

# Bridging science education and science communication

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# The Washington Post

August 21, 2018

**Stupid decisions are to blame for Europe's record measles rate**

# San Francisco Chronicle

June 8, 2018

**Romania's measles outbreak kills dozens of children**

# The New York Times

November 30, 2018

**As Measles Surges, 'Decades of Progress' Are in Jeopardy**

# The Washington Post

August 21, 2018

**Italy's right wing is waging a dangerous attack on vaccinations**



A Venezuelan child received a vaccination in Boa Vista, Brazil, last spring.

What knowledge is required in order to decide whether to get vaccinated against measles?



# What knowledge is required in order to decide whether to get **vaccinated against measles?**

Eat genetically modified food?

Approve genetic engineering of babies?

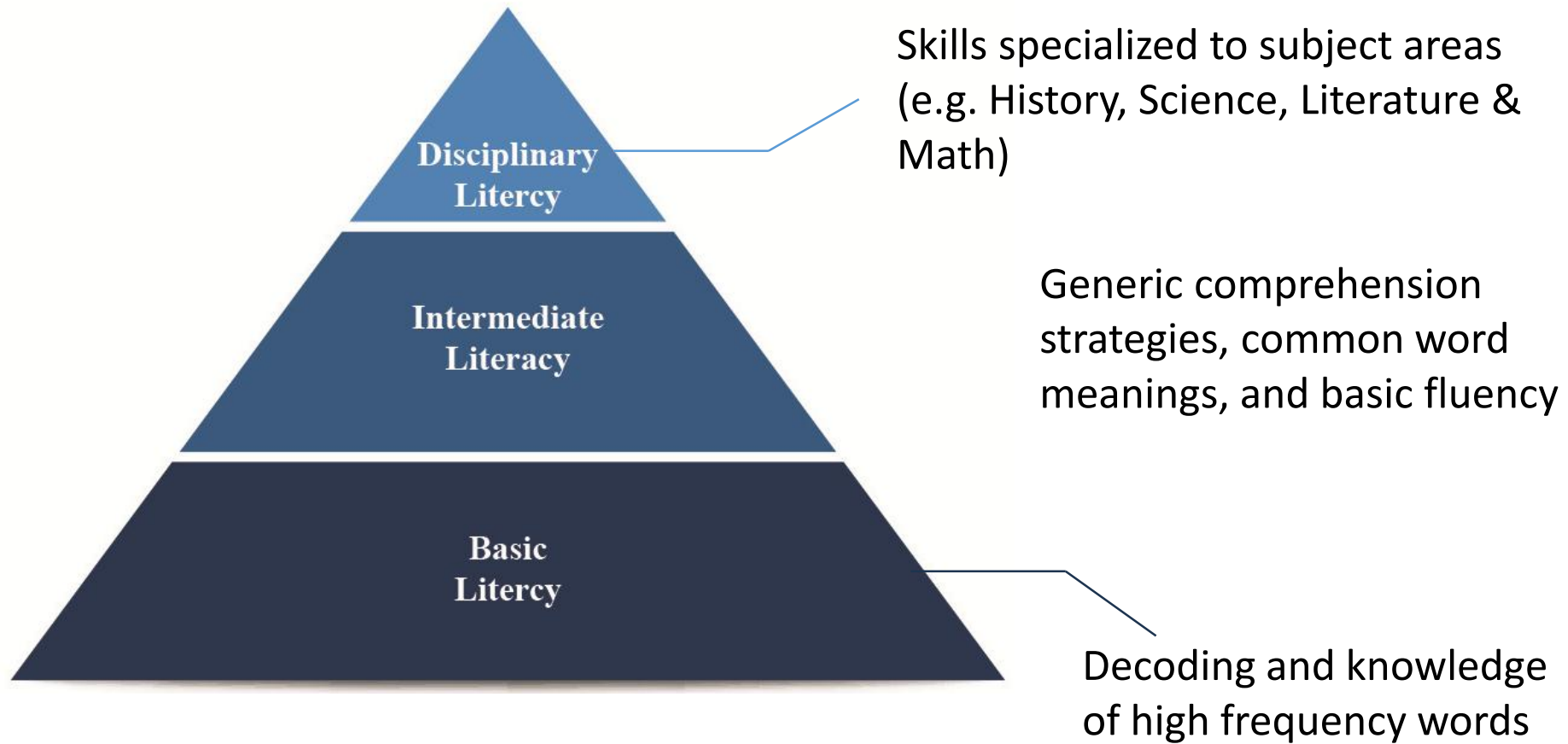
Do something about global warming?

