



Absolutely Relative: How Education Shapes Voter Turnout in the United States

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Accepted: 13 May 2023 / Published online: 28 May 2023
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Abstract

Why has voter turnout in the United States not increased proportionally with educational attainment over time? Relative education theories have attempted to answer this question by highlighting how the value of individuals' education may be influenced by the educational levels achieved by others. For instance, individuals may attain a higher level of education compared to previous generations, but the relative value of their education may not improve if society as a whole also achieves higher levels of education. Thus, this increased educational attainment may have little influence on voter turnout. Using a new measure of relative education and incorporating more recent post-2000 data, this research finds that while the relative education model explains the education–turnout relationship prior to 2000, since then individuals with a higher absolute level of education have been more likely to vote, regardless of the relative value of their education. The rise in voter turnout over the past two decades could be attributed to this increase in the absolute level of education.

Keywords Education · Relative education · Sorting model · Voter turnout · Political participation

1 Introduction

Research has long held implicit notions that education fosters voter turnout (Abramson & Aldrich, 1982; Burden, 2009; Converse, 1972; Franklin, 2004; Lewis-Beck et al., 2008; Sondheimer & Green, 2010; Verba et al., 1995; Wolfinger & Rosenstone, 1980). Nonetheless, voter turnout in the United States has not increased proportionally as the population has become more educated (Berinsky & Lenz, 2011; Brody, 1978; Franklin, 2004; McDonald & Popkin, 2001; Nie et al., 1996; Schlozman et al., 2012; Tenn, 2005), calling previous theories into question. To account for this disparity, studies have examined both absolute and relative education models (Campbell, 2006, 2009; Nie et al., 1996; Persson, 2011, 2013; Tenn, 2005). These theories suggest that more highly educated individuals have a greater incentive to vote. The absolute education theory posits that greater

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educational attainment boosts voter turnout by increasing individuals' cognitive skills and civic engagement. On the other hand, theories espousing the relative value of education postulate that an additional year of education generates higher relative social value, increasing an individual's income and status, which in turn increases their likelihood of voting. The relative education theory (also known as the sorting model) implies an interactive effect between an individual's education and its value compared with the education of others in society (Campbell, 2009; Persson, 2011). The theory posits that as educational attainment increases across society, individuals must make even greater educational gains to attain a higher education status than their peers. This heightened threshold in the competitive educational environment mitigates the effect of educational attainment on voter turnout (Campbell, 2009; Helliwell & Putnam, 2007; Nie et al., 1996; Persson, 2011, 2013; Tenn, 2005).

The last two decades have been marked by increasing voter turnout and changes to the economic value of education. While previous studies have focused on the education–turnout relationship prior to 2000, applying both absolute and relative education models (Campbell, 2009; Nie et al., 1996; Persson, 2012; Tenn, 2005), it is not yet known whether either theory is still valid in explaining the increased voter turnout in both presidential and midterm elections since the year 2000. The increasing voter turnout in recent decades raises important questions. What has changed about the influence of both the absolute and the relative value of education on voter turnout over time? How does the interactive effect between individuals' educational attainment and its social value relative to their peers explain the increased voter turnout since 2000?

Changing dynamics surrounding the value of educational attainment in recent decades necessitate further research on these theories of education. For example, recently, debate has arisen in the United States over the value of a college education. The cost of higher education is rising, as is student loan debt. Yet, the benefits of a college education in terms of social status and income are greater than ever before (Case & Deaton, 2020). Given the changing educational environment and its relationship to voting behavior, it is important to test the influence of education on voter turnout over a longer timeframe to update the absolute and relative education theories set forth in prior works.

