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Can Universities Support Civic Engagement through Science Literacy?

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1. Abstract

Sociologists have identified an interesting paradox in the relationship between higher education and voter behavior. If educational attainment is seen as positively influencing individual voter turnout, why did aggregate voter turnout remain relatively stagnant across election cycles even as higher education access and attainment expanded dramatically over the 20th century? This paper analyzes individual-level survey data from the 2016 U.S. Scientific Literacy Study to show that the number of science classes people take influences their understanding of a pressing public policy issue—climate change. Climate science literacy did not predict voter turnout, but it did predict candidate choice.

Keywords: higher education; regression analyses; secondary data analyses; science education

2. Can Universities Support Civic Engagement through Science Literacy?

Despite a global consensus on climate science and the importance of addressing climate change (Intergovernmental Panel on Climate Change, 2023), only slightly more than half of Americans view climate change as a major threat (Tyson et al, 2023). A scientific topic has become incredibly politicized. There is more than a 50-point gap in the percentage of Democrats or Democratic-leaning adults who view climate change as a major threat (78%) and the percentage of Republicans or Republican-leaning adults who say the same (23%) (Tyson et al., 2023). Across both parties, many Americans question the ability of science and scientists to determine whether climate change is underway, what contributes to climate change, and how to address climate change (Pasquini & Kennedy, 2023). The politicization of climate change and doubt in science leads to overall low levels of support for policies and initiatives to curb climate change and reduce harm to the environment (Tyson et al., 2023).

Universities have a special responsibility in our democracy to prepare students to be civically engaged citizens (Colby et al., 2003; Colby et al., 2010; Daniels, 2021). However, some conservative state policymakers are trying to divorce citizenship education from science education. For instance, Governor Ron DeSantis has moved to institute the Florida Civic Literacy Exam for college and university students (Thomas, 2024), even as he advances efforts to limit learning in the social sciences (e.g., Miller et al., 2023). Policymakers in other states, such as Ohio, are trying to prevent universities from teaching climate science or warping science education to misrepresent the scientific consensus on the subject (e.g., Kowalski, 2023).

The purpose of this paper is to consider relationships among science coursetaking, scientific literacy, and civic engagement. I analyzed a national sample of adults from the 2016 U.S. Scientific Literacy Study to introduce a novel measure of climate science literacy and how it is influenced by science coursetaking—and how science literacy influences voter behavior. Toward the end of this brief, I offer implications for understanding how higher education can—and should—influence civic engagement.

3. Background

Higher education has historically been expected to prepare good citizens, but the ways in which it has done so—its curricular focus—has changed over time. During the colonial era and through the early republic, American colleges were devoted to preparing religious, civic, and political leaders by teaching humanities to outfit the "furniture of the mind" (Geiger, 2014, p. 333). However, by the mid-nineteenth century, higher education began to give way to more practical and applied learning in fields such as agriculture and engineering. Through curricular innovation, universities expanded their mandate from preparing leaders through the humanities to also preparing leaders through the sciences (Geiger, 2014).

At the beginning of the twentieth century, humanities departments still hosted large shares of faculty and enrollments, but their dominance did not last. In the decades that followed, shares of professors and students in humanities declined and universities became reorganized and rationalized around science (Frank & Gabler, 2006). As higher education became a more important social institution, higher education both catalyzed and reflected a global culture of "scientization" (Baker, 2014). Scientization was coined to describe how "people accept a common set of scientific and professional authorities and skills" as the legitimate basis for identifying and addressing problems (Schofer et al., 2021, p. 5).

Despite higher education's embrace of the sciences, scholars assumed that universities primarily prepared students to be civically engaged through the humanities and social sciences, such as through political science courses (e.g., Fernandez, 2021). Science faculty and higher education researchers traditionally saw science courses as apolitical instead of as important opportunities to train citizens who are knowledgeable about addressing important problems in our time (e.g., climate change, global pandemics, vaccines and public health, women's reproductive health (Ro et al., 2022). However, scientization has influenced national and intergovernmental approaches to engaging with issues such as climate change. Entire agencies and bureaucracies were created and populated with university-trained scientists to address a global, pervasive environmental problem. Science was the rationalized way to address a public policy problem (Schofer et al., 2021; Schofer & Hironaka, 2005).

