Factors Affecting US Education between 1998 and 2018*

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Formal education impacts the status of individuals and as an important social determinant of health, is critical to an equitable society. However, trends in education in the United States from 1998 to 2018, show obvious inequities for different people. This paper highlights the educational differences between women and men and between white populations and racialized populations and shows that white individuals have more success in the educational system, and women must acquire higher levels of education to achieve equality in the workplace. These findings will help us better understand the social, political and historical factors that shape educational opportunities and outcomes in the United States.

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*Code and data are available at: https://github.com/saiyedgh/us_edu_data.git

1 Introduction

Education is an important equalizer. It is strongly associated with health because it plays an important role in shaping opportunities for meaningful employment, income and where a person lives. Investing in early-year and high school education determines whether a student pursues higher education so early interventions are critical to future success. Policies and funding by state or federal governments that support equal access to resources and quality education in early education have had some success in leveling the playing field. But it isn't enough. By comparing differences between women, men and different races over a decade in the United States, is it evident that barriers to education continue to exist for racialized individuals and that women are held to higher standards of education in order to achieve equality in the workplace.

This paper looked at the General Social Survey (NORC, n.d.) to collect and analyze data as it related to education levels achieved across the United States from 1998-2008. The data looked specifically at trends in educational achievements in two different ways; by sex and by race. We conducted detailed research and interpretation of the results and designed four data representations. First, we examined all educational attainments in the U.S. from 1998 to 2008. Second, we looked at the educational attainments based on sex from 1998 to 2008. Finally, we will examine the number of degree holders by race.

Our findings will show that females and the white population attain higher education levels than males and other ethnicities.

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"What is the effect of public schools on a student's education path?". This framework will allow us to develop objectives for evaluating the effects of public schools on students.

2 Data

2.1 Data Collection

The raw data used in this study was downloaded from GSS within the package r's highest degree (GSS 2021). The GSS sample is drawn using an area probability design that chooses random households across the U.S.A to participate in their survey. The backgrounds of the households are from a mix of urban and rural communities. The participation is voluntary.

The General Social Survey is conducted by the National Opinion Research Center and it does a great job of representing the entire U.S population. GSS collects a wide range of data varying from social, economic, and political issues with a focus on family life, education, race, and religion.

R's highest degree survey records the individual's highest level of education attained. The variable is important because education develops critical thinking and will help individuals secure better jobs. The study was great because this variable can be used to understand how education can be related to social and economic outcomes and how education varies based on the demographic group.

GSS data is collected every two years dating back to 1972. The dataset can give the user the ability to study the long term effects and better understand the changes over time. They've done a great job of staying consistent with their methods to provide the user with accuracy and reliability over the years (U. of C. NORC 2019).

3 Measurements

The data sourced from GSS was collected from households throughout the United States. Data from the U.S. Census Population was gathered nationwide from all civilians that participated.

4 Discussion of questionnaire

The survey was limited because there was only one question asked which was the Respondent's degree.

5 Visualizing Data

Table 1: Total number of respondents from 1998 - 2018

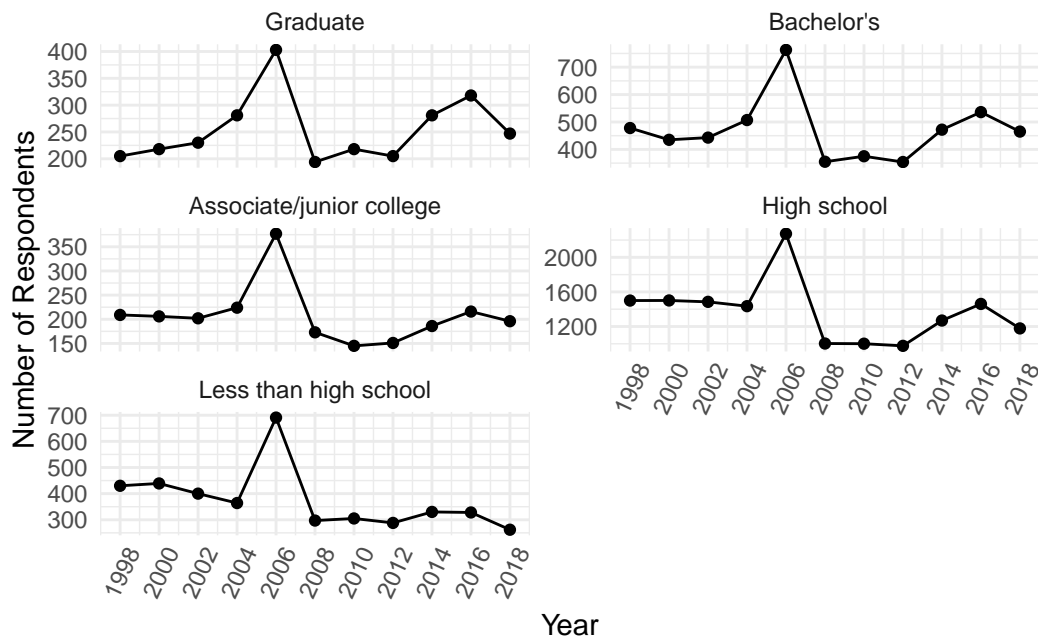|	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018
Total	2822	2799	2760	2811	4507	2022	2044	1974	2538	2859	2348