This study analyzes whether the absolute and relative education theories still hold in the twenty-first century using a unique methodological and measurement approach. In doing so, it contributes a more nuanced understanding of the presence and mechanisms of each of the theories via an understanding of the interactive relationships at play between education, educational ranking, and time. This study also constitutes the first longitudinal analysis of educational attainment, educational environment, and voter turnout with the longest timeframe from 1976 to 2018. This study makes three important contributions to the existing scholarship. First, it demonstrates that in the United States, both the absolute and the relative value of an individual's education predict their voting behavior when data from a longer timeframe (1976–2018) are employed. Previous scholarship on education and voter turnout has typically relied on a more limited dataset, demonstrating correlations from periods before 2000 (Nie et al., 1996; Tenn, 2005) or from a single year (Campbell, 2009) or two (Persson, 2012). Therefore, this study provides a more comprehensive assessment of both models in relation to the changing electorate by analyzing a much longer timeframe. Importantly, the study contributes to the understanding that the theories involving the absolute and relative nature of education's influence on voting behavior are not mutually exclusive, but nuances of a complex relationship between education and voter turnout dependent on the variation in at-large social attainment of education.

Second, this research examines whether the effect of absolute and/or relative education on individuals' propensity to vote has varied over time. While such variation has not previously been modeled explicitly, this study tests for such interactions between each type of educational value and time, finding that both absolute educational attainment and relative educational attainment have affected voting behavior over time and across election types. Specifically, both an additional year of education and a consequently higher educational rank are correlated with propensity to vote over time. The positive effects of individuals' absolute and relative educational attainment on their voting behavior have increased over time, and this pattern has been more salient since 2000. Both the absolute and the relative value of education have a greater impact on an individual's propensity to vote in presidential elections than in midterm elections.

Third, this study draws more nuanced conclusions about the impact of education on voting by testing the interactive effect of an individual's own level of education and his or her educational environment across time. While the relative education theory implies this interactive effect, which has been described in previous studies (Campbell, 2009; Persson, 2011), the interaction has not explicitly been modeled and tested using American time-series data. Using a novel measure of the educational environment that fully captures its scope, the analysis shows that the relative education theory best explains voter turnout in elections before 2000 but has less explanatory power after 2000. Consequently, this study suggests that the increasing influence of absolute educational value over time has led to rising voter turnout since 2000, despite the educational inflation that has also occurred during that time.

In the following sections, this study first outlines the puzzling relationship between education and levels of political participation in recent decades. Then, it introduces the proposed methodological and measurement advancements to better assess both the absolute and relative education theories. Finally, it presents the results, which shed light on the dynamic relationship between education, educational ranking, and propensity to vote over time. The implications of these findings are discussed in the discussion and conclusion section.

2 The Paradoxical Relationship Between Education and Voter Turnout

The conventional wisdom in the literature on political behavior is that education helps predict levels of political participation (Almond & Verba, 1963; Berinsky & Lenz, 2011; Converse, 1972; Franklin, 2004; Leighley & Nagler, 2014; Lewis-Beck et al., 2008; Verba et al., 1995; Wolfinger & Rosenstone, 1980). Despite the well-established association between education and voter participation, scholars have argued that increases in educational attainment over the past few decades have occurred simultaneously with either decreasing or unchanging voter turnout in the United States (Berinsky & Lenz, 2011; Brody, 1978; Franklin, 2004; McDonald & Popkin, 2001; Nie et al., 1996; Schlozman et al., 2012). This paradox has caught scholars' attention: If education is one of the most important predictors of increased voting participation, and it has increased over time, why has not there been a similar increase in voter turnout at the aggregate level in the United States?

Within this body of work, there are two different manners of assigning value to education. Some theories use the absolute value of education (also known as the absolute education model) while some consider its relative value (also known as the relative education

model or sorting model). The absolute education theory emphasizes education's enlightening function, promoting individuals' resultant cognitive capacity and civic skills. The conventional view in the political behavior literature is that these skills lead to increased political participation (Berinsky & Lenz, 2011; Burden, 2009; Highton, 2009; Luskin, 1990). Many social scientists have supported the absolute education model, claiming that "increasing the mean level or amount of education of the population will translate directly into effects on political outcomes" (Emler & Frazer, 1999, p. 261).