Researchers have overlooked the importance of increased exposure to science because they have generally underappreciated higher education's effect on civic engagement (Baker, 2014). As higher education access and attainment expanded dramatically during the twentieth century, voter turnout rates remained stagnant. Baker (2014) argues that "the way to solve the paradox" of increasing educational attainment and static voter turnout "is to ask what an educated polity does to the dimensions of politics in the postindustrial society" (Baker, 2014, p. 249). Apart from voter turnout, higher education can influence the ways students think about social problems, the ways they identify with political parties, the ways they perceive the world, and the way they exhibit greater "reflexivity stemming from . . . exposure to scientific methods and authoritative knowledge production of the

university" (p. 250). From this perspective, higher education's influence on civic engagement may operate through exposure to science; its influence may be seen in *how* alumni understand political issues and choose candidates to support rather than *whether* they turnout to vote. This brief addresses the following research questions:

1. Was there a positive relationship between taking more science courses and climate science literacy?
2. Was there a positive relationship between taking more science courses (and climate science literacy) and voter turnout in the 2016 primary and 2016 general elections?
3. Was there a positive relationship between taking more science courses (and climate science literacy) and candidate choice in the 2016 general election?

4. Data and Method

4.1 Data and Sample

This study analyzed data from the 2016 U.S. Scientific Literacy Study that were collected by AmeriSpeak at the National Opinion Research Center at the University of Chicago (Miller, 2020; Miller et al., 2021). The survey was sent to a national probability sample of 2,840 U.S. adults who were 18-years old or older. The survey included two waves of data collection. The first wave was administered during the U.S. presidential primary process between February and March 2016, and the second wave was administered after the general election between November and December 2016. The project was funded by the National Aeronautics and Space Administration (Miller, 2020). The survey was designed to assess "civic scientific literacy" which "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, 2016, p. 2; see also Shen, 1975).

4.2 Measures

I used the 2016 U.S. Scientific Literacy Study data to compute four dependent variables based on my research questions. First, I used multiple survey items to develop a novel measure of climate science literacy. Informed by sociological literature about the effects of education on environmental protection and climate science outcomes (e.g., Schofer et al., 2021; Schofer & Hironaka, 2005), I began by identifying eight survey items related to how informed respondents were about climate change, including how concerned they were about the issue. These types of questions met Shen's (1975) concept of "civic scientific literacy" which encompasses "the kind of information that a citizen needs to read about and understand current science and technology policy issues" (Miller, 2016, p. 1). I analyzed the eight survey items using exploratory factor analysis (EFA) with principal axis factoring and Promax rotation. Items with a factor loading of 0.40 or greater were included in the factor and the reliability threshold was set to a minimum Cronbach's alpha of 0.65. Three items were dropped, and a five-item factor of *Climate Science Literacy* was created ($\alpha = 0.839$). See Table 1 for EFA factor loadings.

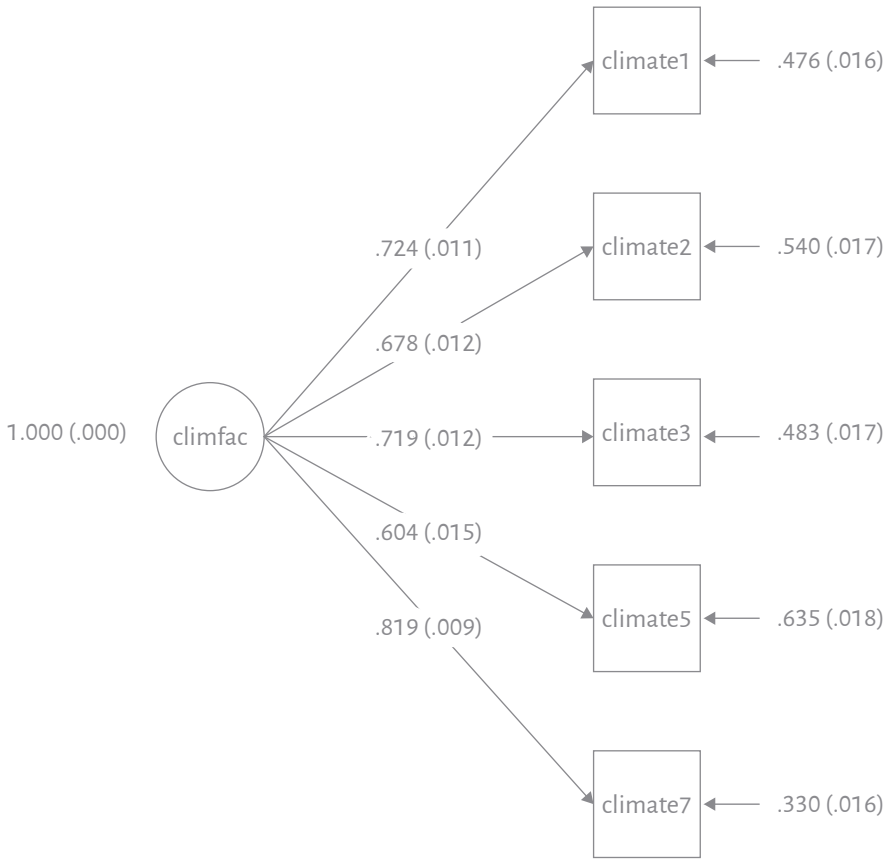
Table 1: EFA Factor Loadings for Composite Factor

