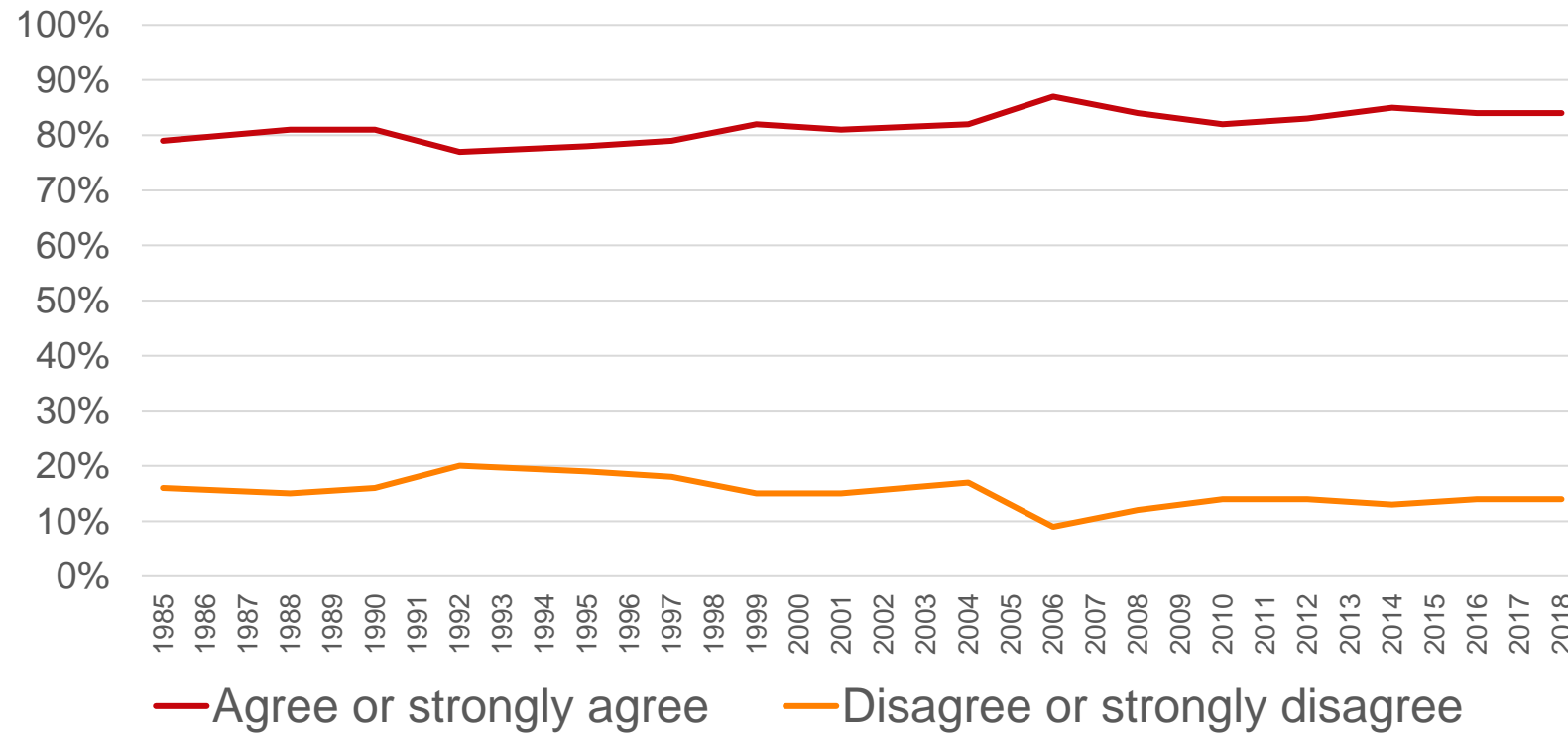
Source: NSF Science & Engineering Indicators
Data: General Social Survey, NSF, University of Michigan