.....



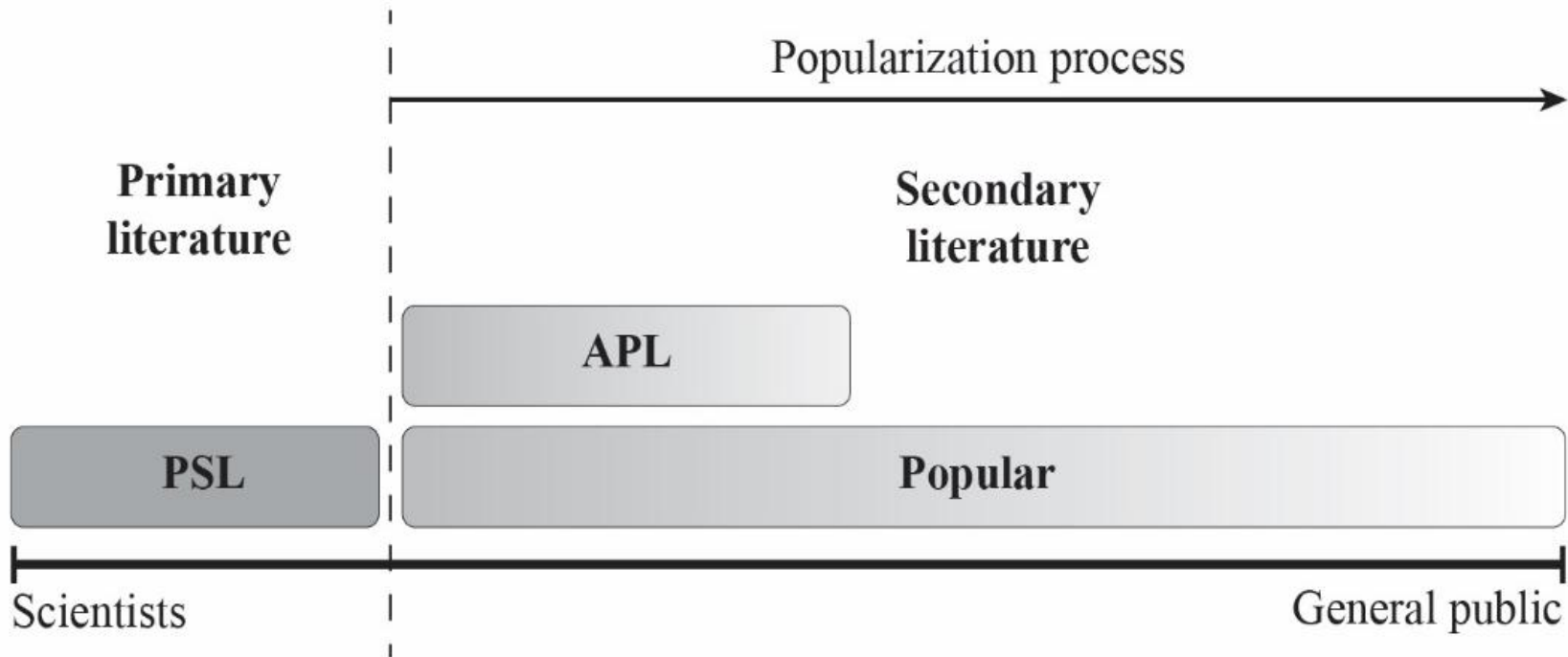
"One of the primary goals of teaching science in school is to provide these people the wherewithal to deal intelligently with science and scientists despite their lack of scientific expertise" (Norris, 1995)

# Disciplinary literacy



(Adapted from Shanahan & Shanahan, 2008)