Figure 1: Total number of respondents by degree from 1998 - 2018.

Figure 1 shows data on the level of education of the United States population across all states between the years of 1998 to 2018. The graphs show the numbers of individuals who attained a graduate, bachelor's, associate/junior college, high school, or less than high school degree.

Table 1 shows a sharp increase across all education levels from 2004-2006 followed by a decline the following two years. This is due to the difference in survey respondents in each period. There are other things happening during this period of time that are more interesting.

By 1998, almost every state defined or implemented academic standards for high school math and reading. Principles and teachers were evaluated to ensure they were suitable to teach at the new high standard that was measured through criterion-referenced tests. Students were promoted to higher grades or retained in lower grades based on their performance against standardized material. In the early days of this change, from 1998 to 2004, it appears there was some success in retaining more high school students based on the decrease of the number of children who had less than high school, and the consistent rate of high school graduates. At the same time, there is an upswing in the number of post secondary graduates with an increase across all post-secondary degrees from 2012 to 2016 with the most significant at the bachelor and graduate levels. This increase could be attributed in part to the increased pipeline of students graduating from high schools across the United States.

The data in Figure 1 shows the changing trends in education levels across a large period of time with federal acts playing a crucial role in increasing access to education.

Table 2: Total number of respondents by sex and degree from 1998 - 2018

Degree	1998		2000		2002		2004		2006		2008		2010		2012		2014		2016		2018	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Associate/junior college	87	122	85	121	88	114	96	128	135	242	80	93	51	94	60	91	64	122	89	127	68	128
Bachelor's	236	242	191	244	202	241	248	259	363	400	173	182	170	205	162	192	215	257	243	293	205	260
Graduate	85	120	127	91	116	114	150	131	203	200	88	106	100	118	95	110	134	147	132	186	111	136
High school	634	866	624	877	629	856	608	827	981	1292	454	549	427	574	433	543	596	673	662	799	546	632
Less than high school	186	244	194	245	192	208	178	186	320	371	135	162	143	162	135	153	132	198	147	181	122	140

Table 2 presents data on the educational details of female and male respondents from 1998 - 2018 across the United States. Associate/junior colleges consistently had more females than male graduates and after 2008, the number of females almost doubled. The negative stigma and lower prestige around associate/junior colleges has led to reduced numbers of all genders when compared to other post secondary education levels. High school students without the required grades or money for university, go into trades rather than junior college. Men are overrepresented in the trades compared to women.

The bachelor's degree follows an increasing trend of women pursuing higher education. In 1998 only six more females than males attained a degree whereas in 2018, 55 more females attained a degree than males. Significantly more men pursue a bachelor's and do not continue on to a graduate degree. In 1998, there were 151 more bachelor's than male master's students. A decade later the number dropped to 85, but rose slightly to 94 in 2018. Similarly, more women pursue a bachelor's than a graduate degree. In 1998, there were more female graduate students than males. From 2000 to 2006 there were more male graduate students and from 2008 onwards there were more female graduate students. After 2008, there was a steady enrolment of more than 100 male graduate students. It's important to understand that graduate school is expensive, time consuming, and can lead to academic burnout.