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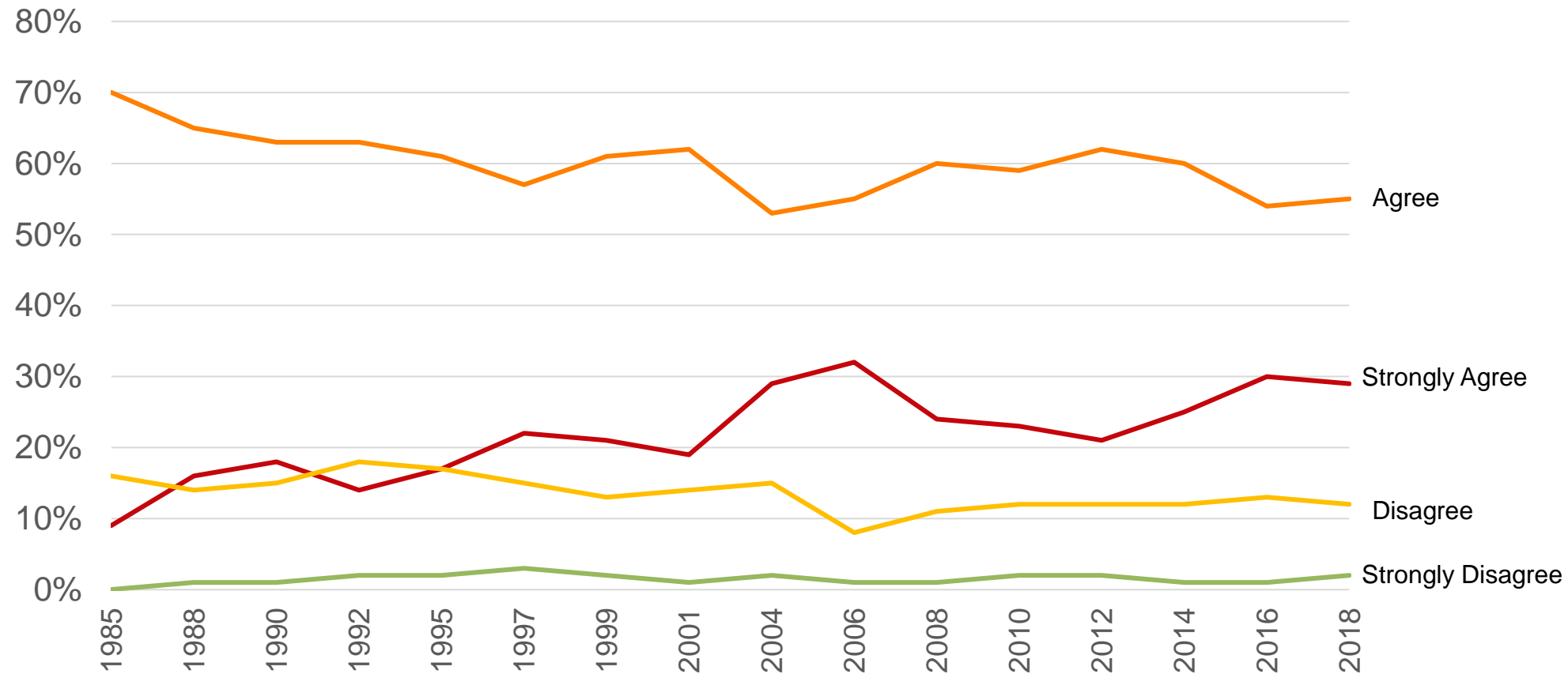
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Public sentiment: basic and applied science

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	"Basic scientific research"	**"Applied scientific research"**
		N= 722

Source: ScienceCounts, "Raising Voices for Science," 2015

Public sentiment: basic and applied science

- *"Below are some words and phrases. For each, please indicate whether you have strong positive associations with the term, feel neutral about the term or have negative associations with the term."*

	"Basic scientific research"	"Applied scientific research"
Positive	58%	
Neutral	39%	
Negative	3%	
		N= 722

Source: ScienceCounts, "Raising Voices for Science," 2015

Public sentiment: basic and applied science

- *"Below are some words and phrases. For each, please indicate whether you have strong positive associations with the term, feel neutral about the term or have negative associations with the term."*

	"Basic scientific research"	**"Applied scientific research"**
Positive	58%	54%
Neutral	39%	42%
Negative	3%	4%
		N= 722