In contrast, across diverse disciplines, the relative model of education identifies education as a positional good that can change an individual's social status (Bol, 2015; Campbell, 2006, 2009; Desjardins, 2008; Di Stasio et al., 2016; Emler & Frazer, 1999; Groot & Van den Brink, 2000; Hartog, 2000; Leuven & Oosterbeek, 2011; McGuinness, 2006; Nie et al., 1996; Persson, 2011, 2013, 2014a, 2014b; Tenn, 2005). Individuals' educational attainment sorts them into social positions, both in terms of employment and income. More highly educated people are more likely to obtain better jobs with higher incomes, which are associated with greater civic participation. Individuals' social position nevertheless exists in relation to others, meaning that the value of an individual's education is determined by the degree of educational attainment among their peers.

Therefore, the relative education theory emphasizes the interactive effect of individuals' educational attainment and its social value within their educational environment. As educational attainment increases across society, individuals must achieve even greater educational attainment to improve their relative position since there is more competition in the educational hierarchy (Di Stasio et al., 2016; Hartog, 2000; Hirsch, 1976; Leuven & Oosterbeek, 2011; McGuinness, 2006; Shavit & Park, 2016; Thurow, 1975). Since overeducation in the labor market persists, "jobs that previously required high school education would after educational expansion require college education" (Persson, 2011, p. 458). This indicates that living in a highly educated society reduces the value of individuals' educational attainment.

The research of Nie et al. (1996) addresses the paradox of declining voter turnout among the highly educated by conceptualizing the relative education theory. Nie et al. (1996) attribute low voter turnout to the decreased relative value of education. These researchers conclude that the increased level of education across the population over time has impeded individuals' propensity to vote by canceling out the absolute value of their education. According to Nie et al., education shifts an individual's social position closer to the center of politically important social networks, and a person with a higher social position is more likely to participate in political activities to advocate for their own interests. Due to limitations in the structure of representative democracy, however, the political system cannot accommodate everyone's political demands (Nie et al., 1996). As individuals become more educated, the political marketplace becomes saturated with demands while the supply of representatives does not increase correspondingly, and the political marketplace becomes less efficient. In this circumstance, as the educated population increases, it becomes more difficult for educated individuals to influence the political decision-making process. Since the number of positions that grant access to political power are limited, the competition to achieve a central social network position where one's political demands are more likely to be met intensifies. Thus, participation in the political arena depends on individuals' degree of educational attainment in relation to the educational attainment of others in the population (Nie et al., 1996).

Although the relative education theory is well established, it remains understudied and has been hindered by inconclusive empirical evidence and modeling strategies and by the limitations of customary measures of relative education. Thus far, empirical studies on the

effect of relative education levels on voter turnout have produced mixed results. From the initial work by Nie et al. (1996) to the most recent literature, some studies have found that the overall increase in education across the population has decreased the effect of education on propensity to vote (Nie et al., 1996; Persson, 2011, 2013; Tenn, 2005). In contrast, Campbell (2006, 2009) found no support for the relative education model when investigating the effect of education on propensity to vote.¹

Moreover, the modeling strategies that previous studies have applied are not appropriate to test the underlying theory of the relative value of education (Campbell, 2009; Persson, 2011). Implicit in the theory is the conditional effect of an individual's relative level of education within their environment on the relationship between their level of education and their propensity to vote; therefore, testing the interaction term between the absolute and relative values of education is necessary. Previous studies, in fact, have just included individual variables measuring an individual's level of education and their educational environment without considering the interaction between the two variables in their models. Accordingly, Campbell (2009) and Persson (2012) demonstrated the interaction effect between the level of education and the educational environment, but these empirical results were limited to a single year (2002) or two (1996 and 2004) of data, respectively. Therefore, no studies to date have analyzed this interaction effect using a sufficient longitudinal data set.