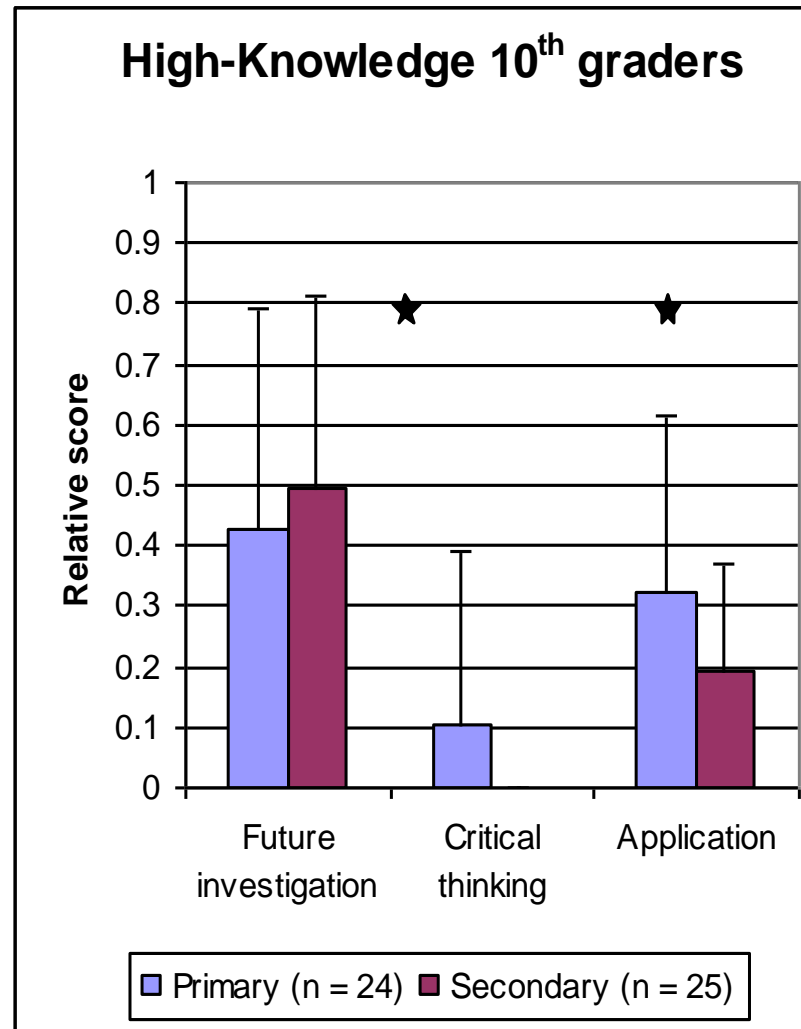
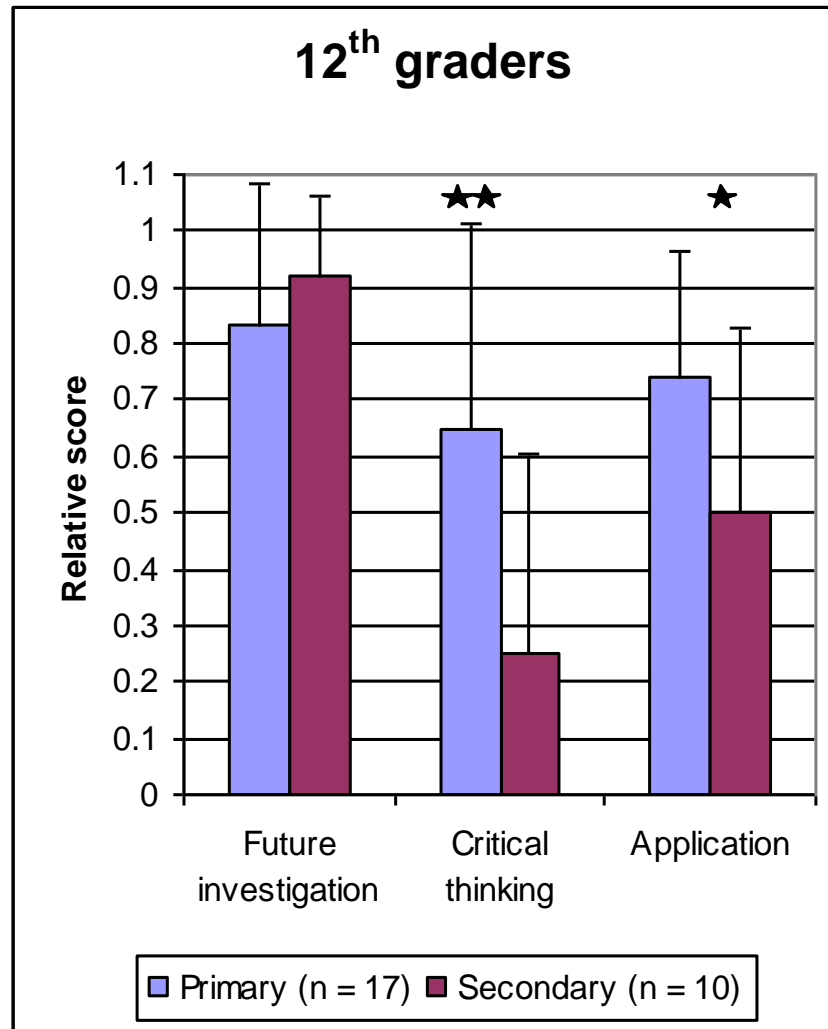
# Popularization of scientific information