Variable	Factor Loadings
Climate Change Factor (n=2,847; Cronbach's alpha = .839)	
climate1: We are already in the first stages of global warming and climate change research.[1]	0.731
climate2: The dangers of global warming are being overemphasized for political reasons.[2]	0.692
climate3: If the current state of fossil fuel use continues, serious long-term environmental damage will occur.[1]	0.751
climate5: The primary human activity that causes global warming is the burning of fossil fuels.[3]	0.620
climate7: How concerned are you about global climate change.[4]	0.823

[1] Four-point scale: 1 = "strongly disagree" to 4 = "strongly agree"
[2] Four-point scale: 1 = "strongly agree" to 4 = "strongly disagree"
[3] Four-point scale: 1 = "definitely false" to 4 = "definitely true"
[4] Five-point scale: 1 = "totally unconcerned" to 5 = "very concerned"

I then conducted confirmatory factor analysis (CFA) in *MPlus* on the five-item climate change factor. Model fit indices showed a good fit, with AIC=31006.274 and BIC=31095.500. Additionally, the Comparative Fit Index (CFI) was 0.994, the Root Mean Square Error of Approximation (RMSEA) was 0.044, and the Tucker Lewis Index (TLI) was 0.989. These values met recommended benchmarks for model fit standards including a CFI greater than 0.92, a RMSEA value of less than 0.07 (Hair et al., 2019), and a TLI greater than 0.95 (Hu & Bentler, 1998, 1999). The factor model also indicated good item-construct fit since all factor loadings ranged from .604 to .819, which were above acceptable thresholds (Field, 2005; Tabachnick & Fidell, 2007). See Figure 1 for the full CFA model.

Figure 1: Climate Science Literacy Factor



Note: The numbers on the arrows pointing to the right from the *Climate Science Literacy* measure (climfac) to each item are standardized factor loadings, with standard errors in parentheses. Numbers next to the boxes representing individual survey items are residuals or the difference between the model and the observed data.

I also conducted measurement invariance testing for Trump voters and Clinton voters. EFA indicated that factor loadings were higher for each item among Trump voters compared to Clinton voters, and the overall measure had higher reliability among Trump voters (Cronbach's α = 0.724) compared to Clinton voters (Cronbach's α = 0.857). CFA fit indices (CFI, RMSEA, and TLI.) show good model fit for the configural model across groups. See Table 2 and Figure 2 and Figure 3.

Table 2: Summary of Measurement Invariance Analysis

	Clinton Voters (N = 907)	Trump Voters (N = 648)
Exploratory Factor Analysis		
Factor Loading		
climate1	0.557	0.766
climate2	0.595	0.698
climate3	0.647	0.763
climate5	0.497	0.664
climate7	0.665	0.844
Cronbach's *alpha*	0.724	0.857
Confirmatory Factor Analysis		
AIC	8863.621	7091.014
BIC	8935.756	7158.123
CFI	0.994	0.991
RMSEA	0.031	0.058
TLI	0.988	0.982

