Policy Trends in Science Education by Christian Tyler

Dataset Description
I used the dataset titled "**Evolution_Public_Schools**", which amasses the responses from the 2019 Survey of American Science Teachers. In the survey, teachers responded with both their political affiliation and which state they currently reside in. The survey asked basic information questions of the science teachers as well as their thoughts and approaches to teaching or omitting evolution in their class.

Research Question
Upon looking at the dataset I came up with the question, To what extent, if any, is there a statistically significant difference between the political affiliation of middle and high school science teachers and their geographic location in the United States?

Research Ethics
The dataset represents a relatively small subset of the national population of science teachers. Consequently, the range of responses and data we have may not accurately reflect the views or experiences of all science teachers across the country, so we have to analyze our data with the knowledge that it may not be an accurate representation of the greater population.

Variables

Variable	**Type**	**Measuring**
State	Categorical	The state where surveyed teachers teach
Political Affiliation	Categorical	The political affiliation of surveyed teachers

Hypothesis
The United States has a higher proportion of Democrat science teachers in middle school and high school than Republican middle school and high school science teachers.

Data Source
2019 Survey of American Science Teachers

Software(s) Used
Tableau and Excel

Data Preparation and Description
Cleaning

1. I got rid of every variable outside of ‘Political Affiliation’ and ‘State’.
2. Also got rid of every political affiliation other than Democrat or Republican. This was done because the number of respondents from other political affiliations were not statistically significant.