The adaptation of scientific articles lowers the lexical complexity, while at the same time retaining the main linguistic features of the primary articles and the authenticity of the scientific writing

(Ariely & Yarden, submitted)

# Demonstration of inquiry skills following reading APL or Popular text



\* $p \leq 0.05$ , \*\* $p \leq 0.01$  ; Analyzed by t-test

**Dr. Moriah Ariely**

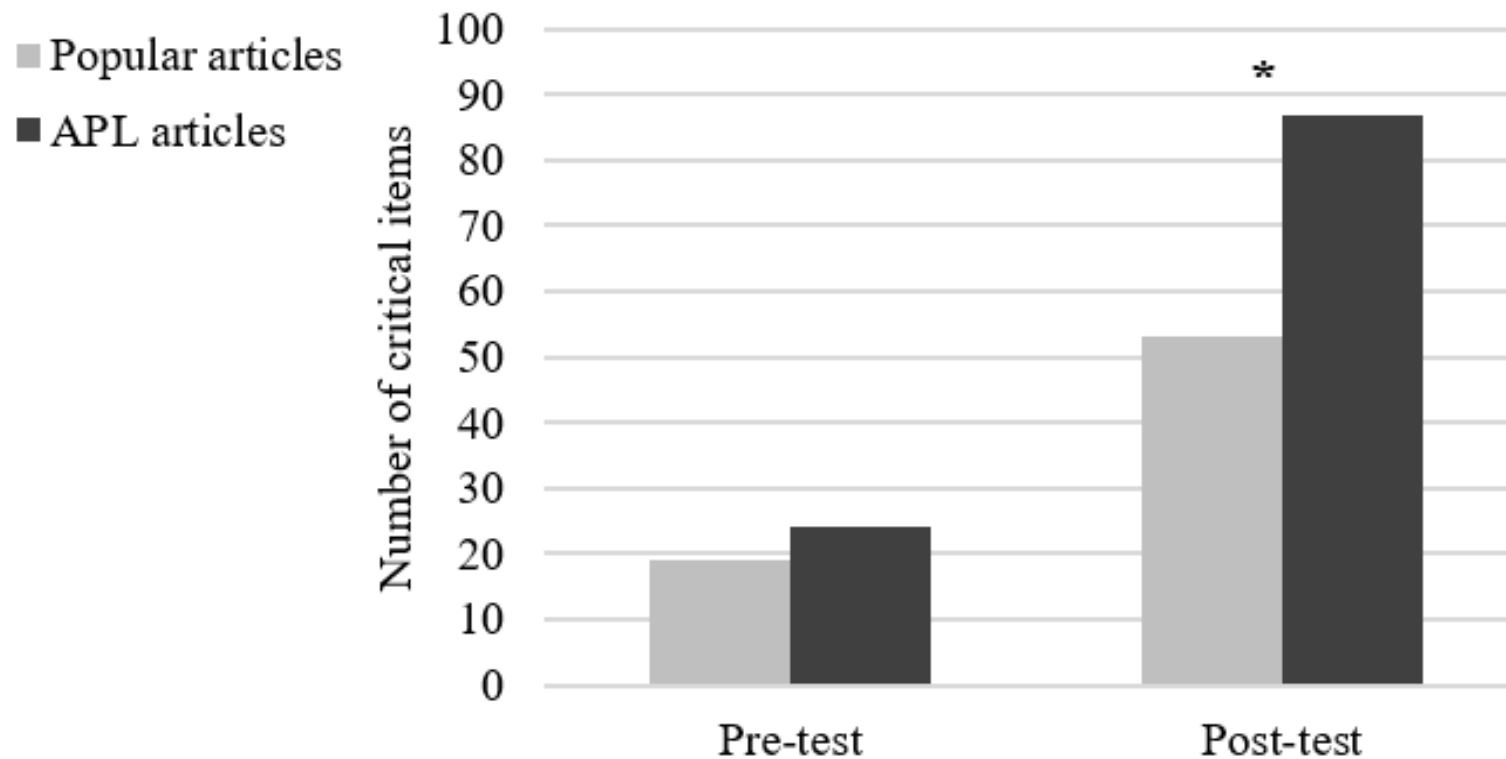
# Instructional strategy – contradictory articles

Providing students with textual resources that convey contradictory viewpoints can increase the likelihood that they discuss and explore the differences between them.