Figure 2: Climate Science Literacy Factor: Clinton Voters

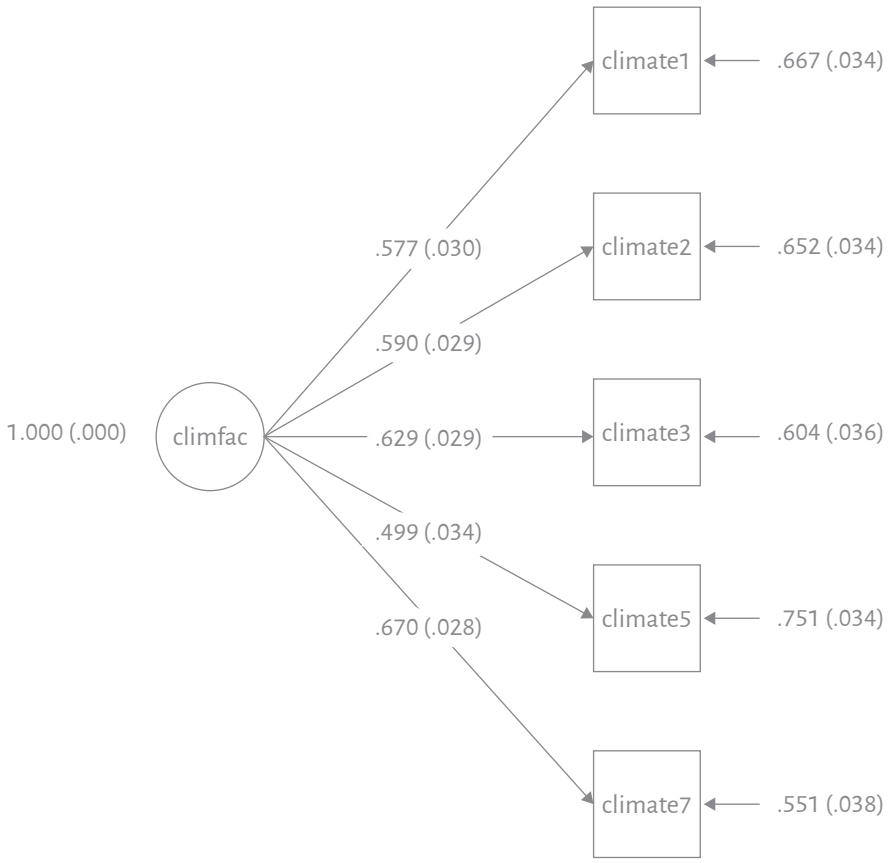
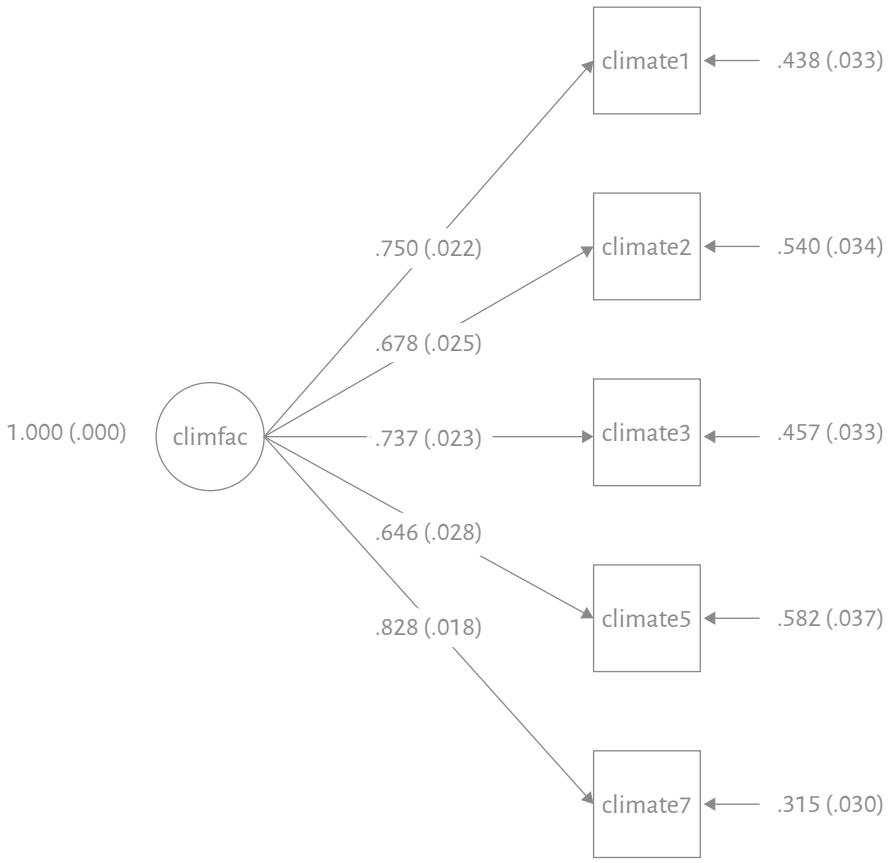


Figure 3: Climate Science Literacy Factor: Trump Voters



For the second and third research questions, three additional dependent variables measured voting behaviors, including candidate choice. Two dichotomous variables recorded whether respondents reported voting in the 2016 Democratic or Republican presidential primary election and whether they reported voting in the general presidential election (1 = yes, 0 = no). A third dichotomous variable indicated self-reported candidate choice, limited to the two major party candidates (1 = Clinton, 0 = Trump).

Key independent variables were selected to measure participants' science coursework and science literacy. Science coursework was recorded through a survey question that asked: "How many college-level science courses have you taken since you left high school?" For ease of interpretation, I transformed the continuous count of science courses to create a standardized variable. Science literacy was measured using the *Climate Science Literacy* factor scores that served as a dependent variable for the first research question.

