# Civic Scientific Literacy in the United States in 2016

**A report prepared for**
**the National Aeronautics and Space Administration**
**by the University of Michigan**


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**June 15, 2016**

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There is broad agreement among the leaders of modern nations that it is important for a substantial portion of their adult populations to be scientifically literate. The need for a scientifically literate population is critical in democratic societies in which citizens may influence the formation of science policy on issues ranging from support for biomedical research to the level of use of fossil fuels for energy production.

In the second half of the 20th century and today, the United States has led the way in the measurement of civic scientific literacy.[1] This report builds on several decades of work that was initiated by a survey sponsored by the National Association of Science Writers in 1957, with funding from the Rockefeller Foundation, and conducted by the Survey Research Center at the University of Michigan (Davis, 1958). The 1957 study was conducted only a few months prior to the launch of Sputnik and provides an essential baseline measure. In 1979, Kenneth Prewitt and Jon Miller resumed the series with support from the National Science Board (Miller, Prewitt, & Pearson, 1980; Miller 1983) and Miller is continuing that work with the support of a new five-year cooperative grant from NASA (NNX16AC66A).

This report will begin with a brief discussion of the salience of science and technology in the United States. A second section will look at the current level of civic scientific literacy and changed over the last three decades. A final section will discuss the sources, uses, and impact of civic scientific literacy in a modern society.

## THE SALIENCE OF SCIENCE

Although commentators often speak of the public understanding of science, the public is not a single homogenous group – even in democratic societies. There are numerous public policy issues on the national agenda at any given moment and even more involving state and local policies. Science and technology issues are very important to some individuals and not very important to others. Some citizens will be very interested in foreign policy issues, while others may focus their attention on agricultural or food issues. And other adults may be more concerned about tax policy or the state of the economy. For decades, it has been impossible for any individual to follow and be knowledgeable about the full range of public policy issues. Social scientists refer to this process as issue specialization and it is the inevitable result of the growth a large complex societies (Almond, 1950; Miller, 1983a; Miller & Inglehart, 2012).

[1] Civic scientific literacy refers to the level of understanding of basic scientific constructs that an individual would need to access and make sense of information about public policy issues involving science and technology. Benjamin Shen (1975) defined three kinds of scientific literacy: (1) consumer scientific literacy – the kind of information needs to shop in a pharmacy, a computer store, or a garden shop, (2) civic scientific literacy – the kind of information that a citizen needs to read about and understand current science and technology policy issues, and (3) cultural scientific literacy – an understanding of the ways of knowing related to science and other ways of knowing. The work included in this report refers to civic scientific literacy.

The level of public interest in science and technology broadly has been measured in a series of national surveys over the last 35 years. Throughout this period, approximately half of American adults have reported that they are "very interested" in issues involving science and technology (see Figure 1). The level of interest in science and technology dipped slightly in the first decade of the 21st century, but the results of the 2016 survey indicate that it has returned to its traditional level – it was 52% in 2016. This level of interest in science and technology is slightly lower than the level of public interest in new medical discoveries and economic conditions, but significantly higher than public interest in foreign policy, agricultural policy, and numerous other areas of domestic public policy.

The level of interest in science and technology policy issues does not predict engagement in the process of resolving public policy disputes about science and technology. Those individuals who (1) have a high level of interest in science and technology, **and** (2) think that they are well informed about science and technology, constitute the *attentive public for science and technology* (Rosenau, 1974; Miller, 1983a, 2004). It is this group that follows science and technology news closely in the media (traditional and online) and who are likely to contact a Congressional or Administration representative about a science matter). When there are open disputes about science policy issues, it is the attentive public that will be seen and heard by decision-makers.

The 2016 survey found that the sense of being well informed about science and technology increased to 19% and that the proportion of American adults attentive to science and technology now includes 17% of American adults (see Figure 1). This is a significant increase over recent decades.

## CIVIC SCIENTIFIC LITERACY

Civic scientific literacy (CSL) refers to the ability of a citizen to find, make sense of, and use information about science or technology to engage in a public discussion of policy choices involving science or technology (Miller, 1983b, 1987, 1995, 1998, 2000, 2004 010a, 2010b, 2012; Miller, Pardo, & Niwa, 1997). This is a skill that is especially important in democratic societies.