Source: ScienceCounts, "Raising Voices for Science," 2015
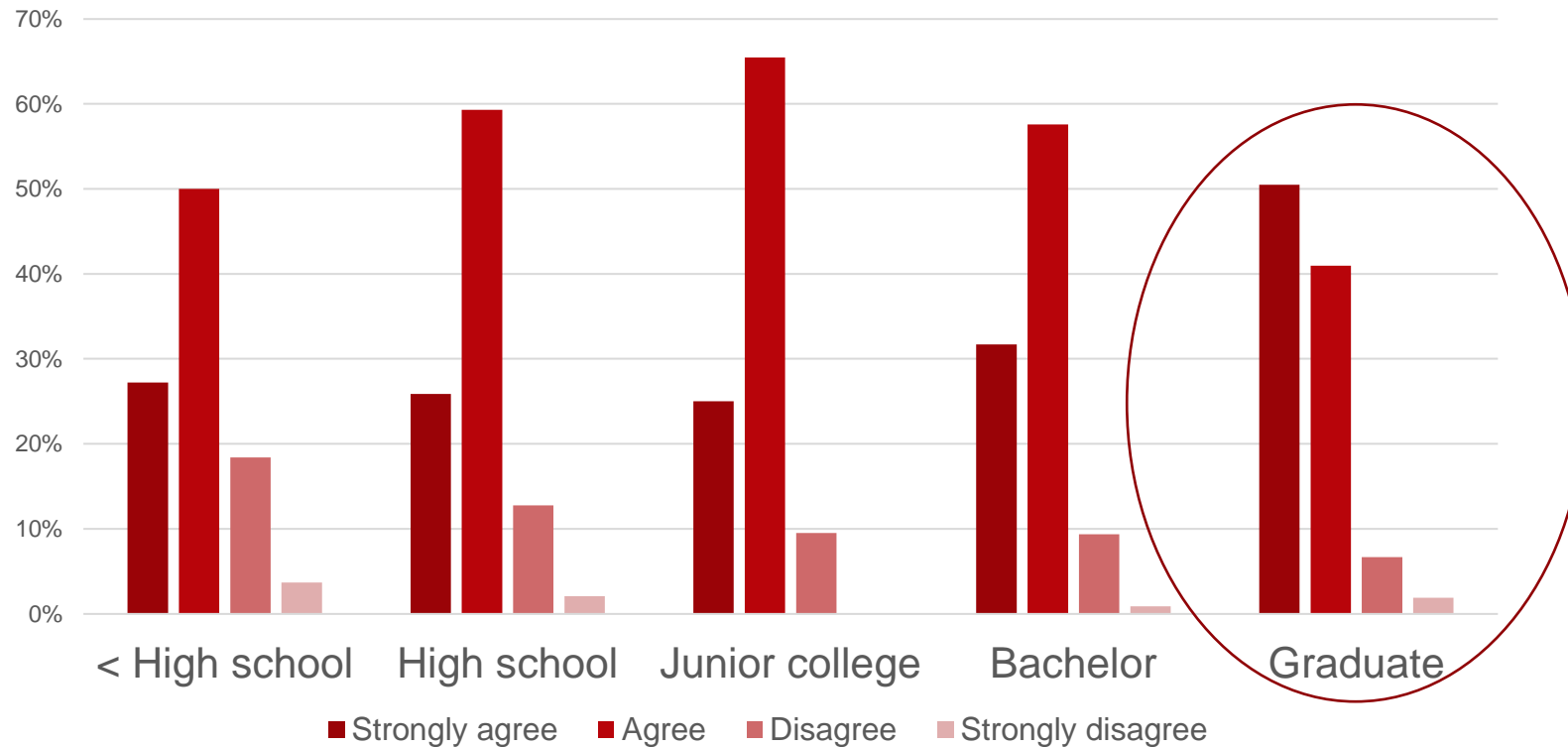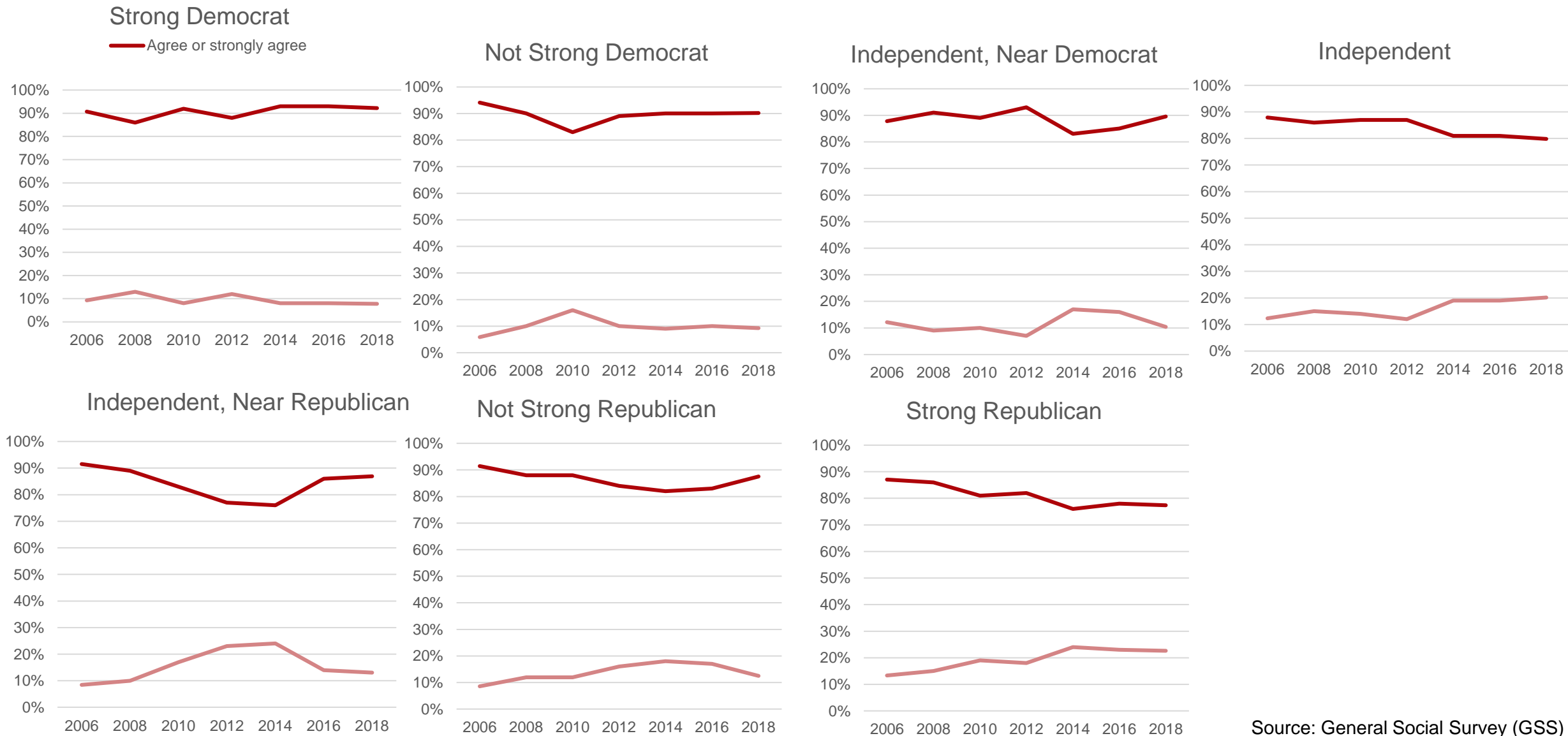
More education, more support