I also included control variables to account for participant's demographic and political characteristics, which have been previously used in political science research to examine voter turnout (e.g., Kim et al., 2020; Plutzer 2017). First, we included several measures of demographic identities (e.g., gender, race/ethnicity, age, marital status, income, and highest education). Next, we included measures of participant's political characteristics. These included a continuous measure of attention to the election, a categorical variable for political party affiliation, and a continuous measure of participants' identification on a liberal to conservative scale. See Table 3 for a list of variables and how they were coded. See Table 4 for descriptive statistics and a demographic profile of the analytic sample.

Table 3: Variable Definitions and Coding Scheme

Variable	Definition/Coding Scheme
Dependent Variables	
Climate Science Literacy	Standardized five-item factor scores
Voted in Primary Election	Have you voted in a 2016 Republican or Democratic primary election or caucus? 0=No; 1=Yes
Voted in General Election	Voted in the 2016 general election in person, early, or absentee; 0=No; 1=Yes
Candidate Choice	0=Voted for Trump; 1=Voted for Clinton
Demographics and Background Characteristics	
Sex	Dichotomous: 0=Male; 1=Female
Race	1=White; 2=Black; 3=Hispanic; 4=Two or more race groups and other
Educational Attainment	1=less than high school; 2=high school diploma or GED; 3=Some college (community college, associates, or vocational school); 4=bachelor's degree or above
Age	Continuous
Marital status	Dichotomous: 0=Not married; 1=Married
Income	1=Under $30,000; 2=$30K to $49,999; 3=$50K to $99,999; 4≥$100K
Political Characteristics	
Attention to Election	1=Not much at all; 2=Occasionally; 3=Moderately closely; 4=Very closely
Political Party	1=Democrat; 2=Republican; 3=Independent; 4=Other and decline to state
Conservativism	Continuous from 0=Very liberal to 10=Very conservative
Scientific Literacy	
Science Courses	Transformed (standardized) number of college-level science courses taken; Recoded (categorized) number of college-level science courses taken
Climate Change Factor	Standardized five-item factor scores

Table 4: Descriptive Statistics for Variables Included in Analyses

	Yes		No	
	N	%	N	%
Voted in Primary Election	1,349	62.86%	797	37.14%
Voted in General Election	1,745	82.27%	376	17.73%
Voted for Clinton	907	58.33%	648	41.67%
	Mean		SE	
Climate Science Literacy	0.00		0.02	
Age	50.23		0.37	
Attention to Election	3.00		0.02	
Conservativism	5.25		0.06	
Science Classes Taken (Standardized)	0.09		0.02	
Number of Science Classes (Categories)				
0	1,320		47.77%	
1 or 2	543		19.65%	
3 or 4	372		13.46%	
5 or more	528		19.11%	
Educational Attainment				
Less than High School	110		4.10%	
High School Diploma or Equivalency	607		22.63%	
Some College	839		31.28%	
Bachelor's or Above	1,126		41.98%	
Sex				
Female	1,550		55.20%	
Male	1,258		44.80%	
Marital Status				
Married	1,339		47.69%	
Not Married	1,469		52.31%	
Race				
Black	389		13.85%	
Hispanic	389		10.29%	
Other	246		8.76%	
White (Non-Hispanic)	1,884		67.09%	
Income				
Under $30,000	846		30.13%	
$30,000 to $49,999	536		19.09%	
$50,000 to $99,999	854		30.41%	
> $100,000	572		20.37%	
Political Party				
Democrat	1,051		39.01%	
Republican	662		24.57%	
Independent	649		24.09%	
Other/Decline to State	332		12.32%	

4.3 Analyses

I first checked for multicollinearity among independent variables using bivariate correlations as well as the tolerance and variance of inflation statistics. All correlations were within acceptable limits. Then I estimated ordinary least squares (OLS) regression for the first research question and logistic regression models for the second and third research questions. I reported adjusted *R*2 to show that the OLS model explained a substantial percentage of the variance in the data and pseudo-*R*2 statistics to show that the logistic regression models were substantially better than null models at predicting the likelihood of each outcome, particularly candidate choice (McFadden, 1979). I also used path analysis (Cain, 2020; Lleras, 2005) to examine the direct and indirect relationships among science coursetaking, *Climate Science Literacy*, and candidate choice.

