OUTREACH GOING WRONG?
When we talk nano to the public, we are leaving behind key audiences*

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Scholars, policy makers, and outreach specialists in the nanotechnology community may be struggling with toxicological data and regulatory frameworks, but they seem to be able to agree on one thing: The public is unaware of the new technology and uninformed about the science behind it.

Ironically, this conclusion may not be supported by data. Our analyses of national survey data with identical wording over the last five years has found widening gaps in nanotech knowledge between the least educated and the most educated citizens. People who are already information-rich are benefiting from traditional outreach efforts, such as museum exhibits or NOVA programming. Unfortunately, those who need outreach and education the most -- those with little or no formal education – are being left behind.

This should come as no surprise. Data from the 2008 NSF Science and Engineering Indicators Report[1] show that four in ten Americans with at least some college education attended a science and technology museum in the past year. Among respondents that have not completed high school, the proportion is less than one in ten. Public opinion research has also shown that respondents with higher socioeconomic status (SES) acquire new information at a higher rate than low SES respondents[2].

Our analyses of two large national surveys in 2004 and 2007 (see online appendix for methodological information) show that those respondents with at least a college degree displayed an increase in knowledge levels between 2004 and 2007 while respondents with education levels of less than a high school diploma had a significant decrease in nanotechnology knowledge levels (see Figure).

These findings ease concerns about uninformed and unaware publics that have had a paralyzing effect on efforts to communicate this new technology. But they also raise concerns that the group most in need – those with the lowest levels of formal education – have not been helped. Among this group, nanotechnology knowledge levels have in fact *de*creased over time. The scientific community has not done a good job of educating this segment of the public about an issue that may be increasingly difficult to understand for lay audiences, given fuzzy regulatory scenarios, inconclusive reports about risks, and limited coverage in mainstream media[3].

So is there a silver lining in all of this? The answer is a clear "yes." Our data also allowed us to examine a wide variety of factors that may help audiences close knowledge gaps, including mass media. In multivariate models, the number of days a week that respondents spent online was significantly related to knowledge levels about nanotechnology. It helped those with low formal education levels to catch up with their more educated counterparts.

In other words, the internet may finally live up to the hype that has surrounded it since the 1990s as a tool for creating a more informed citizenry by serving as a "leveler" of knowledge gaps about nanotechnology. This is particularly encouraging, given recent reports about increasing broadband penetration and migration of science audiences online[4]. It is also a clear mandate to researchers to explore the potential of non-traditional ways of connecting with lay audiences about emerging technologies. At the moment, we are not just seeing existing gaps between citizens based on their educational attainment, but every day that researchers spend not addressing these emerging gaps will create a larger disconnect between scientifically literate audiences and the information poor. Closing these gaps is therefore not an option; it is a necessity, especially in light of a projected 2009 U.S. budget that has reduced spending for "education and social dimensions" of nanotechnology to $33.5 million from $39.2 million in 2007.

References

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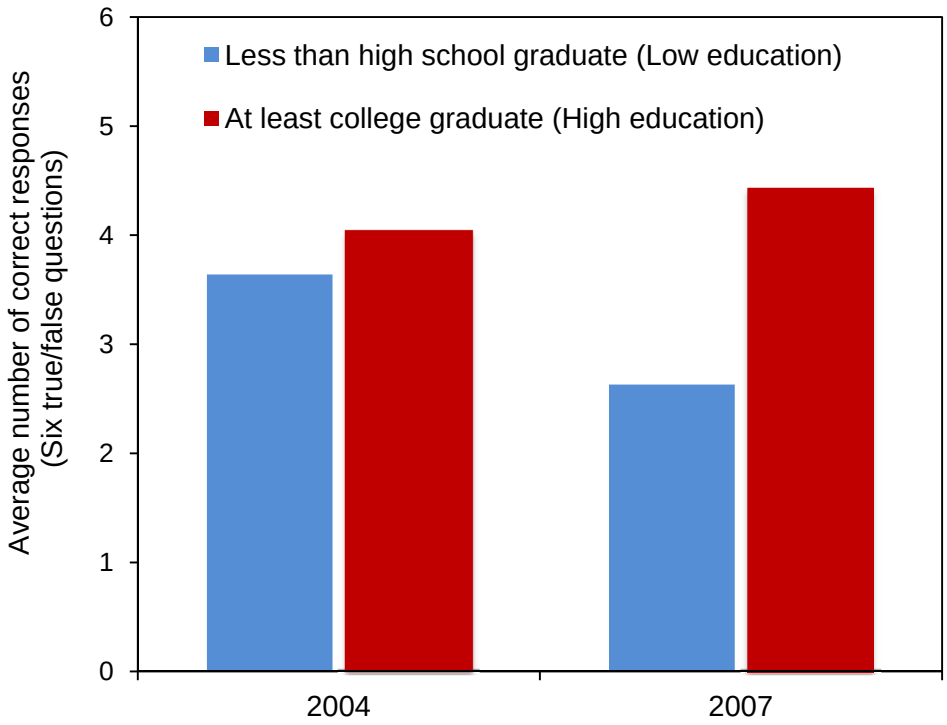
Figure 1: Widening Knowledge Gaps about Nanotechnology (2004-2007)