(Asterhan & Schwarz, 2016)



# Does the genre of the contradictory articles (APL vs. popular) influence students' ability to critically assess a popular article?



Comparison between the pre- and post-tests (total criticism) of the popular articles and APL articles groups. \* $p < .05$  (one-tailed T-test).

What is the knowledge that is required to become a critical consumer of scientific information?



**Is adapted primary  
literature the answer?**

# Bridging science education and science communication

## Science Education

Science literacy

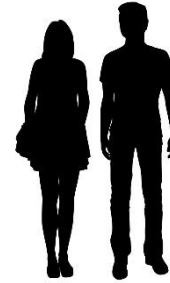
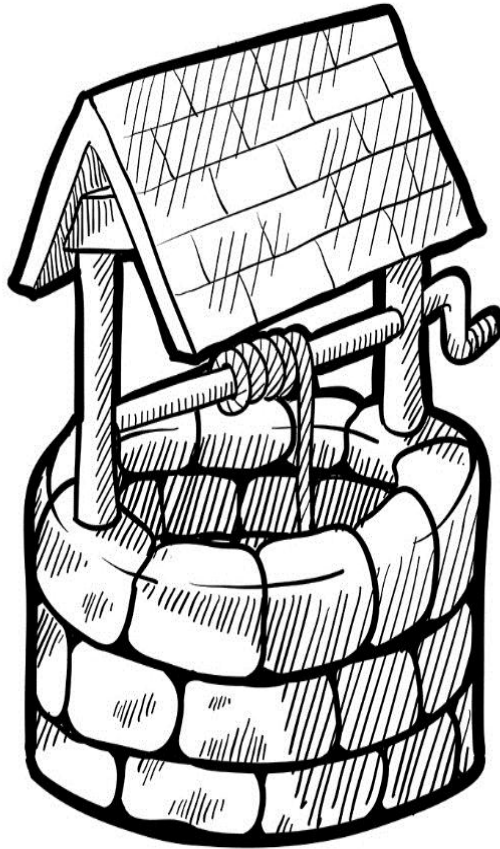
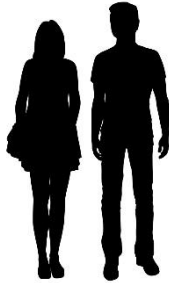


## Science Communication

Public engagement  
with science

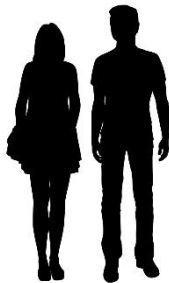
# Well of science

Reflective citizens  
(OECD, Osborne)



Bounded  
understanding  
of science  
(Bromme)

Competent outsiders  
(Feinstein)



Functional  
science  
literacy  
(Ryder)