Females consistently graduated high school more than males from 1998 to 2018. This was the most significant gap between females and males across all categories of education level.

Education is compulsory for all children but the age at which one can discontinue schooling varies by state and is from 14 to 18 years old (USDE 2022). The gap between males and females decreased over time in less than high school. From 2014 to 2018 there was a decline for females and from 2014 to 2016 an increase for males showing that females are more likely to continue their formal education beyond high school when compared to males.

Across all degrees there was a decrease in males from 2016 to 2018, which could have been impacted by the steep rise in political polarization, right wing rhetoric, and anti-intellectualism following Trump's election.
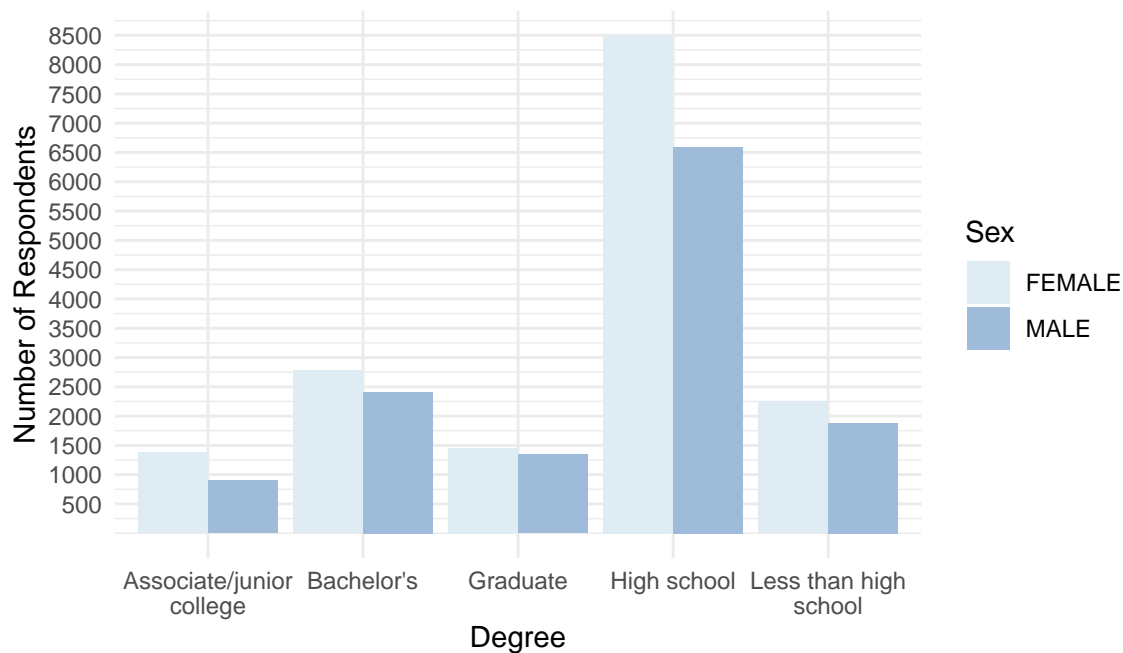

Figure 2: Education levels by sex.

Figure 2 shows the number of degree holders based on their gender.

Across all levels of education, there were more females than males. In our census data 50.5% of the population is female and the numbers correspond with the demographic proportion. This makes sense since everything follows the same pattern because you need a highschool diploma to pursue higher education. The most significant gap is with high school degrees who are the most populous with 6,500 males and 8,500 females. This correlates with the census data as 88.9% of the population has a high school degree or higher. There are less than 200