Original Dataset

PSU ID	State	State postal code	Analysis weight		From paper or web	Class with biggest enrollment	Class with biggest enrollment	Class with biggest enrollment	Class with biggest enrollment	Hrs devoted to cell biology	Hrs devoted to ecology	Hrs devoted to human health	Hrs devoted to human evolution	Hrs devoted to general evolutionary processes	Hrs devoted to recent global warming	Hrs devoted to pollution and human impact	Hrs devoted to intelligent design or creationism	
20940	Alabama	AL	0.91	High school	Paper survey returned			Other	FORENSIC SCIENCE 2(	Not covered	Not covered	Not covered	Not covered	Not covered	Not covered	Not covered	Not covered	N
20908	Alabama	AL	0.76	High school	Web completion			Other	physical science	6-10 hours	20 or more hours	3-5 hours	Not covered	Not covered	Not covered	11-15 hours	Not covered	6-
10967	Alabama	AL	0.97	Middle school	Web completion	Physical Science				Not covered	Not covered	1-2 hours	Not covered	Not covered	Not covered	Not covered	Not covered	N
10966	Alabama	AL	1.26	Middle school	Paper survey returnec	Other	DISCIPLINARY SCIENCE			Not covered	Not covered	Not covered	Not covered	Not covered	20 or more hours	20 or more hours	Not covered	6-
10952	Alabama	AL	1.00	Middle school	Paper survey returnec	Earth Science				Not covered	Not covered	Not covered	Not covered	Not covered	3-5 hours	3-5 hours	Not covered	N
20927	Alabama	AL	0.99	High school	Paper survey returned			Intro. Biology or Life Science		11-15 hours	6-10 hours	1-2 hours	1-2 hours	3-5 hours	1-2 hours	1-2 hours	1-2 hours	6-
20916	Alabama	AL	0.82	High school	Paper survey returnec	Life Science				11-15 hours	1-2 hours		6-10 hours	6-10 hours	1-2 hours	1-2 hours	Not covered	3-
20925	Alabama	AL	0.80	High school	Paper survey returned			AP or IB Biology		20 or more hours	20 or more hours	3-5 hours	20 or more hours	20 or more hours	3-5 hours	3-5 hours	Not covered	2(
20941	Alabama	AL	0.97	High school	Paper survey returned			Adv. Biology or Life Science		15-20 hours	Not covered	3-5 hours	1-2 hours	1-2 hours	Not covered	Not covered	Not covered	3-
22497	Alaska	AK	0.69	High school	Paper survey returned			Intro. Biology or Life S	OCEANOGRAPHY & N	3-5 hours	20 or more hours	20 or more hours	20 or more hours	20 or more hours	20 or more hours	20 or more hours	Not covered	2(
22502	Alaska	AK	0.54	High school	Web completion			AP or IB Biology		15-20 hours	11-15 hours	15-20 hours	Not covered	20 or more hours	1-2 hours	1-2 hours	Not covered	6-
12507	Alaska	AK	0.87	Middle school	Web completion	Earth Science				Not covered	20 or more hours	15-20 hours	15-20 hours	15-20 hours	20 or more hours	20 or more hours		2(
22498	Alaska	AK	0.55	High school	Paper survey returnec	Life Science		Advanced Topics (e.g., Genetics)		Not covered	1-2 hours	6-10 hours	Not covered	Not covered	Not covered	1-2 hours	Not covered	1-
12509	Alaska	AK	1.10	Middle school	Paper survey returnec	Physical Science				Not covered	11-15 hours	Not covered	Not covered	1-2 hours	11-15 hours	1-2 hours	Not covered	3-
22134	Arizona	AZ	1.45	High school	Paper survey returned			Intro. Biology or Life Science		6-10 hours	11-15 hours	3-5 hours	6-10 hours	6-10 hours	3-5 hours	6-10 hours	Not covered	6-
22165	Arizona	AZ	1.08	High school	Paper survey returned					11-15 hours	11-15 hours	1-2 hours	Not covered	11-15 hours	1-2 hours	3-5 hours	Not covered	1-
22133	Arizona	AZ	1.11	High school	Paper survey returned			Intro. Biology or Life Science		15-20 hours	15-20 hours	3-5 hours	15-20 hours	11-15 hours	3-5 hours	3-5 hours	Not covered	1(
22152	Arizona	AZ	1.12	High school	Paper survey returned			Environmental Science (inc. AP)			20 or more hours	6-10 hours	Not covered	6-10 hours	15-20 hours	20 or more hours	Not covered	1(
22144	Arizona	AZ	0.86	High school	Paper survey returned			Intro. Biology or Life Science		15-20 hours	11-15 hours	1-2 hours	1-2 hours	11-15 hours	1-2 hours	6-10 hours	Not covered	6-
12131	Arizona	AZ	0.79	Middle school	Paper survey returnec	Integrated Science				6-10 hours	6-10 hours	1-2 hours	1-2 hours	6-10 hours	3-5 hours	6-10 hours	Not covered	1-
22128	Arizona	AZ	1.23	High school	Paper survey returned			Intro. Biology or Life Science		20 or more hours	20 or more hours	3-5 hours	3-5 hours	20 or more hours	1-2 hours	3-5 hours	Not covered	3-
12119	Arizona	AZ	1.13	Middle school	Web completion	Integrated Science				1-2 hours	6-10 hours	Not covered	Not covered	6-10 hours	Not covered	1-2 hours	Not covered	6-

Cleaning Step 1 (see above)

State	Politically, how do you usually identify?
Alabama	Democrat
Alabama	Republican
Alabama	Independent
Alabama	Republican
Alabama	Independent
Alabama	Republican
Alabama	Republican
California	Other
Alabama	Democrat
Alabama	Republican
Alabama	Independent
Alabama	Democrat
Alabama	Democrat
Alaska	Democrat
Alabama	
Alaska	Democrat
Alaska	Democrat
Alabama	
Alaska	Democrat
Alaska	Independent
Alabama	Other
Alaska	Democrat
Arizona	Democrat
Arizona	Republican
Arizona	Independent

Cleaning Step 2 (see above)

State	Politically, how do you usually identify?
Alabama	Democrat
Alabama	Republican
Alabama	Republican
Alabama	Republican
Alabama	Republican
Alabama	Democrat
Alabama	Republican
Alabama	Democrat
Alabama	Democrat
Alaska	Democrat
Alaska	Democrat
Alaska	Democrat
Alaska	Democrat
Alaska	Democrat
Arizona	Democrat
Arizona	Republican
Arizona	Democrat
Arizona	Republican
Arizona	Republican
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat
Arizona	Democrat

Recoding

1. Rather than having one data point for every teacher, I grouped by State and used a PivotTable to calculate the total number of Democrats and Republicans for each state. **Note that this step was how we calculated the t-test and made Visualization 2.**
2. I then found the ratio of Democrats per Republican by dividing the total number of Democrat science teachers by the total number of Republican science teachers in a new column. **Note that this step was only used to make Visualization 1, as it was easier to use a one number ratio to make the heat map rather than**

two different numbers. Note also that if there was a 0 for Republicans, we represented the ratio as 15 to avoid the "DIV/0" error - this was only for purposes of the heat map.