Agreement for basic science support by years of education completed
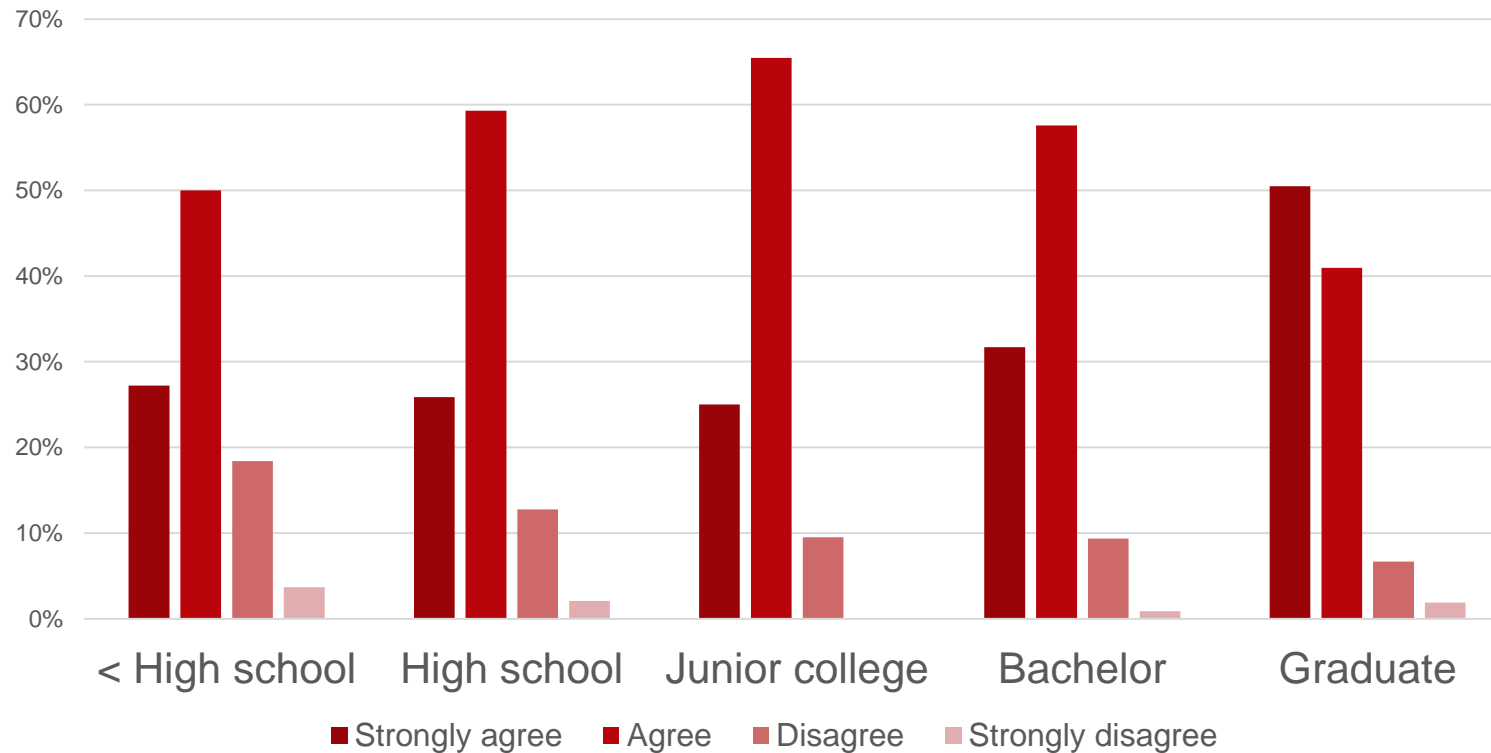
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Strong political ideology drives support for funding

Strong Democrat
— Agree or strongly agree

Not Strong Democrat

Independent, Near Democrat

Independent

Independent, Near Republican

Not Strong Republican

Strong Republican

Source: General Social Survey (GSS)

Trends: public opinion of basic science

- Support for basic science has remained high over time.

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- Support for basic science has remained high over time
- Public, overall, has positive views of basic science
- How does the STEM community engage on basic science?