males and females at the graduate level which is the smallest gap. The second smallest at the bachelor level since 33.7% of the population has a bachelor's degree or higher. The smallest number is the associate/junior college for both sexes (Gierdowski 2019).
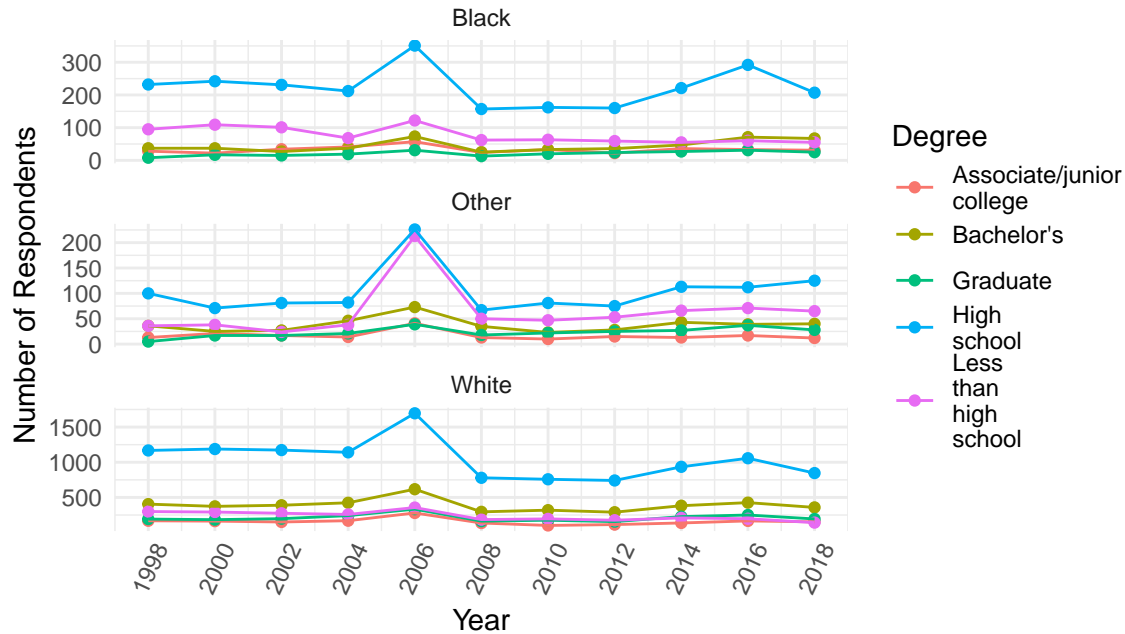

Figure 3: Total number of respondents by race and degree from 1998 - 2018.

Figure 3 is sourced from multiple reports relating to the education system and the demographic makeup of the United States. The data is presented in a chart to display the findings.

Demographic data from the 2021 United States Census Bureau reports the population is made up of 75.8% White individuals, 13.6% Black individuals, and grouped as 'other' are 18.9% Hispanic individuals, 6.1% Asian individuals, and 1.3% American Indian and Alaska Native individuals.

Education data is sourced from the National Centre for Education Statistics, who report on the education attainment levels across different racial groups (NCES 2012).

When looking at these two data sets, it shows a similar trend with all demographic categories achieving high school as their highest level of education reached. Under the 'other' category, there is a notably small gap between the high number of people who graduate and those who do not graduate from high school and both the Black and Other groups show a more significant rise in graduates from 2012 to 2018 than the white group. Overall, there are significantly more white individuals at higher levels of education when compared to all other

racial groups. White individuals have a higher proportion of individuals completing their bachelor's degree and lowest proportion who did not graduate high school. By comparison, Black individuals are graduating high school at around a 1 to 4 ratio when compared to their white counterparts and are half as likely to graduate high school than other racialized individuals. Black individuals have the lowest proportion of graduate degrees. It is obvious from these graphs that white individuals are more successfully completing higher levels of education when compared to their non-white peers.

6 Results

According to our findings, education levels have been steady over the past twenty years, with ups and downs due to economic and social issues. Our observation was because of education acts in 2004 and 2006, there was a spike in the number of graduates due to more resources and opportunities. The analysis examined education levels based on sex. The study showed that women were more likely to achieve higher educational attainment than men. This could be attributed to women having access to more resources and a shift in gender roles.

Further evaluation of the same theory in the third figure again showed women had higher levels of education, with most of the population finishing with a high school degree. Our study looked at two angles to observe the relationship between education, race, and gender, with important conclusions coming from all graphs and figures. The study on the number of people's educational attainment related to ethnicity showed that Black and Hispanic individuals were less likely than white individuals to achieve higher levels of education. There need to be future studies looking into specific areas, schools, and programs of studies to understand the real impact of race and gender on education. It's important to keep investigating these issues and to bring equality to education.