# Public Engagement with Science



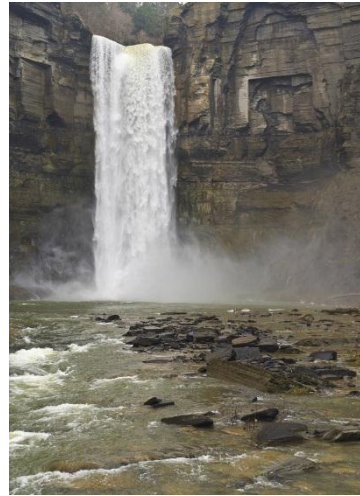
# Public Engagement with Science

Czech  
Wikipedia  
user Pack  
a



WELLS - SUSTAINABLE WATER  
SUPPLIES

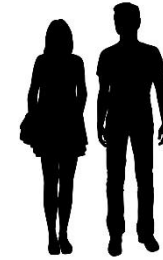
Sylvia  
Duckwort  
h



by zbdh12

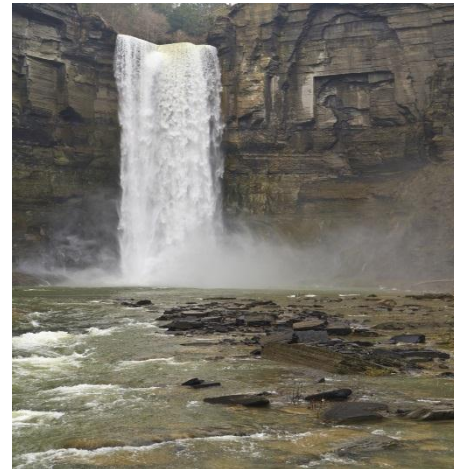
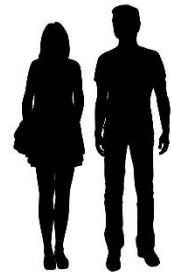
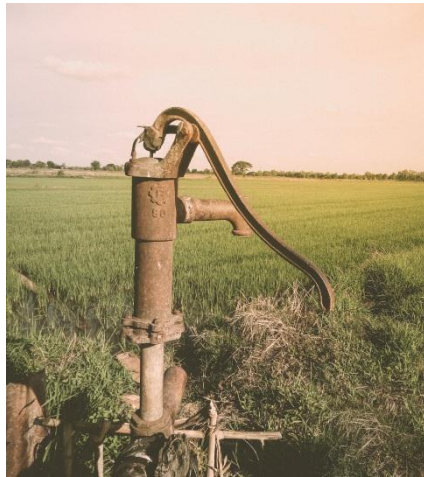
# Public Engagement with Science

Czech Wikipedia



WELLS - SUSTAINABLE WATER SUPPLIES

Sylvia Duckworth



by zbdh12

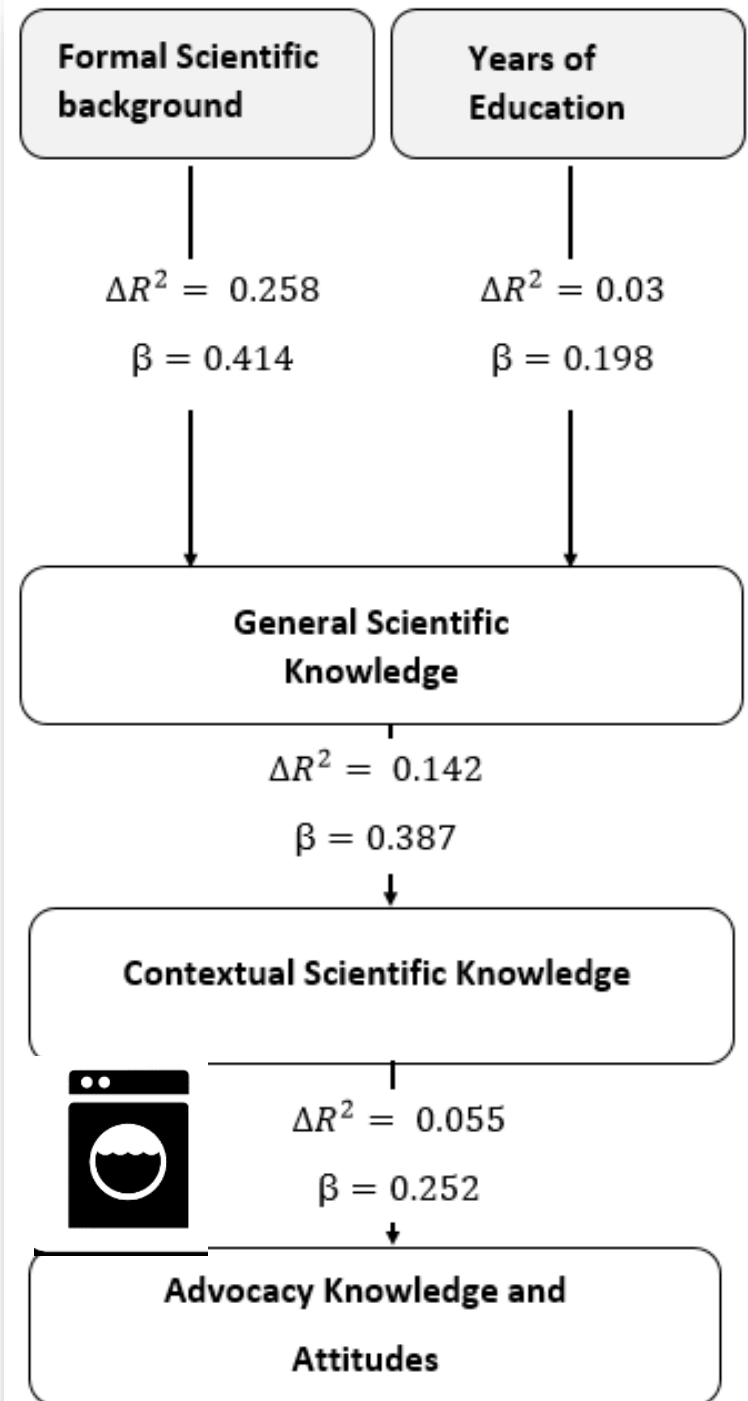
What evidence is there that science education supports evidenced-based decisions?