Public engagement with basic science: a review of the STEM literature
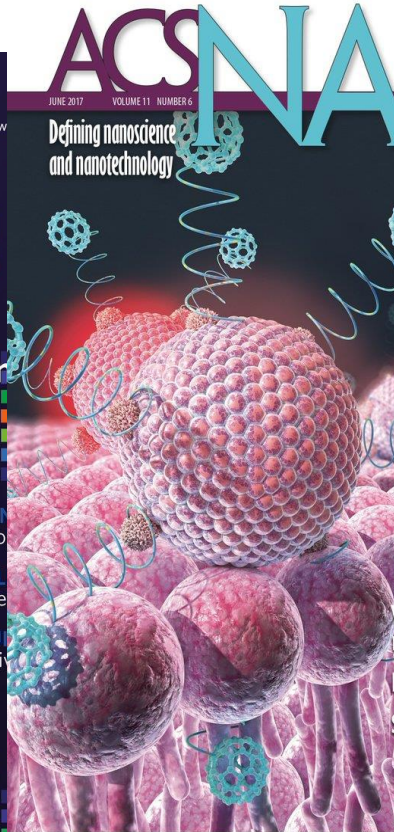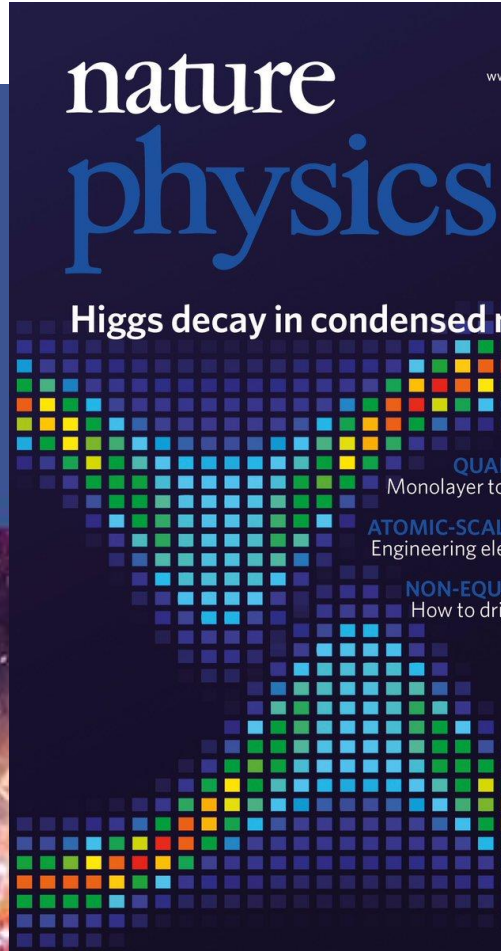
Our approach

- Large scale analysis of the STEM peer-reviewed literature
    - To what extent is public engagement covered?
    - If covered, can we identify if it is focused on basic research?
- Leverage computational tools
    - Casting a "wide-net" of journals
        - Keyword-based approach

Defining public engagement

"[P]rocesses and initiatives focused on enabling public participation in the responsible innovation and development of new technologies, including the management and assessment of technical risks."

Fig. 2. Goals, principles, and modalities of effective public engagement.

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- *"Addresses fundamental limitations of current theories and descriptions of matter in the energy range important to most energy technologies." (DOE)*

Casting a wide net: 2015-2019

- Web of Science

- STEM focus areas:
  - Astronomy & Astrophysics
  - Chemistry
  - Neuroscience
  - Nanoscience
  - Psychology

- Unit of analysis:
  - Abstract and title

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Field of Interest	Number of Journals Studied	Number of Article Abstracts Collected
Chemistry	578	758,565
Physics	469	404,880
Neuroscience	272	223,831
Nanoscience	103	30,989
Astronomy & Astrophysics	68	98,727
Psychology	642	23,971
Total	**2,132**	**1,540,963**

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Search string development

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Group	Keywords
Group 1: Communication process	participate, engage, communicate, consult, deliberate, involve, empower, co-creation, persuade and their variants
Group 2: Communication modality	meeting, townhall, museum, zoo, festival, crowdsourcing, workshop, outreach and their variants
Group 3: Communication audience	public, citizen, consumer, client, participant, stakeholder, politician, administrator, representative, student, NGO, policy, civic and their variants
Key Phrases related to public engagement	public discourse, citizen discourse, public debate, citizen debate, public understanding, public acceptance, consensus conference, deliberative poll, citizen science, informal learning, citizen panel, focus group, public opinion, non-governmental organization

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Few articles on public engagement in STEM journals

Field of Interest	Number of Abstracts/Titles Identified	
Chemistry	2,288 (<.01%)	
Physics	837 (<.01%)	
Neuroscience	2,595 (.01%)	
Nanoscience	0	
Astronomy & Astrophysics	290 (<.01%)	
Psychology	16,138 (67%)	
Total	**22,148**	

Few articles on public engagement in STEM journals

Field of Interest	Number of Abstracts/Titles Identified	Number of Titles Identified
Chemistry	2,288 (<.01%)	174
Physics	837 (<.01%)	52
Neuroscience	2,595 (.01%)	40
Nanoscience	0	0
Astronomy & Astrophysics	290 (<.01%)	20
Psychology	16,138 (67%)	414
Total	**22,148**	**700**