Lastly, how to improve measures of the relative value of education has been a central matter of debate. While Nie et al. (1996) advanced the relative education model theoretically and empirically, a shortcoming of their measure is that their operationalization of relative education does not adequately capture individuals' positions in their social networks (Campbell, 2009; Helliwell & Putnam, 2007; Persson, 2011, 2013; Tenn, 2005). Nie et al. (1996) operationalized the variable, *Educational Environment*, using the average years of education among a birth cohort aged 25 to 50 years old for a given individual who is 25 years of age. Yet, as Tenn (2005) has pointed out, this measure makes it "impossible to distinguish the effect of relative education from the effect of age and generation" (p. 271) because the relative education measure is only a function of age. Thus, age and educational environment are highly correlated, producing a significant multicollinearity problem (Tenn, 2005). To overcome this issue, Tenn (2005) provides an alternative measure of relative education that is the percentile rank of an individual's educational attainment within his or her same-year birth cohort.

The original measure of relative education (Nie et al., 1996) has also drawn criticism for not fully capturing competition in individuals' educational environment because it overlooks individuals' specific social networks (Campbell, 2009; Helliwell & Putnam, 2007). Some researchers have suggested comparing an individual's education with the average years of education of all respondents in the census region where the individual resides (Helliwell & Putnam, 2007). In addition, Campbell (2009) has argued that "social networks are not national; they are local," proposing that the educational environment should be defined using a smaller geographical context, such as the state, metropolitan area, or zip code, instead of the entire region (p. 775). Consequently, he utilized the average level of education of a given age group within such a geographic area (Campbell, 2009).

¹ Campbell (2009) did find evidence of the effect of relative education on other types of engagement, including persuading others; displaying buttons, signs, or stickers; contributing financially to campaigns; and volunteering for candidates or political organizations.

3 Change in Voter Turnout and Educational Environments

Although theories of education have been well established in political behavior research, the next question is whether they are supported beyond the original contribution of Nie et al. (1996). Existing studies have analyzed the relationship between education and voter turnout in the United States over a limited period of time, covering the years from 1972 to 2000 (Nie et al., 1996; Tenn, 2005), the year 2002 (Campbell, 2009), and the years 1996 and 2004 (Persson, 2012). Since the longest timeframe examined in a previous study was from 1972 to 2000, it is unclear whether either the absolute education theory or the relative education theory can explain voter turnout since 2000. There have been many changes in voter turnout and the educational environment in the United States over the past two decades; thus, further investigation of both education theories' explanatory power necessitates a longer timeframe and more recent observations.

For example, voter turnout had been relatively static and had even decreased over time leading up to 2000, as has been described in previous studies. Yet, this declining pattern has changed since 2000, and turnout in both presidential and midterm elections has increased. Figure 1, which was created using McDonald's (2022) voting eligible population (VEP) turnout data, shows voter turnout in the United States from 1976 to 2018. The upward trend is not uniform across the two election types, and is characterized by some static points and some increases since 2000. There has been a minor increase in turnout, with two outliers to the gradual upward trend in the 2014 and 2018 midterm elections. The aggregate pattern of an observable increase in voter turnout in presidential elections is present over time. Given this overall increase in voter turnout across election types over the past two decades, what has changed in the relationship between each type of educational value and voter turnout over time, especially since 2000?

The educational environment has also changed dramatically in recent decades, affecting the value of individuals' education in terms of their social status in relation to others. First, the benefits of education are greater than ever before. There is a widening gap between people with college degrees and those without such degrees. Individuals with college degrees tend to hold better positions. According to the Bureau of Labor Statistics (BLS, 2020) as of 2019, individuals with a bachelor's degree averaged \$1,248 in weekly earnings compared to \$746 among those with only a high school diploma—an increase of more than 67%. The data indicate that the more individuals learn, the more they earn, and the less likely they are to be unemployed (BLS, 2020). The effects of education are not only financial, as there are also implications for socialization and health. Case and Deaton (2020) have found that: (a) those with college degrees have much lower death rates from drug overdoses, alcoholism, or suicide; (b) people without college degrees are less likely to get married and to attend church; and (c) people without college degrees are more likely to have chronic pain and drinking issues. In that same vein, since the 1990s, people without college degrees have been significantly less happy than those with college degrees.