ONLINE APPENDIX

Methods

The U.S. survey was conducted by the University of Wisconsin Survey Center under the auspices of the NSF-funded Center for Nanotechnology in Society at Arizona State University. Data collection for the study began on February 15 and ended on June 27, 2007, using a dual frame method of national random digit dial and listed household phone survey. The total sample size was 1,015, with the AAPOR response rate of 30.60 % (calculated using Formula 3).

Question Wording

Education Levels
(2004 U.S. Public Awareness of Nanotechnology Study)
(2007 U.S. Public Awareness of Nanotechnology Study)
What is the highest grade or year of school you completed?

Newspaper Exposure
(2004 U.S. Public Awareness of Nanotechnology Study)
(2007 U.S. Public Awareness of Nanotechnology Study)
How many days a week do you read a printed newspaper?

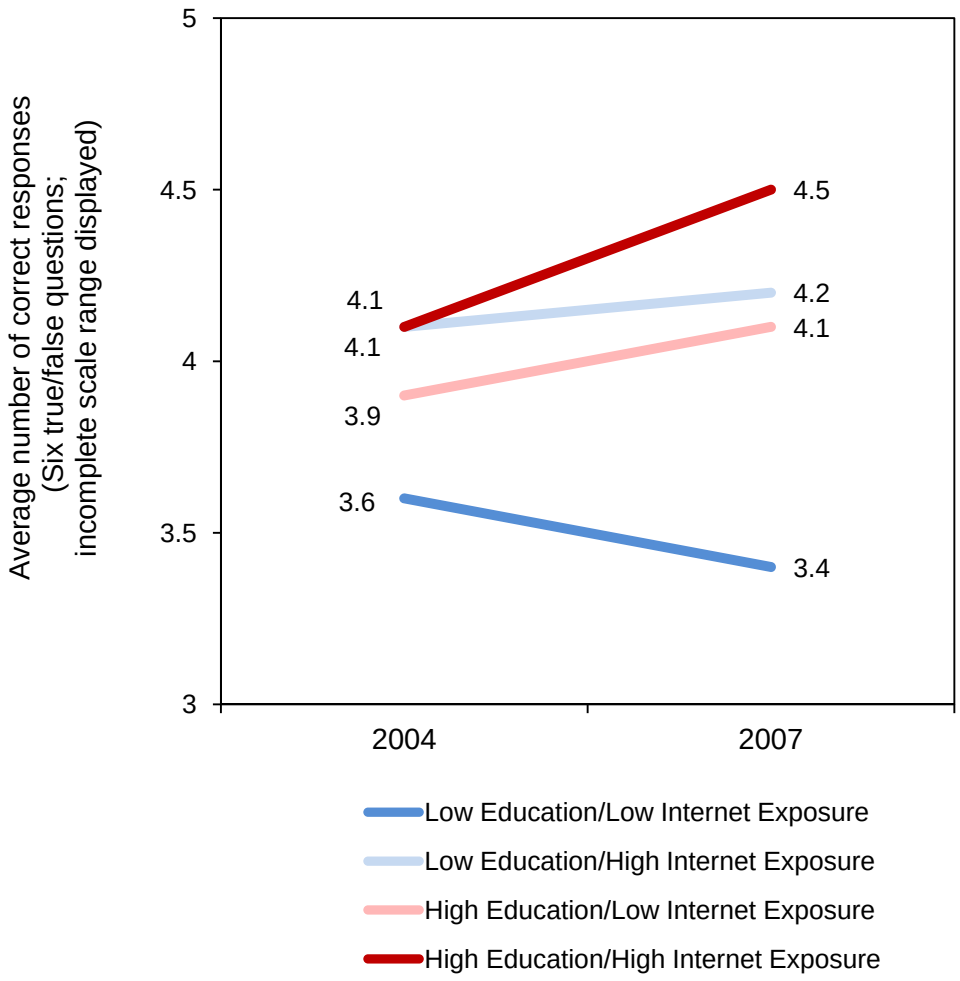
Internet Exposure
(2004 U.S. Public Awareness of Nanotechnology Study)
(2007 U.S. Public Awareness of Nanotechnology Study)
How many days a week do you go on-line to access the Internet?