The measure of CSL used in this analysis and report is designed to assess the ability of a citizen to read about emerging scientific or technological issues in public media (print, broadcast, or online) at the level found in the Tuesday Science News section of the *New York Times* or in a *Nova* show on television. It is not a measure of technical or occupational skill. It reflects the knowledge of individual citizens to understand basic scientific concepts such as the nature or matter, the structure of a molecule or DNA, and the application of probability to simple problems.

A citizen with an understanding of those basic constructs would be able to make sense of new and emerging science issues years after the ending of their own formal schooling. For example, stem cells because a public policy issue years after most American adults had finished their formal schooling, but those adults with a good understanding of the structure of a cell and the role of DNA would – in most cases – be able to read a moderately sophisticated news story about

the dispute over the use of embryonic stem cells and make sense of the story and the basic issues. An individual might have to read several stories (in print or online) to gain a strong understanding of the issue, but CSL is a measure that identifies those individuals who have a core on basic scientific constructs that would like this kind of adult science learning possible.

Using data from a national probability survey of 2,840 adults conducted using the National Opinion Research Center's AmeriSpeak Panel, the 2016 Michigan survey found that 28% of American adults qualified as civic scientifically literate (see Figure 2). This is the same level found in a similar study in 2008. An examination of the pattern of growth in CSL over the last 28 years indicates that the level of adult CSL increased steadily between 1988 and 2008, but that it has plateaued in the last decade.

Analyses over the last three decades have shown that the rate of CSL is driven primarily by the completion of college-level science courses and completion of a baccalaureate degree (Miller, 2010a, 2010b). The stability observed in these results suggests that less growth in these factors and may – in part – reflect the impact of the Great Recession on educational enrollments. We will continue to examine the factors associated with the stalled rate of growth in CSL and expect to be able to identify and discuss causal factors in subsequent reports.

**The factors associated with CSL in the United States in 2016**

Although the 28% of American adults qualified as civic scientifically literate, the rate was higher for some groups of citizens and lower for other groups. It is useful to look briefly at the patterns of CSL in 2016.

The two strongest predictors of CSL were the level of educational attainment and exposure to college science courses (see Table 1). Forty-six percent of American adults with a baccalaureate degree qualified as CSL and 62% of adults with a graduate or professional degree met this standard. In contrast, only 17% of adults with a high school diploma qualified as CSL.

Exposure to one or more college level science courses was a strong predictor of CSL, with 40% of adults with one to three college science courses (the general education requirement in most colleges or universities) qualifying as CSL and 62% of adults with four or more college science courses qualifying as CSL. The higher number of science courses may indicate either a major in a college field or a substantial number of science courses in support of another field.

Men were more likely to qualify as CSL than women and younger adults were more likely to score as CSL than older adults. The presence or absence of minor children in the home – sometimes called the science fair effect – was not a significant factor in the level of CSL.

## SUMMARY

The 2016 Michigan Survey of Scientific Literacy found that slightly more than half of American adults have a high level of interest in new scientific discoveries and new inventions and technologies. Given in the context of the marketplace for public interest in public policy issues,

this level represents significant growth over the last decade. Approximately 17% of American adults are attentive to science and technology policy issues, meaning that they have a continuing level of interest and tend to follow these issues in the news. This proportion has increased in recent years.

During the last decade, the proportion of American adults who qualify as being scientifically literate remained at about 28%. Prior to 2007, national surveys had shown a steady increase from approximately 10% in 1988 to 28% in 2008. Given the growing number of public policy issues that involve science or technology, the failure of the rate of civic scientific literacy to grow in the last decade is troubling.

The commitment of NASA and other federal and non-governmental agencies and groups to re-organize and invigorate their informal adult science learning programs in the next decade is a promising step in the right direction. Through continuing study of the level of CSL in the United States and an examination of the sources of CSL in American adults, we hope to be able to describe future changes in the level of CSL in the United States and to provide useful insights into strategies for enhancing CSL in modern democratic societies.