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Manual content analysis
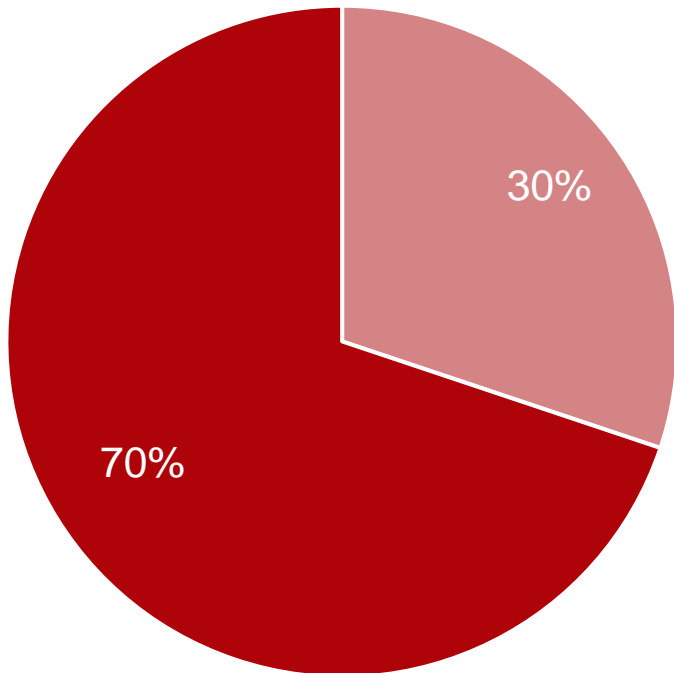
700 Articles

30%

70%

■ Focus on PE ■ No Focus on PE

Manual content analysis

700 Articles

30%

70%

43 articles

■ Focus on PE   ■ No Focus on PE

Manual content analysis

700 Articles

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30%

70%
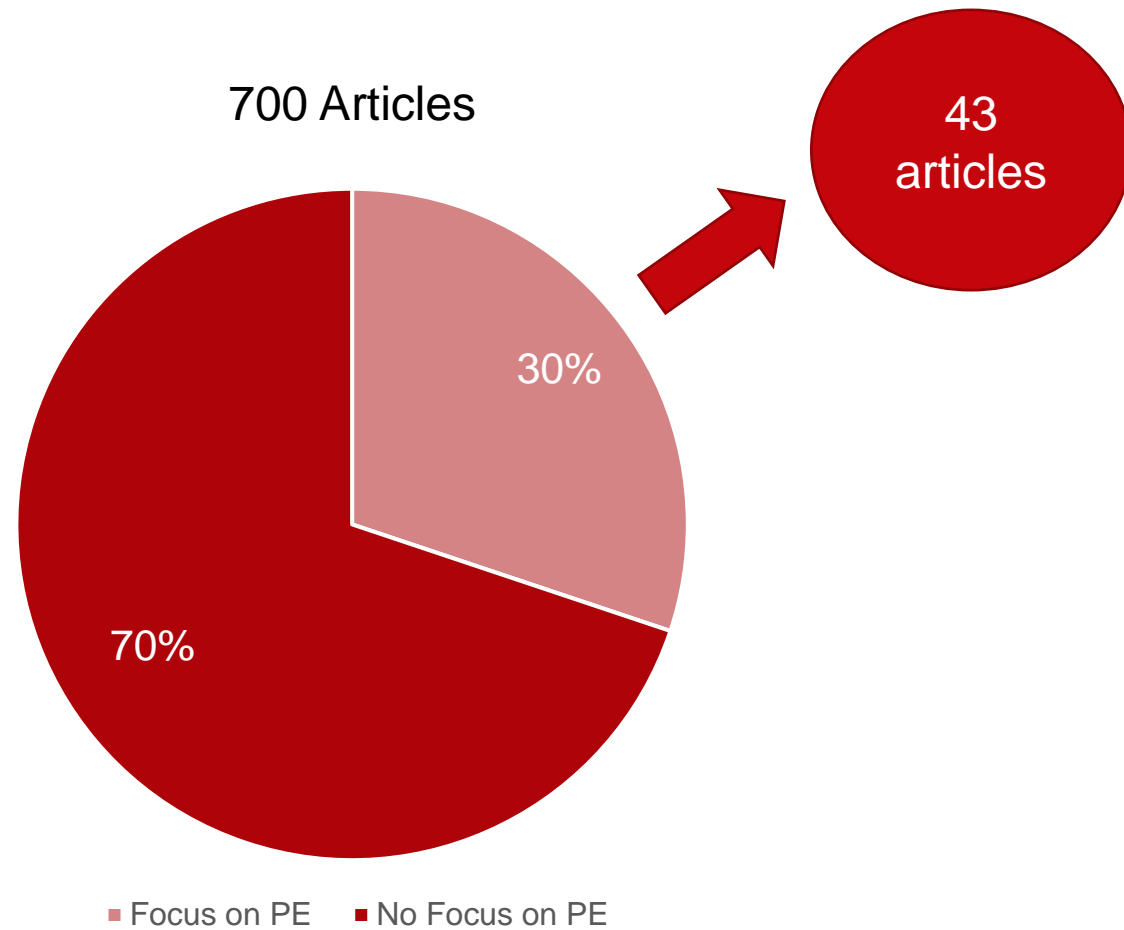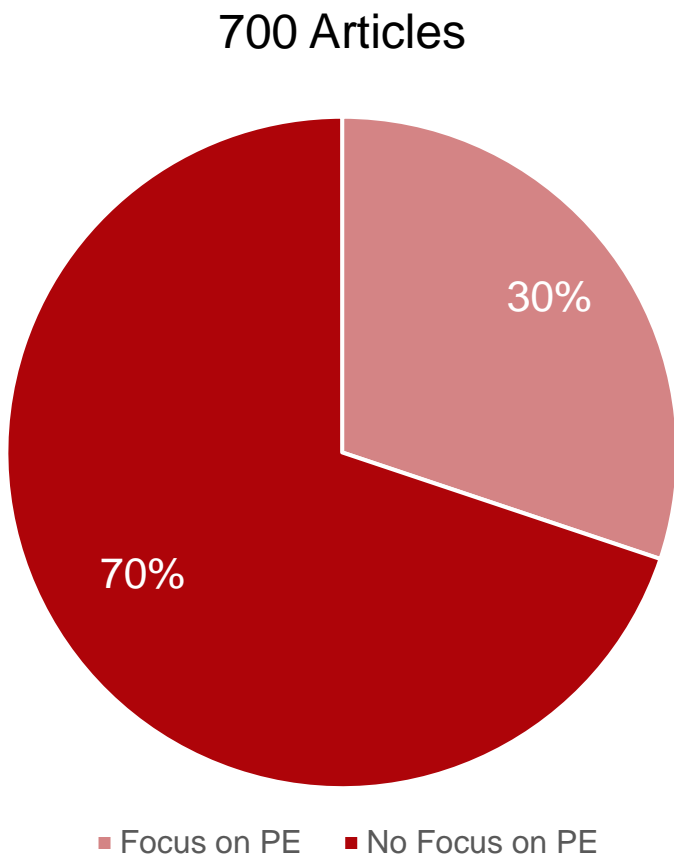
Title	Journal
Using Polymer Semiconductors and a 3-in-1 Plastic Electronics STEM Education Kit To Engage Students in Hands-On Polymer Inquiry Activities	Journal of Chemical Education
Experimenting with a Visible Copper-Aluminum Displacement Reaction in Agar Gel and Observing Copper Crystal Growth Patterns To Engage Student Interest and Inquiry	Journal of Chemical Education
Bringing Organic Chemistry to the Public: Structure and Scent in a Science Museum	Journal of Chemical Education
The Moon Zoo citizen science project: Preliminary results for the Apollo 17 landing site	Icarus
Enhancing student performance in introductory physics in topics related to electricity and magnetism through the use of voluntary workshops	European Journal of Physics