Recoding Step 1 (see above)	Recoding Step 2 (see above)

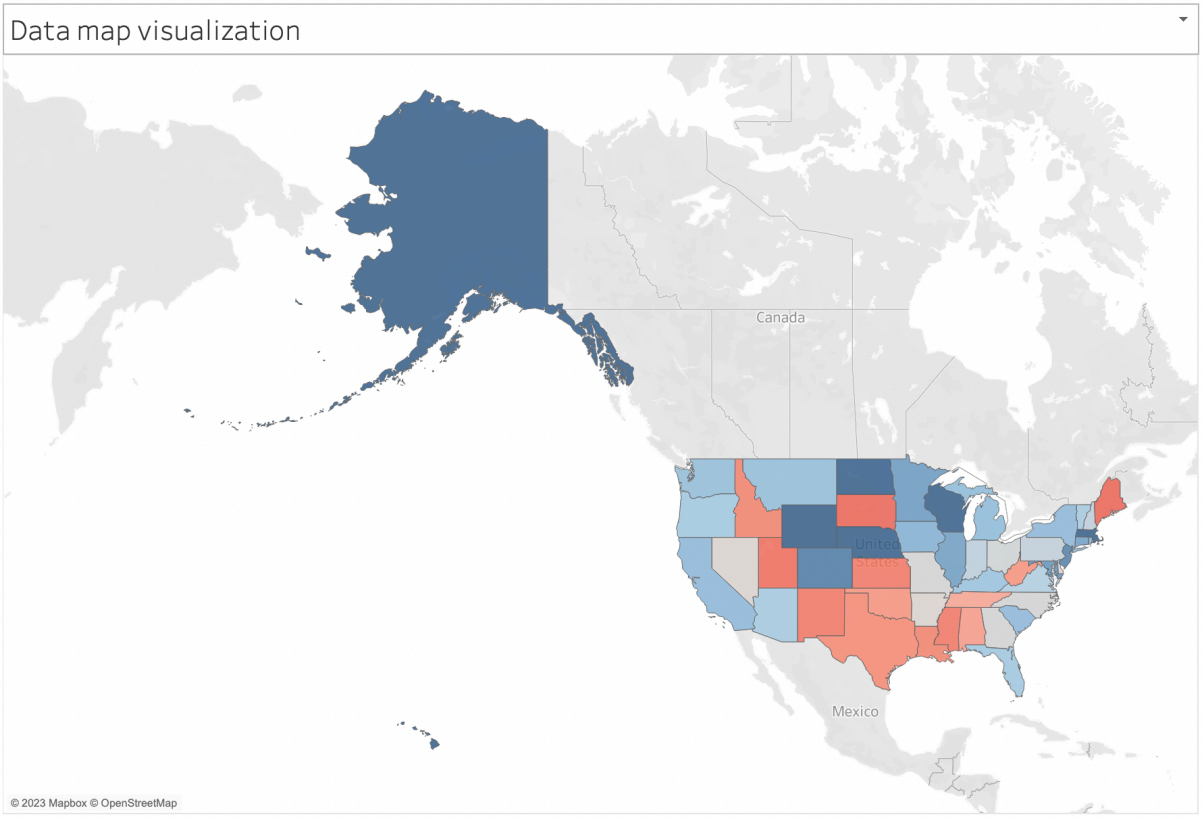
State	Democrat	Republican
Alabama	4	5
Alaska	5	0
Arizona	10	5
Arkansas	5	5
California	51	15
Colorado	8	1
Connecticut	5	1
Delaware	1	0
District of Co	1	0
Florida	23	10
Georgia	14	12
Hawaii	3	0
Idaho	2	3
Illinois	32	6
Indiana	11	7
Iowa	8	2
Kansas	6	10
Kentucky	10	4
Louisiana	4	6
Maine	1	2
Maryland	12	2
Massachusett	12	1
Michigan	19	6
Minnesota	22	4
Mississippi	3	5
Missouri	9	8
Montana	3	1
Nebraska	4	0
Nevada	4	4
New Hampsh	3	2