7 Discussion

7.1 U.S. Acts positively contributed to advances in education

There were a number of interventions targeted at reducing early school leaving and increasing post secondary pursuits. One of these interventions was The Adult Education and Family Literacy Act of 1998 - a primary federal law supporting basic education for out-of-school adults mainly at the secondary level. The act contributed to the decline we see in less than high school students from 2000 to 2004.

Another was The Carl D. Perkins Career and Technical Education Act of 2006 which contributed to an increase in community college enrollment (Dortch 2019). The $1.1 billion

of funding in 2012 provided individuals with career and technical education programs like business administration. Federal Acts like the Education Opportunity Act of 2008 - an initiative designed for colleges and high school students that provided financial assistance for post-secondary education - was in response to the financial crisis of 2008 when families and individuals were limited in their ability to afford a post-secondary education. The impact was not immediate due to the time it took to roll out the plan and for the resources to be allocated equally.

7.2 Women are more likely to graduate

Despite some small variations, overall, there were increasingly more females than males pursuing education. The labour markets reward women with relatively higher financial returns for college enrollment. According to the Federal Reserve Bank of St Louis (Oksana Leukhina 2022), the difference in female hourly wage relative to male hourly wage decreases as women pursue higher education. Women with only a high school diploma made about 24% less per hour compared with men in that same education group. Relative to men, women earn an additional 5.3% return by getting an associate or a bachelor's degree; that is, women with an associate degree made 28% more relative to women with only a high school degree, whereas women with a bachelor's degree made 68% more. This is why there is a higher number of women with a bachelors or graduate degree compared to associate/junior college, almost or around double across all years.

Other factors could be that there are more high paying job opportunities in male dominated careers for men that do not require higher education than there are for females. For example, construction workers can enter the workforce with high school education or less and earn twice as much as a woman with a masters degree in the humanities. Nursing, a career where women are overrepresented, earn less and work more hours than a similar career like firefighting where men are overrepresented. In other words, women have to acquire more education to make a similar wage than a man with no post secondary education. More education is an important way to close the gender pay gap.

Overall, more women are participating in the labor force than ever before, and with this shift in gender roles, women no longer expected to marry at a younger age but can now share the same freedoms as their male counterparts (Oksana Leukhina 2022).

7.3 Education is directly correlated with income level

The National Centre for Education statistics shows that education is directly tied to household income and that household income is directly tied to race. The median household income in the United States is $48,298, yet the median household income for white individuals is over 40% higher at $77,999.

Public schools in the United States are funded through property taxes. This results in higher income neighborhoods ending up with more access to resources and better-funded schools. At the same, due to previous redlining policies, racialized neighborhoods are devalued, driving down the value of homes, leading to less taxes and underfunded educational institutions. In other words, it is not a coincidence that white individuals, living in richer neighborhoods, have a better education experience resulting in higher rates of graduates when compared to racialized groups.

8 Limitations

The highest degree variable in the GSS survey is a valuable tool for researchers investigating education and social outcomes. However, it is important to recognize that the variable has some limitations that can affect the accuracy and reliability of the findings. One of these limitations is that the data relies on self-reported information from respondents, which can lead to inaccuracies due to misreporting or biases in the data. Additionally, the highest degree variable only captures formal education and does not account for non-traditional educational experiences, such as vocational training or apprenticeships, which can affect the relationship between education and outcomes like income and employment.

Furthermore, the highest degree variable is limited in the level of detail it provides, as it does not offer insight into the quality of education or the specific field of study. This can be an important factor when studying the correlation between education and outcomes. Furthermore, there may be biases in the survey data due to sampling or response issues, which can impact the generalizability of the findings.

Therefore, while the highest degree variable in the GSS survey is a useful resource for researchers, it is crucial to be aware of the limitations and potential biases in the data. Researchers should exercise caution when drawing conclusions based on this variable and consider alternative data sources when necessary.

9 Ethics & Bias

The survey must give Informed consent by explaining the purpose of the study, how the data will be used, and state that the data is anonymous. Confidentiality is important to protect the privacy of respondents to ensure the information collected is kept private. Volunteers shouldn't be forced to participate in the survey or given incentives. It's important to respect cultural differences by being self-aware and educating yourself before conducting the survey.