As a robustness check, I re-estimated the analyses using a recoded variable measuring science coursetaking. The original models used a standardized variable of the reported number of science courses each respondent took after high school. As a sensitivity analysis, I recoded the original number of science courses into a categorical variable (0 = respondents did not take any science courses after high school; 1 = respondents took one or two science courses after high school; 2 = respondents took three or four science courses after high school; 3 = respondents took five or more science courses after high school). For these analyses, I set 0 as the reference group so that other categories are compared to not having any post-high school formal exposure to science education.

4.4 Limitations

The secondary data from the 2016 U.S. Scientific Literacy Study offered unique opportunities to examine broader educational attainment, science coursetaking, and science literacy. However, the survey did not collect data on the college experience, such as participating in service-learning courses or other forms of engagement, which are often included in higher education literature (e.g., Ro et al., 2021; Ro et al., 2022; Ro et al., 2023). In addition, the dataset did not include information about college contexts, such as college or university characteristics, which can influence individuals' civic engagement (e.g., Fernandez et al., 2020). The dataset also had limitations in how it reported participants' race. For instance, we were not able to identify Asian respondents in the sample or other groups, including members of Indigenous or Tribal communities. The methods and findings in this study were correlational and did not support causal inference.

The *Climate Science Literacy* measure is only one possible measure that could be used to examine how exposure to science classes influences voter behavior. Future research may examine a broader concept of science literacy. However, climate change was a salient issue in the 2016 U.S. presidential primary and general elections (e.g., Brown & Sovacool, 2017). Additionally, Kim et al., (2020) used a machine learning approach to analyze data from the 2016 Cooperative Congressional Election Study to show that climate change was one of only a few policy issues that explained voter turnout. For the purposes of this paper, it made sense to focus on climate science based on available secondary data.

5. Results

After controlling for demographic characteristics typically used to analyze voting (e.g., educational attainment, gender, age, marital status, race, income, attention to the election, political party affiliation, and self-reported placement on a liberal-conservative scale), ordinary least squares regression showed that a one standard deviation increase in taking college-level science courses correlated with a 0.06 standard deviation increase in *Climate Science Literacy* ($p < 0.001$). The *Climate Science Literacy* measure was not statistically significantly related to voter turnout. Although the number of science courses did not have an independent effect on candidate choice, a one standard deviation increase in *Climate Science Literacy* related to 3.32 times higher odds of voting for Clinton than Trump; the pseudo *R*2 of 0.61 indicates the model is a substantial improvement over a null model predicting the likelihood of voting for Clinton. See Table 5.

Table 5: Summary of Regression Analyses Examining Science Coursetaking, Climate Science Literacy, and Voter Behavior

	Climate Science Literacy			Voted in Primary Election			Voted in General Election			Voted for Clinton		
	Coef.	SE	P-Value	OR	SE	P-Value	OR	SE	P-Value	OR	SE	P-Value
Climate Science Literacy				0.88	0.07	0.11	1.13	0.13	0.28	3.32	0.52	0.00
Science Classes Taken (Standardized)	0.06	0.02	0.00	1.10	0.07	0.12	1.20	0.14	0.11	1.02	0.12	0.84
Educational Attainment												
HS or GED	0.19	0.12	0.10	4.17	1.79	0.00	3.66	1.63	0.00	2.17	1.88	0.37
Some college	0.23	0.11	0.04	5.52	2.34	0.00	4.32	1.87	0.00	1.65	1.42	0.56
Bachelor's or Above	0.23	0.11	0.04	5.23	2.23	0.00	6.75	3.03	0.00	3.48	3.03	0.15
Female	0.08	0.04	0.03	1.33	0.16	0.02	1.54	0.27	0.02	1.21	0.27	0.38
Age	0.00	0.00	0.63	1.03	0.00	0.00	1.03	0.01	0.00	1.00	0.01	0.96
Married	-0.09	0.04	0.02	1.18	0.15	0.20	1.34	0.26	0.13	1.26	0.29	0.31
Race												
Black	-0.05	0.06	0.42	2.11	0.49	0.00	1.25	0.40	0.47	17.21	8.50	0.00
Hispanic	0.04	0.06	0.51	0.68	0.14	0.06	0.50	0.13	0.01	2.64	1.13	0.02
Other	0.00	0.06	0.95	1.16	0.24	0.48	0.56	0.15	0.04	2.06	0.83	0.07
Income												
$30,000 to $49,999	-0.04	0.05	0.41	1.40	0.25	0.06	0.93	0.21	0.76	2.44	0.85	0.01
$50,000 to $99,999	-0.07	0.05	0.18	1.52	0.25	0.01	2.56	0.62	0.00	1.33	0.39	0.34
> $100,000	0.00	0.06	0.99	1.66	0.31	0.01	1.84	0.51	0.03	1.03	0.34	0.94
Attention to Election	0.05	0.02	0.01	1.60	0.11	0.00	1.66	0.16	0.00	1.01	0.13	0.97
Political Party												
Republican	-0.69	0.05	0.00	0.98	0.19	0.94	1.00	0.30	1.00	0.04	0.01	0.00
Independent	-0.21	0.05	0.00	0.45	0.07	0.00	0.57	0.13	0.01	0.23	0.06	0.00
Other/Decline to State	-0.30	0.07	0.00	0.39	0.09	0.00	0.31	0.09	0.00	0.13	0.05	0.00
Conservativism	-0.13	0.01	0.00	1.00	0.03	1.00	1.04	0.04	0.38	0.67	0.04	0.00
	N = 1,936			N = 1,516			N = 1,483			N = 1,163		
	Adj. R^2 = 0.37			Pseudo R^2 = 0.13			Pseudo R^2 = 0.20			Pseudo R^2 = 0.61		