# The usefulness of science knowledge for parents of hearing-impaired children

Public Understanding of Science  
1-19  
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DOI: 10.1177/0963662518772503  
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**Sophie Shauli and Ayelet Baram-Tsabari**  
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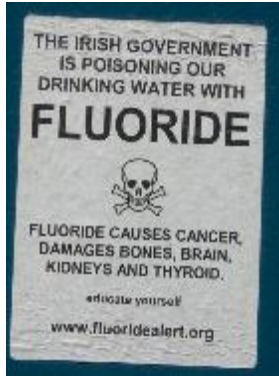
- General science knowledge is useful for developing contextual science understanding
- Parents who displayed higher contextual science knowledge emerged as having **slightly** better.



# Fluoridation of drinking water **f**

N = 895 (2012-2014)

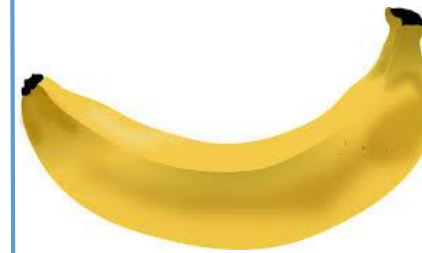
N = 266 (2015)



William Murphy

# Polio re-vaccination **f**

N = 401 (2013)



# What do people mean by "healthy food"?



N = 9,443 non-commercial items (2017)

# Climate change



N = 648 (2011-2012)



# Animal experimentation



N = 684 (2009-2010)



# What did we look for? Transfer!

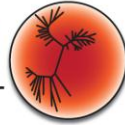
1. Procedural knowledge
2. Epistemological knowledge
3. Engaging in argument from evidence
4. Science content knowledge



# Engaging in argument from evidence

JOURNAL OF MICROBIOLOGY & BIOLOGY EDUCATION  
DOI: <https://doi.org/10.1128/jmbe.v19i1.1500>

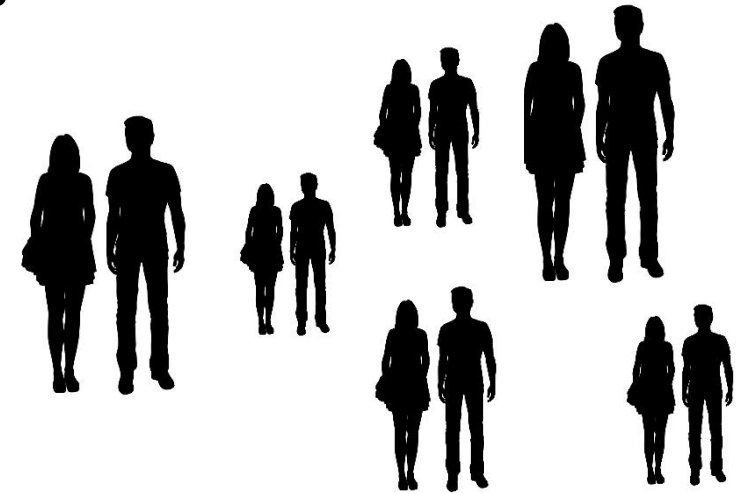
**Science Communication**



## Science and Politics in the Polio Vaccination Debate on Facebook: A Mixed-Methods Approach to Public Engagement in a Science-Based Dialogue †

Daniela Orr\* and Ayelet Baram-Tsabari  
*The Technion – Israel Institute of Technology*