Second, inequality is rising, as are the cost of college and student loan debts. Despite the overall growth trends in income over time, income inequality in the United States has gotten much worse in recent years. "The wealth gap between America's richest and poorer families more than doubled from 1989 to 2016" (Schaeffer, 2020). The incomes of upper-income households have rapidly risen, whereas the incomes of middle-income and lower-income households have declined in recent decades (Pew Research Center, 2020). In a society with high income inequality, low social mobility is inevitable (Keamey & Levine, 2014).

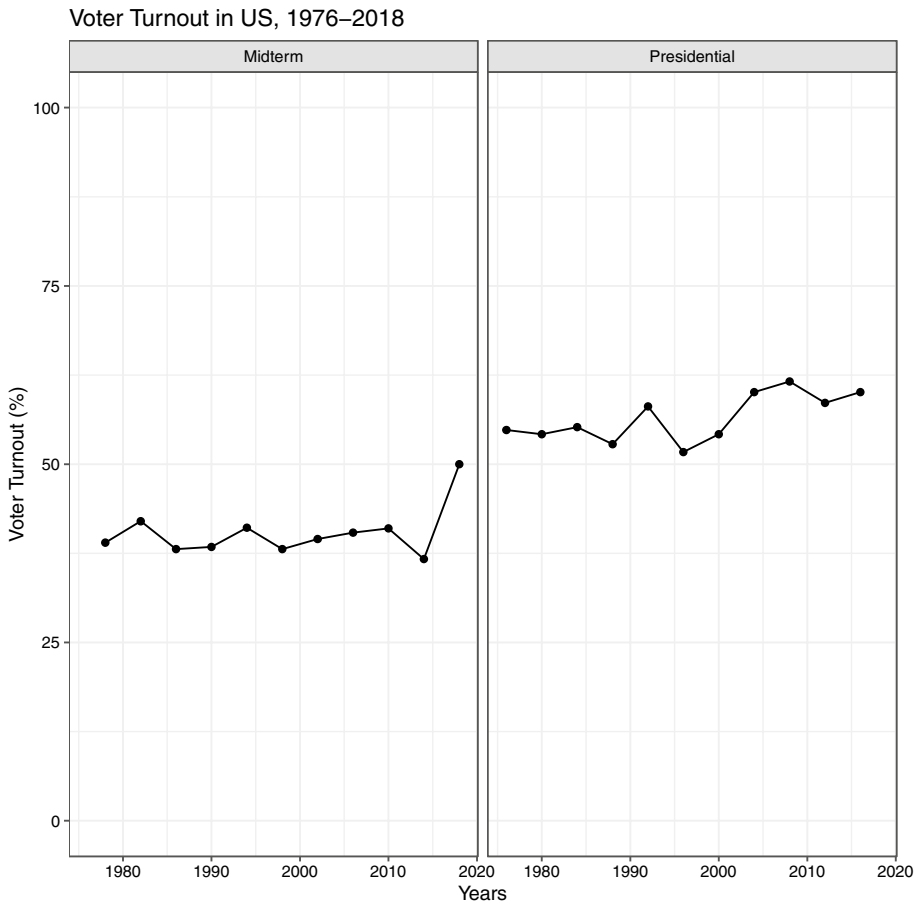


Fig. 1 Voter Turnout in Midterm and Presidential Elections, 1976–2018

Increasing inequality has also had obvious effects when it comes to education. Educational resources and outcomes vary widely across income groups and racial groups. There are large differences between high- and low-income families’ expenditures on education, which produce differences in academic achievement and college enrollment (Greenstone et al., 2013). Students of color are less likely to have educational resources, such as qualified teachers or well-developed curricula, and are more likely to have lower academic performance than white students (Reardon & Fadle, 2017). The inequality in educational opportunity and achievement also affects college enrollment and graduation rates, which can play a pivotal role in social mobility. “College graduation rates have increased dramatically over the past few decades, but most of these increases have been achieved by high-income Americans” (Greenstone et al., 2013, p. 11). Accordingly, the inequality in education results in persistent disparities in education, which inhibit people from climbing the social ladder (Bukodi & Goldthorpe, 2016).