When science coursetaking was measured using an ordinal instead of a standardized variable, the number of science classes was positively related to *Climate Science Literacy*. The robustness check or sensitivity analysis suggests that the positive and statistically significant relationship between science coursetaking and *Climate Science Literacy* operates through substantial, repeated exposure to science. Taking between one and four science classes was not statistically significantly different from not taking any science courses. Taking five or more science courses related to a 0.20 standard deviation increase in *Climate Science Literacy* ($p < 0.001$).

In the preferred models, science coursetaking and *Climate Science Literacy* did not relate to voter turnout during the U.S. presidential primary or general elections (see Table 5). However, in the robustness or sensitivity analyses, respondents who took five or more science classes had higher odds of turning out to vote in the primary (OR = 1.53; $p < 0.05$) and general (OR = 2.46; $p < 0.001$) elections. See Table 6.

Table 6: Summary of Robustness Checks Examining Science Coursetaking, Climate Science Literacy, and Voter Behavior

	Climate Science Literacy			Voted in Primary Election			Voted in General Election			Voted for Clinton		
	Coef.	SE	P-Value	OR	SE	P-Value	OR	SE	P-Value	OR	SE	P-Value
Climate Science Literacy				0.88	0.07	0.10	1.12	0.13	0.34	3.34	0.52	0.00
Science Classes Taken												
1 or 2	0.06	0.05	0.26	0.83	0.15	0.28	1.46	0.37	0.13	0.97	0.31	0.93
3 or 4	0.05	0.06	0.36	1.40	0.29	0.10	1.17	0.34	0.58	1.59	0.59	0.21
5 or more	0.20	0.06	0.00	1.53	0.30	0.03	2.46	0.74	0.00	1.39	0.49	0.34
Educational Attainment												
HS or GED	0.18	0.12	0.12	4.21	1.81	0.00	3.49	1.56	0.01	2.14	1.86	0.38
Some college	0.21	0.11	0.07	5.56	2.38	0.00	3.81	1.68	0.00	1.57	1.36	0.61
Bachelor's or Above	0.19	0.12	0.10	4.86	2.13	0.00	5.39	2.51	0.00	2.88	2.58	0.24
Female	0.07	0.04	0.06	1.34	0.16	0.02	1.52	0.27	0.02	1.24	0.27	0.32
Age	0.00	0.00	0.75	1.03	0.00	0.00	1.03	0.01	0.00	1.00	0.01	0.85
Married	-0.09	0.04	0.01	1.16	0.15	0.24	1.34	0.26	0.13	1.24	0.28	0.34
Race												
Black	-0.05	0.06	0.39	2.17	0.51	0.00	1.23	0.39	0.51	17.46	8.70	0.00
Hispanic	0.04	0.06	0.49	0.69	0.15	0.08	0.51	0.14	0.01	2.65	1.13	0.02
Other	0.00	0.06	0.96	1.16	0.24	0.50	0.55	0.15	0.03	2.09	0.84	0.07
Income												
$30,000 to $49,999	-0.04	0.05	0.44	1.41	0.25	0.06	0.94	0.21	0.77	2.45	0.86	0.01
$50,000 to $99,999	-0.06	0.05	0.18	1.54	0.25	0.01	2.64	0.64	0.00	1.37	0.41	0.30
> $100,000	-0.01	0.06	0.91	1.64	0.31	0.01	1.86	0.52	0.03	1.00	0.33	0.99
Attention to Election	0.05	0.02	0.02	1.59	0.11	0.00	1.63	0.16	0.00	0.99	0.13	0.93
Political Party												
Republican	-0.69	0.05	0.00	0.99	0.20	0.98	0.99	0.29	0.97	0.04	0.01	0.00
Independent	-0.21	0.05	0.00	0.45	0.07	0.00	0.57	0.13	0.02	0.22	0.06	0.00
Other/Decline to State	-0.30	0.07	0.00	0.38	0.09	0.00	0.31	0.08	0.00	0.12	0.05	0.00
Conservativism	-0.13	0.01	0.00	1.00	0.03	0.93	1.04	0.04	0.37	0.66	0.04	0.00
	N = 1,936			N = 1,516			N = 1,483			N = 1,163		
	Adj. R^2 = 0.37			Pseudo R^2 = 0.13			Pseudo R^2 = 0.20			Pseudo R^2 = 0.61		