There could be a non-response bias where survey participants are unwilling or unable to respond to a survey question. The reasons would vary from person to person. Social desirability bias: Respondents will report higher levels of education to have themselves viewed favorably by others. This is known as social desirability bias. They must ensure that all of the population have an equal chance of being selected to participate in the survey. It's important to make sure the wording of the question doesn't influence a certain response.

10 Conclusion

Looking at the data alone, one might dangerously conclude that women and white individuals go farther in formal education because they are smarter than their peers, when in fact it is a result of the historical racism and sexism that continue to exist in our society today. Women need to acquire higher education to be paid similar to a man who is less educated and racialized individuals who grow up in families with little to no formal education and therefore less income, are subject to under-resourced early education and financial barriers to higher education when compared to white individuals living in wealthier communities. These cycles of oppression, wealth and poverty have continued for centuries and are difficult to break.

There are institutional systems in place both in education and the workplace, that must be dismantled for the cycle to end. It's only through greater awareness, laws, public policy and program interventions that increased diversity in higher education and equal pay for equal work will result in greater health and equality for all citizens.

11 Appendix

11.1 Supplementary Survey

Our supplemental survey is available here : https://docs.google.com/forms/d/1FrWGKemyska_hn_VHqFEBlvB9yYB_fZ2mha_1RQQSw8/edit

11.1.1 Preamble

We are conducting a survey to further investigate factors that influence the attainment of a degree. Our focus is on exploring the impact of demographic and socioeconomic factors when pursuing education. We're interested in hearing about individual experiences and how it affected your willingness to learn and stay motivated.

Your participation in the survey is entirely voluntary. You can choose to skip questions or withdraw from the survey at any time. Rest assured that all responses will be kept confidential and used solely for research purposes. Please contact Will at "willdavidson@gmail.com" for any questions or concerns.

11.1.2 Questions

1. What is your gender identity?

   - Woman

   - Man

   - Transgender

   - Non-Binary

   - Prefer not to answer

2. What is your race/ethnicity?

   - American

   - Indian or Alaskan Native

   - Asian/Pacific Islander

   - Black or African American

   - Hispanic White/Caucasian

   - Multiple ethnicity/other (please specify)

- Prefer not to answer

3. What is your highest level of completed education?

- Less than high school
- High School
- Associate/Junior College
- Bachelor's
- Graduate/JD
- PhD
- Prefer not to answer

4. Are you planning on pursuing further education?

- Yes
- No
- Prefer not to answer

5. If you answered yes, what level?

- High School
- Associate/Junior College
- Bachelor's
- Graduate/JD
- PhD
- Prefer not to answer

6. If you are affiliated with a religion, has it created any barriers or challenges?

- Yes
- No
- Other

7. Have you experienced any challenges or barriers related to your gender identity when obtaining your degree?

- Yes

- No

8. If you answered yes, what challenges or barriers have you faced

   - Discrimination
   - Lack of representation
   - Access to resources
   - Other
   - Prefer not to answer

9. Are tuition costs a significant factor when deciding whether to pursue your degree?

   - Yes
   - No
   - Prefer not to answer

10. Did you receive any financial assistance during your degree attainment

    - Yes
    - No
    - Prefer not to answer

11. Do you have any student debt?

    - Yes
    - No
    - Prefer not to answer

12. Have you experienced any challenges related to accessing technology or reliable internet for the purposes of completing your degree?

    - Yes
    - No
    - Prefer not to answer

Thank you for taking the time to participate in our survey. Your feedback is incredibly valuable and will help us better understand the factors that influence the pursuit of further education. We appreciate your willingness to share your thoughts and experiences with us, and we will use this information to improve our data.

11.2 Code

The report was created using `R` (R Core Team 2020) and `R Studio` (RStudio Team 2020) with `Quarto` (Quarto, n.d.) – a new version of `R Markdown` (RStudio, n.d.). The main library utilized for this purpose is `Tidyverse` (Wickham et al. 2019). Its used sub-packages include `dplyr` (Wickham et al. 2022) to enable query-like syntax, and `ggplot` (Wickham 2016) to create graphs and charts. Other packages and tools include `here` (Müller 2020), `janitor` (Firke 2021), `knitr` (Xie 2022), `kableExtra` (Zhu 2021), and `scales` (Wickham and Seidel 2022). Their respective function is to find *CSV* files, clean data, generate reports, create tables, and enable customized legends and break points.

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