Furthermore, the cost of college education in the United States has sharply risen in recent decades. As reported by the National Center for Education Statistics (NCES, 2019), the cost of a public college education for the 2017–2018 academic year was nearly 2.2

times the cost for the 1985–1986 academic year.² For many people, the high price of a college education is burdensome and results in increased student loan debt. “Student loans are the second-biggest form of household debt in the United States. More than 43 million borrowers hold over \$1.6 trillion in student loans—a sum that has more than tripled in 13 years” (Lieber & Bernard, 2020). This underlines the current situation in the United States, where student loan debt is difficult to discharge. Unfortunately, under these circumstances, those who start out economically disadvantaged with fewer opportunities for education are likely to remain so.

Given these changes to the education landscape in the US, have the positive effects of education on voter turnout disappeared as it becomes more difficult for individuals to access a central social network position with their existing level of education? This study suggests that despite the education inflation in recent years, the absolute value of higher education may still increase election participation, and this might be a reason for the upward trend in voter turnout over the last two decades. There are at least two reasons why education may still encourage voter turnout, updating our understanding of the absolute and relative education theories suggested in the highlighted prior work.

First, education’s enlightening effects may have increased voter turnout in recent years, since education levels have been increasing over time. The political knowledge and tolerance that individuals accumulate during their educational journey can encourage them to vote even if they have a harder time achieving a given social position due to education inflation. As Campbell (2009) has argued, the relative education theory presented in prior research overlooks the effect of the actual learning that takes place in educational settings. For example, in school, people learn how to access political information and the potential benefits of engaging in the political arena (Carpini, 1997). Individuals might be motivated to vote by learning the importance of their vote in society; they might also realize that everyone should have equal representation in voting regardless of the relative values of different individuals’ educations. In other words, if education develops individuals’ knowledge and their democratic values, more highly educated people should participate in elections to express their democratic values or their political interests even if the educational environment changes. Individuals’ sense of duty to participate electorally due to the cultivated democratic values would not entirely disappear as education inflation increases. Therefore, as more people in society increase their educational attainment, education’s enlightening effects should continue to increase voter turnout.

A second reason why turnout may have increased in recent decades is the remarkable advancement of technology, particularly the Internet. This technological development has opened doors for individuals of all social positions to engage in the political decision-making process, even if they do not have a social position close to the center of politically important social networks. The main assumption of the relative education value theory in prior work is that individuals with fewer connections to their representatives or the mass media are less likely to vote, given the increasing number of educated people (Nie et al., 1996). As more people become educated, it becomes less convenient for individuals to approach elected officials or the media, according to the original theory. However, it is difficult to believe that people consider the relative education level of the rest of society to

² This is the average total tuition, fees, room, and board charged for full-time undergraduate students in degree-granting institutions. The values are based on the Consumer Price Index (CPI), adjusted to the academic year 2017–2018. From 1985–1986 to 2017–2018, the average price of an education at a public university increased from \$8,143 to \$17,797.

gauge whether the democratic system can accommodate their demands. Technology allows individuals today to use email or social media, such as YouTube, Twitter, Instagram, or Facebook to engage with their representatives, government agencies, and the mass media to address issues they are concerned about in their communities. While the political system cannot accommodate everyone's demands because of limitations in the structure of representative democracy (Nie et al., 1996), individuals in the twenty-first century do not need high positions in society to express political views or participate in the political decision-making process compared with the period from 1972 to 2000 analyzed by Nie et al. (1996). The expansion of education in society might no longer impede people's participation in voting. Overall, these reasonings lead to four hypotheses:

- (1) The Absolute Value of Education Hypothesis (H1): As individuals are more educated, they are more likely to participate in voting over time.
- (2) The Relative Value of Education Hypothesis (H2): As individuals have a higher educational ranking in society, they are more likely to participate in voting over time.
- (3) The Pre-2000 Interaction Effect Hypothesis (H3): Before 2000, the positive effect of an individual's education on their voter turnout is more likely to decrease as others in the population achieve greater educational attainment.
- (4) The Post-2000 Interaction Effect Hypothesis (H4): After 2000, the positive effect of an individual's education on their voter turnout is more likely to be maintained regardless of the educational attainment of others in the population.