Finally, in both preferred and supplemental analyses, *Climate Science Literacy* predicted candidate choice, but science coursetaking did not. After controlling for background characteristics and political backgrounds, a one standard deviation increase in *Climate Science Literacy* related to more than three times higher odds of voting for Clinton (See Table 5 and Table 6). Path analysis helped to visualize the findings from the first and third research questions by showing that science coursetaking directly relates to science literacy but not candidate choice; science literacy does, however, influence candidate choice. See Figure 4.

Figure 4



Note: Figure 1 summarizes findings from path analysis using Stata's **sem** command with only the three variables above (omitting controls included in other analyses in this paper). The parameter estimates are standardized coefficients.
*** $p < 0.001$

6. Discussion

Universities play a special role in ensuring the survival of our democracy by preparing informed, civically engaged citizens (Colby et al., 2003; Colby et al., 2010; Daniels, 2021). Regarding one of the most globally pressing crises, Americans are woefully under informed and skeptical. Climate change demands immediate government attention, but first, voters must elect candidates who will not only be committed to addressing climate change—they must also be committed to doing so in concert with other governments and leaders on the world stage.

This paper presents several analyses of data from the 2016 U.S. Scientific Literacy Study. First, I demonstrate that a handful of survey items can be used to measure climate science literacy and that the measure works well among both Republican and Democratic voters. Then, as should be expected, I show that increased exposure to science curricula is positively related to the measure of climate science literacy. On its own, science coursetaking generally does not influence voter turnout or candidate choice. After controlling for science coursetaking, climate science literacy predicts candidate choice and not voter turnout; in other words, it influences *how* (but not *whether*) adults participate in the democratic process. Path analyses also suggest that science coursetaking operates indirectly through influencing climate science literacy.

6.1 Implications for Theory

Sociological literature offered insights for theorizing how higher education influences civic engagement (Baker, 2014; Schofer et al., 2021), particularly around climate change (Schofer & Hironaka, 2005), but it had not tested those hypotheses individual-level data on couresetaking or voter behavior. I found that taking more science classes does not directly influence who turns out to vote or which candidate they support. However, science coursetaking influenced a novel measure of *Climate Science Literacy*, which does predict candidate choice. I focused on climate science literacy based on prior sociological research and available secondary data, but scholars may develop other measures of science literacy. Future research should continue to examine the ways that taking science courses may foster "reflexivity stemming from . . . exposure to scientific methods" (Baker, 2014, p. 250), which may influence *how* people understand social and political issues and *how* they participate in politics.

6.2 Implications for Practice

Campus leaders and faculty should consider that science education and civic education may be more interrelated than previously expected. Compared to humanities faculty, STEM faculty advocate less strongly for civic engagement. STEM faculty are also less likely to recognize the importance of civic engagement for influencing how students think about social issues. They are also more likely to say that it is too time intensive—that will not help in the pursuit of tenure—to incorporate civic engagement in STEM courses (Buzinski et al., 2013). Campus conversations and resources should be devoted to questioning and challenging these assumptions. This paper suggests that science courses influence voter behavior. While campuses can try to expand opportunities for students to take science courses—or even increase science course requirements—they should first try to break down the perceived dichotomy between science and civic engagement.

6.3 Implications for Policy

Amid a rising tide of populism and autocracy, policymakers in the U.S. and around the world are trying to wield higher education for STEM education, scientific discovery, economic growth, and technological innovation, while simultaneously circumscribing academic freedom and civic engagement that challenges the regime (e.g., Douglass, 2021). This paper suggests that approach oversimplifies or misunderstands relationships between science education and civic engagement. As others have argued (e.g., Baker, 2014), it is inconceivable to think of high-quality science education that also limits critical thinking. Policymakers, such as Florida's elected officials, should reconsider their approach of trying to legislate civic literacy (e.g., Thomas, 2024). Unless legislators intend to ban learning in the sciences as well as the humanities, state legislatures should work to protect rather than undermine academic freedom.

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