Moving forward

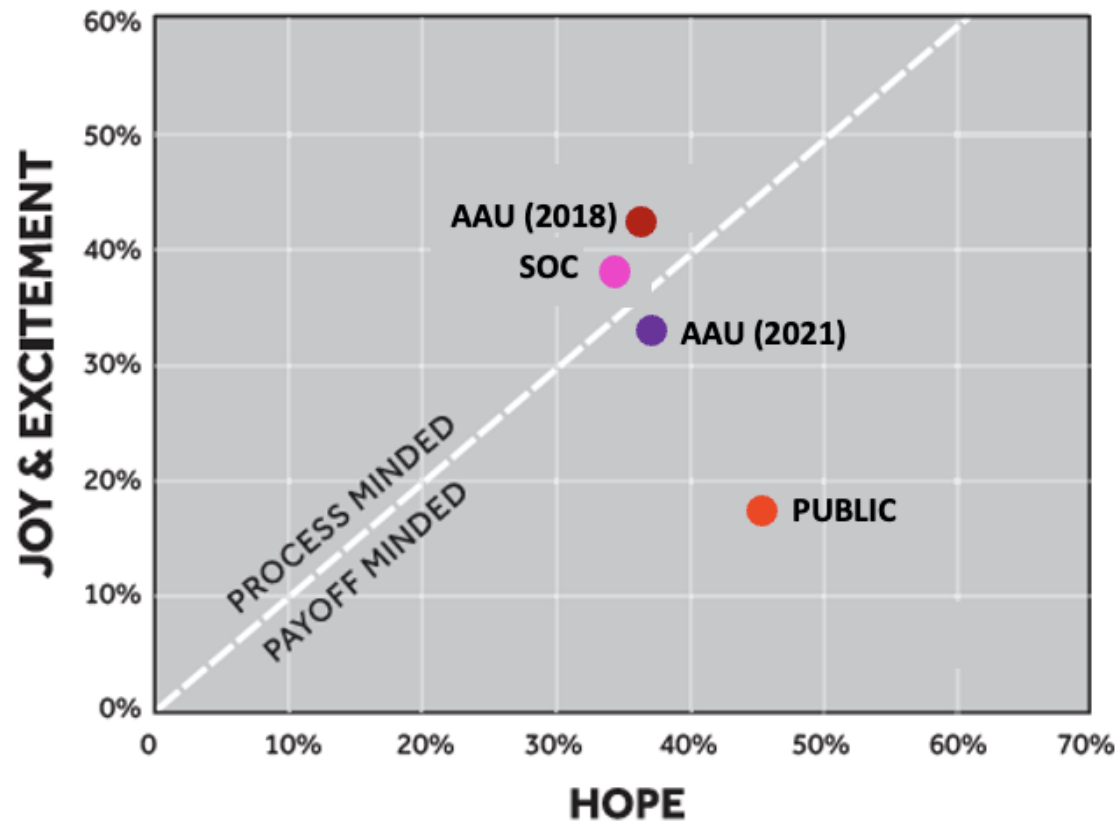- Lack of PE literature in STEM Journals….