Television Exposure
(2004 U.S. Public Awareness of Nanotechnology Study)
(2007 U.S. Public Awareness of Nanotechnology Study)
On the average weekday evening, how much television do you watch? (minutes)

Knowledge about Nanotechnology
(2004 U.S. Public Awareness of Nanotechnology Study)
(2007 U.S. Public Awareness of Nanotechnology Study)
"Next, I am going to read a few statements about science and technology. For each one, please tell me if you think the statement is true or false."

1) Nanotechnology involves materials that are not visible to the naked eye.
2) U.S. corporations are not using nanotechnology to make products sold today.
3) Experts consider nanotechnology to be the next industrial revolution of the US economy.
4) A nanometer is a billionth of a meter.
5) Nanotechnology allows scientists to arrange molecules in ways that do not occur in nature.
6) A nanometer is about the same size as an atom.

Figure A1: Exploring Knowledge Gaps about Nanotechnology Across Education Level and Internet Exposure



Notes:
(1) Low education = Less than college degree; High education = At least college graduate
(2) Low internet exposure = 0-4 days/week; High internet exposure = 5-7 days/week
(3) Results of Three-Way ANCOVA (controlling for newspaper exposure, television exposure, gender and age):
Main Effect of Year ($F=4.01$, $p=0.045$);
Main Effect of Education Level ($F=12.56$, $p<0.001$);
Main Effect of Internet Exposure ($F=7.21$, $p=0.007$);
Interaction Effect for Education and Internet Exposure ($F=10.91$, $p=0.001$)
Interaction Effect for Education, Internet Exposure, and Year ($F=2.95$, $p=0.086$)

Table A1: Hierarchical OLS Regression Analysis for Nanotechnology Knowledge Levels

	Before – entry β
Year	
2007	0.06*
Incremental R-Square (in %)	*0.4**
Demographics	
Age	-0.27**
Gender	-0.00
Education	0.20**
Incremental R-Square (in %)	*9.9***
Exposure to Media	
Newspaper Exposure (Days/week)	0.06*
Internet Exposure (Days/week)	0.12**
TV Exposure (Minutes/weekday night)	0.07**
Incremental R-Square (in %)	*1.7***
Two-Way Interactions	
Education * Newspaper Exposure	-0.04
Education * Internet Exposure	-0.09**
Education * TV Exposure	0.02
Year * Newspaper Exposure	-0.03
Year * Internet Exposure	0.03
Year * TV Exposure	0.07**
Incremental R-Square (in %)	*1.4***
Three-Way Interactions	
Education * Newspaper Exposure * Year	0.01
Education * Internet Exposure * Year	-0.06*
Education * TV Exposure * Year	-0.02
Incremental R-Square (in %)	*0.3*
Total R-Square (in %)	*13.8***

Notes:
(1) * p<0.05; ** p<0.01
(2) Gender: Male=1 and Female =0
(3) Categories for Education variable: 1=no school; 2=Grades 1-8; 3=Grades 9-11; 4=Grade 12 or GED; 5=Some college; 6=College graduate and above.
(4) Newspaper exposure = 0-7 days/week
(5) Internet exposure =0-7 days/week
(6) TV exposure = 0-1440 minutes/day
(7) Year: 0=2004 and 1=2007

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