State	Democrat	Republican	Ratio (dem:rep
Alabama	4	5	0.8000
Alaska	5	0	15.0000
Arizona	10	5	2.0000
Arkansas	5	5	1.0000
California	51	15	3.4000
Colorado	8	1	8.0000
Connecticut	5	1	5.0000
Delaware	1	0	1.0000
District of Co	1	0	15.0000
Florida	23	10	2.3000
Georgia	14	12	1.1667
Hawaii	3	0	15.0000
Idaho	2	3	0.6667
Illinois	32	6	5.3333
Indiana	11	7	1.5714
Iowa	8	2	4.0000
Kansas	6	10	0.6000
Kentucky	10	4	2.5000
Louisiana	4	6	0.6667
Maine	1	2	0.5000
Maryland	12	2	6.0000
Massachusett	12	1	12.0000
Michigan	19	6	3.1667
Minnesota	22	4	5.5000
Mississippi	3	5	0.6000
Missouri	9	8	1.1250
Montana	3	1	3.0000
Nebraska	4	0	15.0000
Nevada	4	4	1.0000
New Hampsh	3	2	1.5000
New Jersey	15	2	7.5000
New Mexico	3	5	0.6000
New York	31	9	3.4444
North Carolir	14	12	1.1667
North Dakota	2	0	15.0000
Ohio	22	18	1.2222
Oklahoma	3	4	0.7500
Oregon	9	4	2.2500
Pennsylvania	35	24	1.4583