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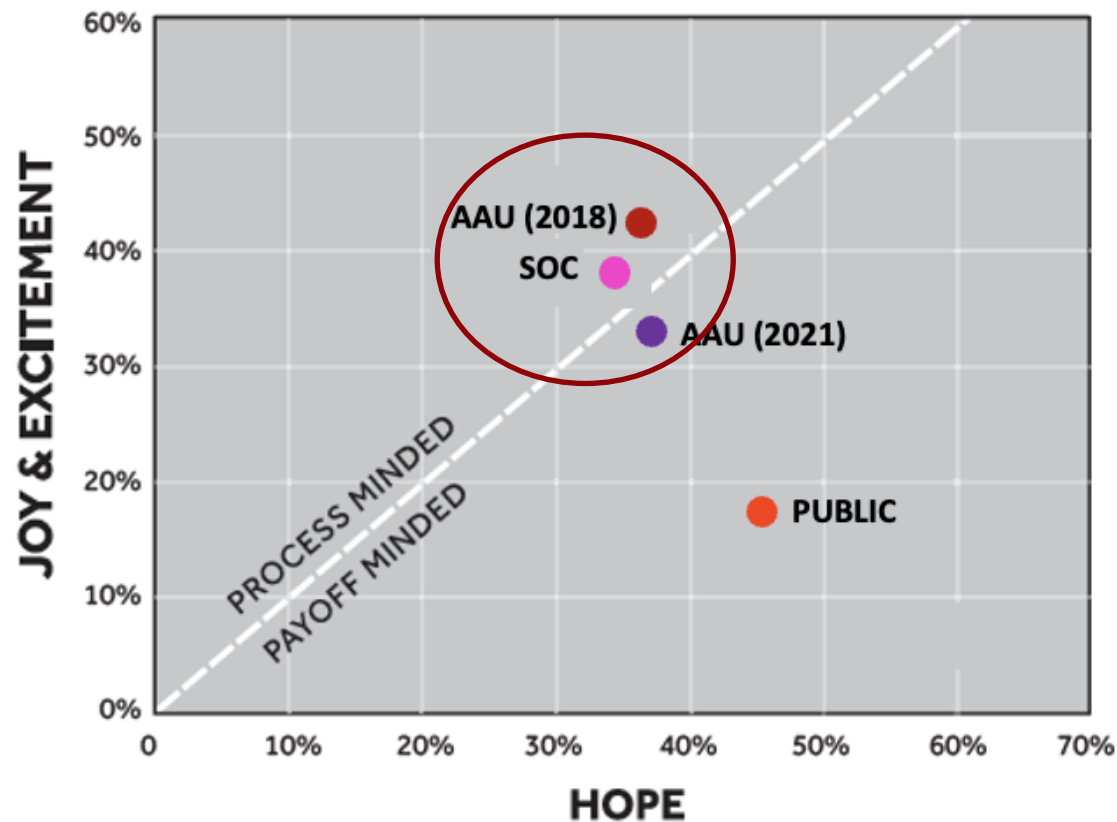- Lack of PE literature in STEM Journals….but, may exist outside of peer-reviewed literature.

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- What does social science evidence suggest?

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- What does social science evidence suggest?

- What are the goals of PE on basic science?
  - Changing minds or changing science?

APPX: Journals

AIDS CARE-PSYCHOLOGICAL AND SOCIO-MEDICAL ASPECTS OF AIDS/HIV	3
AMERICAN JOURNAL OF COMMUNITY PSYCHOLOGY	1
BRITISH JOURNAL OF HEALTH PSYCHOLOGY	1
COMPUTERS IN HUMAN BEHAVIOR	1
ERGONOMICS	1
EUROPEAN JOURNAL OF PHYSICS	1
HISPANIC JOURNAL OF BEHAVIORAL SCIENCES	1
ICARUS	1
INTERNATIONAL JOURNAL OF HUMAN-COMPUTER STUDIES	4
ISRAEL JOURNAL OF CHEMISTRY	1
JOURNAL OF ADOLESCENT RESEARCH	1
JOURNAL OF APPLIED DEVELOPMENTAL PSYCHOLOGY	1
JOURNAL OF CHEMICAL EDUCATION	13
JOURNAL OF CULTURAL HERITAGE	1
JOURNAL OF EDUCATIONAL MEASUREMENT	1
JOURNAL OF EMOTIONAL AND BEHAVIORAL DISORDERS	1
JOURNAL OF NANOPARTICLE RESEARCH	1
JOURNAL OF NEUROCHEMISTRY	1
JOURNAL OF THE LEARNING SCIENCES	1
LEARNING AND INDIVIDUAL DIFFERENCES	2
LEARNING AND INSTRUCTION	1
NEUROSCIENTIST	1
SENSORS	2
SPACE SCIENCE REVIEWS	1

How does the public feel about science?

- *Which of the following best describes what you feel when you hear the word "science"?*
  - Fear
  - Hope
  - Joy
  - Boredom
  - Caution
  - Other

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