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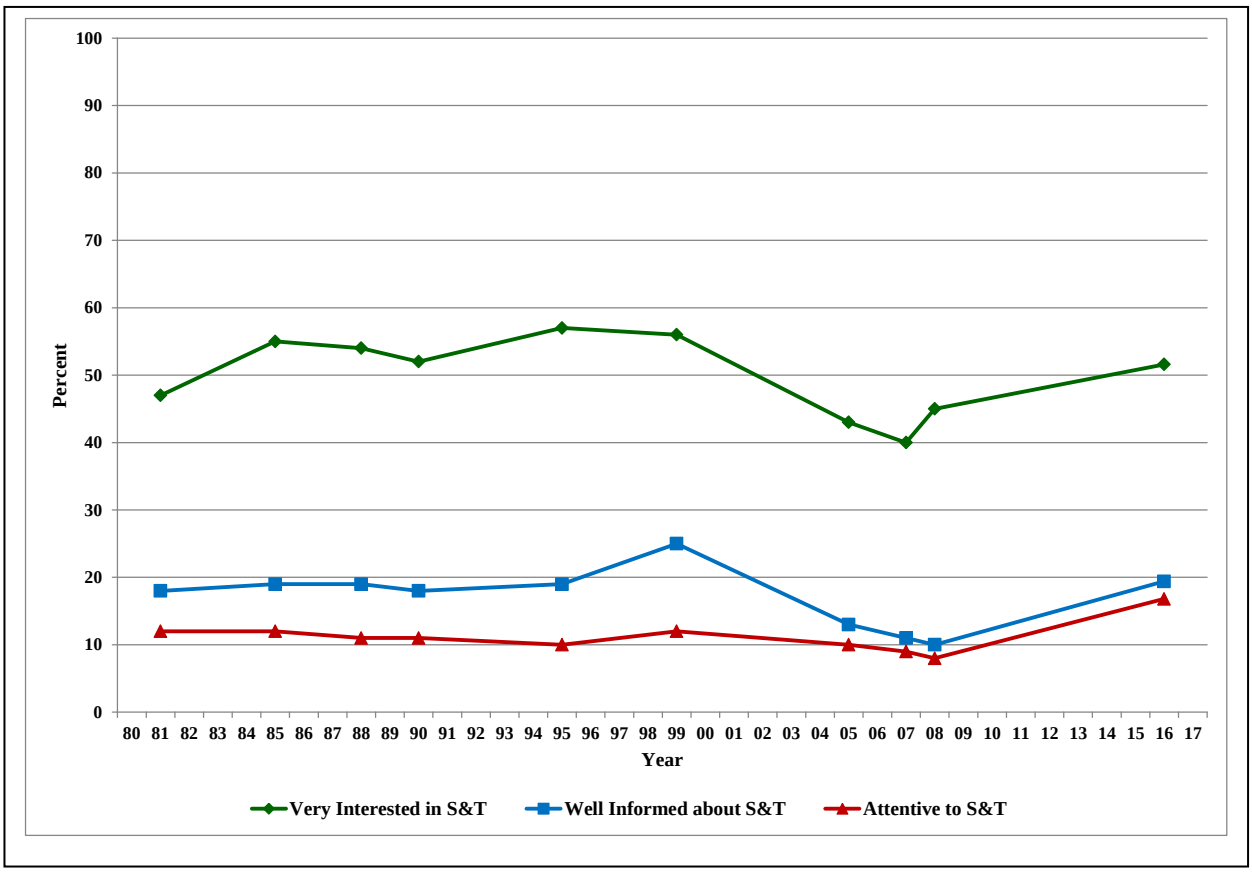