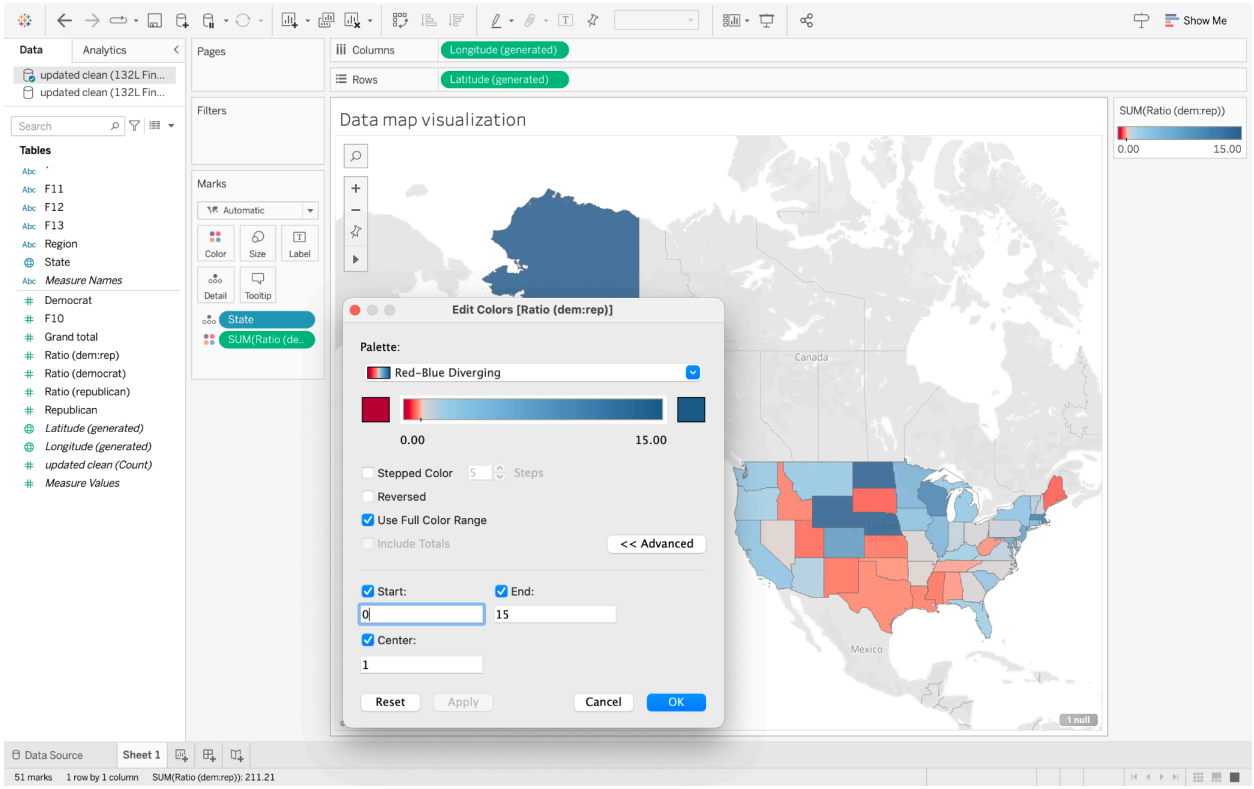
Data Analysis and Description

I then used the Data Analysis Toolpak in Microsoft Excel and conducted a matched pairs two-sample t-test to calculate the difference in means. I found a p-value of 6.24×10^{-7}. That is far below the significance value of .05, so I can reject the null hypothesis and can conclude that there is a higher ratio of democratic science teachers in America.

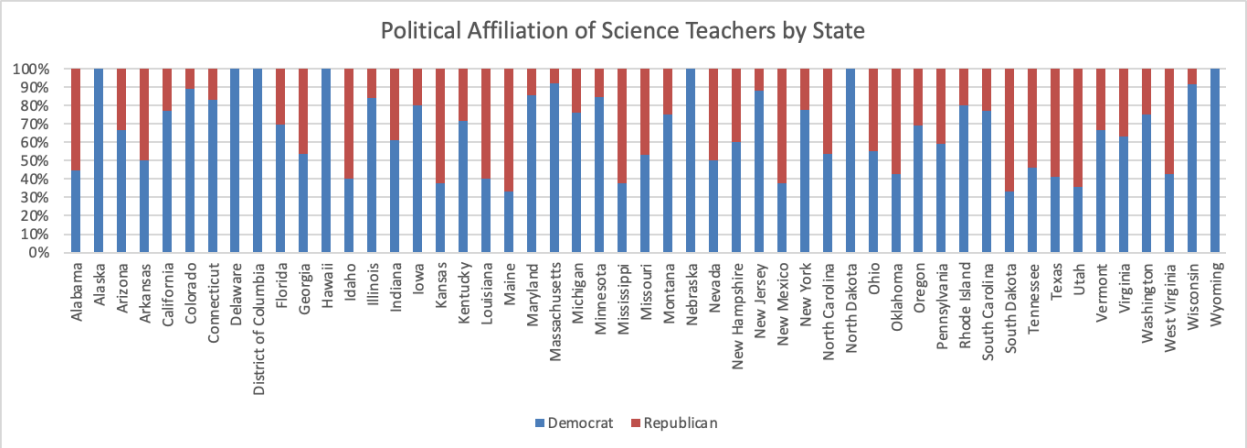
Visualization 1:



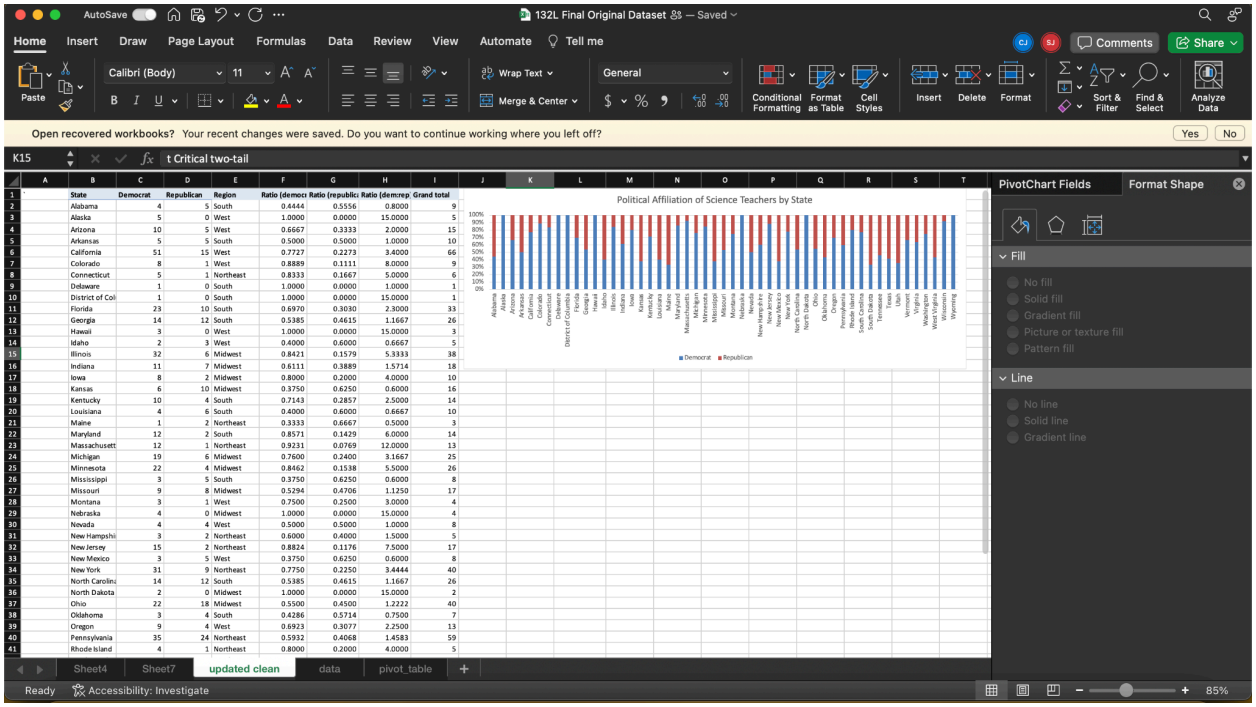
This visualization was created in Tableau using the geographic data display tool and edited to maximize color scale. We took a ratio of democratic to republican teachers and our data ranged from 0.3750 to 15, which can be seen on the image below.



Visualization 2:



This visualization was created in Excel using the stacked bar graph tool and edited to clearly display the four regions' relative percentages of Republicans and Democrats.



Conclusion

My analysis of the dataset "**Evolution_Public_Schools"** aimed to identify if there was a statistically significant difference (and if so, to what extent) in the political affiliations of both middle and high school science teachers in the United States: Northeast, South, West, and Midwest. Based on our hypothesis, I initially thought that there would be higher proportions of Democrat Science teachers in the Northeast compared to the other regions (the South, Midwest, and the West). I tested our hypothesis by cleaning and recoding our data to solely focus on political affiliation (Democrat or Republican) and State. I then assigned each state to its

respective region in the United States, using our operational definition pictured above. I counted the number of Democrats and Republicans in each state and then created a ratio comparing the two. Blue states represent a ratio in favor of Democrats, while red states represent a ratio in favor of Republicans. The darker the color appears, the greater the ratio is.
I then ran matched pairs two-sample t-test to calculate the difference in means. I found a p-value of 6.24 x 10^ -7, which is well below the standard significance threshold of 0.05. Ultimately, this led us to conclude that there is a higher ratio of democratic science teachers in America, thus proving our hypothesis.

Recommendations for future/additional work

1. **Make it a longitudinal study:** Doing this study over several years would help in understanding trends and changes in political affiliations among science teachers over time.

2. **Expand the sample size:** to obtain a more representative sample, studies based around this topic should include a larger and more diverse set of responses from science teachers across the country. This would help in providing a more accurate picture of the political affiliations of science teachers in the United States.