Of 401 items: **96%** did not present any evidence to support their argument



**The discourse was almost entirely detached from scientific backup**

Of 9,443 items: **96%** did not present any evidence to support their argument

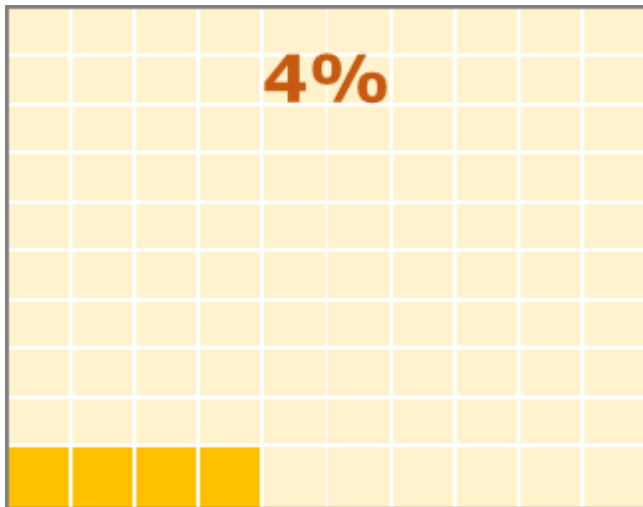




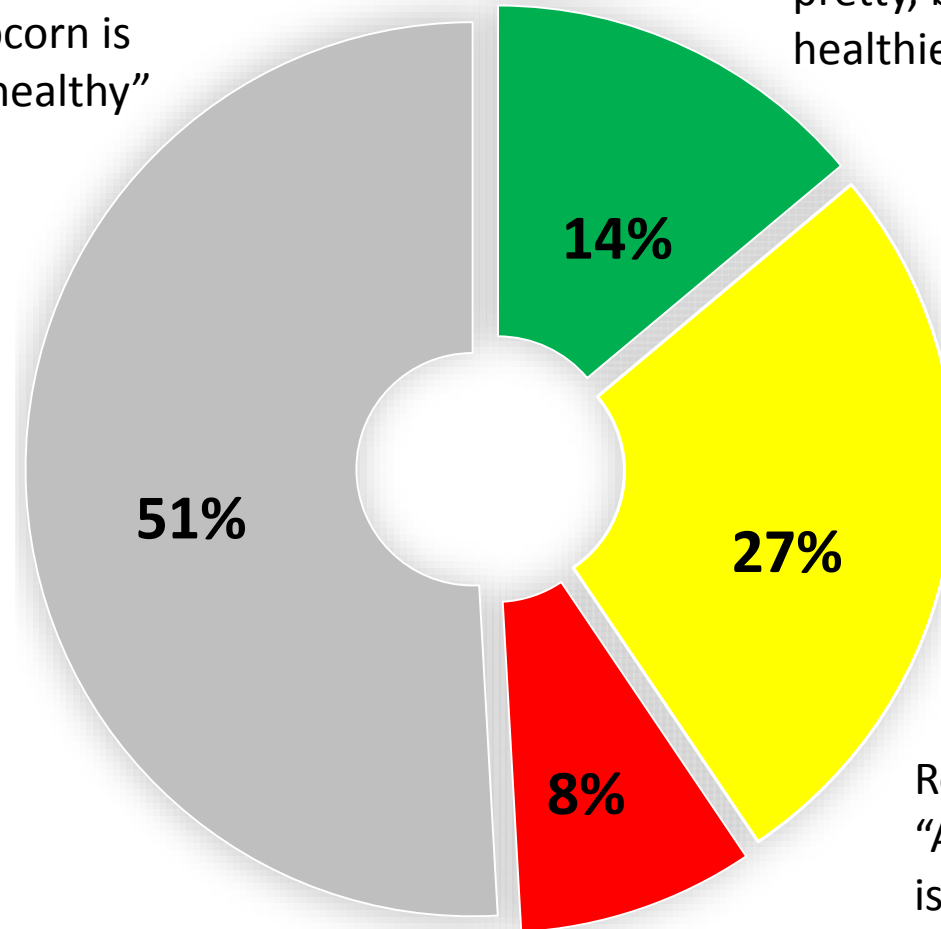
# What do people mean by “healthy food”?

(n = 9,443)

Veracity of 500 randomly selected claims from Facebook discussions about ‘healthy food’  
Orr and Baram-Tsabari (in preparation)



Vague:  
“popcorn is not healthy”



Supported: "You should switch to natural food coloring. It is not as pretty, but it is much healthier"

Evidence do not exist: "Drink tea with lemon and honey twice a day and you will be healthy as an ox"

Refuted:  
“Aluminum foil is poisonous”

# Components of Science Literacy

(National Academies of Sciences, Engineering and Medicine, 2016)



**Aviv Sharon**

1. Foundational literacies
- ★ 2. Content knowledge
- ★ 3. Understanding of scientific practices
4. Identifying and judging appropriate scientific expertise
5. Epistemic knowledge
- ★ 6. Cultural understanding of science
7. Dispositions and habits of mind,  
such as inquisitiveness and open-mindedness

★ Common to  
most applications  
of science literacy

What components of science literacy are most relevant to becoming a critical consumer of scientific information?

Knowing which expert to trust