**Figure 1: Interest in and Attentiveness to Science and Technology: 1981-2016.**

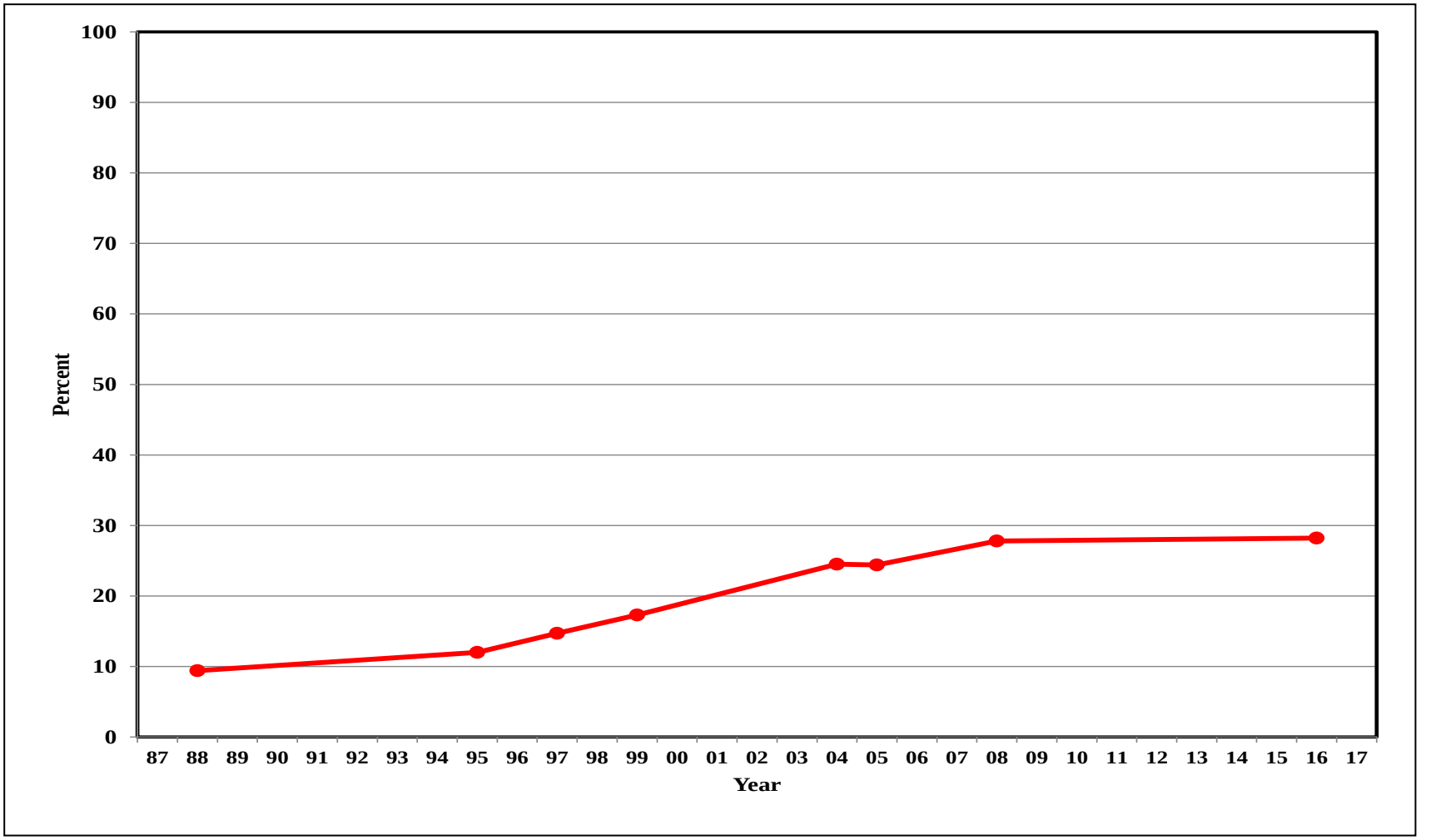


**Figure 2: Civic scientific literacy in the United States, 1988-2016.**

**Table 1: Factors associated with Civic Scientific Literacy (CSL), 2016.**

| | % CSL | Gamma | N |
|---|---|---|---|
| All Adults | 28 | -- | 2,835 |
| **Gender** | | | |
| Male | 36 | -0.37 | 1,370 |
| Female | 20 | | 1,465 |
| **Education** | | | |
| Less than high school | 7 | 0.61 | 347 |
| High school graduate or GED | 17 | | 1,368 |
| Associate degree | 27 | | 225 |
| Baccalaureate degree | 46 | | 532 |
| Graduate or professional degree | 62 | | 361 |
| **College science courses** | | | |
| None | 10 | 0.74 | 1,615 |
| 1 to 3 courses | 40 | | 631 |
| 4 or more courses | 62 | | 587 |
| **Respondent age** | | | |
| 18 to 24 years old | 32 | -0.13 | 352 |
| 25 to 34 years old | 32 | | 487 |
| 35 to 44 years old | 30 | | 469 |
| 45 to 54 years old | 30 | | 484 |
| 55 to 64 years old | 24 | | 503 |
| 65 or more years old | 21 | | 538 |
| **Minor children at home** | | | |
| None | 29 | NS | 1,833 |
| One or more | 26 | | 1,001 |

Gamma is a measure of the correlation between ordinal measures. The Gamma coefficient reflects the proportion of the total variance or mutual dependence between two variables that is accounted for by the relationship between the two measures (Costner, 1965).