4 Testing the Absolute and Relative Values of Education on Voter Turnout

This research examines four questions: (a) How do individuals' absolute levels of education relate to their propensity to vote over time? (H1) (b) How do individuals' relative educational positions predict their propensity to vote over time? (H2) (c) Is the relationship between individuals' formal education and their voting behavior conditional on the relative value of their education? (H3) and (d) Has this effect changed since 2000? (H4).

The analysis uses the Current Population Survey (CPS) Voting and Registration Supplement (Flood et al., 2020), which includes self-reports of election participation for the 22 presidential and congressional elections from 1976 to 2018.³ To take into account the time

³ Scholars often point out that CPS voter turnout may be overreported (Ansolabehere and Hersh 2012; Ansolabehere et al., 2022). The CPS relies on self-reports of voting, and it has been suggested that certain respondents, including blacks and Hispanics, may overstate turnout rates (Ansolabehere et al., 2022). While this is a limitation of the data available, there are at least two reasons why this study uses the CPS data. First, this study assumes that the overreporting issue does not threaten this study's inferences, because there is no evidence that the overreporting issue caused by individuals' educational attainment has increased over time (Ansolabehere & Hersh, 2012). Ansolabehere and Hersh (2012) examined reported voter turnout in the 1980, 1984, and 1988 National Election Study (NES) and voter turnout in the 2008 Cooperative Congressional Election Study (CCES) and found that the correlation between individuals' educational attainment and overreporting of their voter turnout has decreased over time. In fact, there was no evidence suggesting inflated overreporting of voter turnout caused by individuals' educational attainment over time (Ansolabehere & Hersh, 2012). Second, the CPS covers the longest timeframe available, capturing individual voter turnout in the United States from 1976 to 2018.

necessary to acquire an education, the data is taken from the subset of respondents over age 25.⁴ The study starts with the following model:

$$\begin{aligned} \text{Voter Turnout}_{it} = & \beta_0 + \beta_1 \text{Years of Education}_{it} + \beta_2 \text{Education Rank}_{it} \\ & + \beta_3 \text{Interaction Term}_{it} + \beta_4 \text{Controls}_{it} + \mu_t + \int_{it} \end{aligned}$$

The dependent variable is *Voter Turnout*, which is coded as a dichotomous variable indicating whether a respondent *i* voted in the most recent November election, at the time of survey year *t*.⁵ The main independent variable, *Years of Education* (Absolute Value of Education), is a continuous measure of the highest year of schooling that the respondent had completed at the time of the survey.⁶ Considering the debate over the measures of relative education used in previous studies, this research incorporates suggestions from both Tenn (2005) and Campbell (2009), employing both individuals' relative educational percentile rank and the geographic unit in which they reside in the model—two measures that have not previously been included in the same model. The second independent variable, *Education Rank* (Relative Value of Education), is measured as a respondent's educational percentile rank within his or her birth cohort, i.e., those born in the same year who reside in the same geographical unit—the US state—where the respondent was living at the time of the survey.⁷ For example, for a respondent born in 1960 and living in Alabama, 60% of his/her birth cohort in Alabama had completed 12 years of education, 30% had completed 16 years, and 10% had completed 18 years. If the respondent had completed 16 years of education, he or she was assigned the value 90 for the relative education variable, as the respondent is in the 90th percentile for educational attainment in their educational environment.

To capture interaction effects of each hypothesis, this study includes a different interaction term in each model. The first model includes an interaction term between *Years of Education* and *Time* (year dummies) to evaluate whether the effect of absolute education on voter turnout varied over time (H1). The second model includes an interaction term

⁴ Previous studies on the relative education model limit their analyses to respondents age 25 or older (Campbell, 2009; Nie et al., 1996). This study also assumes that individuals are likely to have finished their education by the time they reach age 25, meaning that by this point the full effect of their absolute and relative education may be analyzed.

⁵ This research only considers eligible voters. The variable is coded 1 if respondents voted in the most recent November election or 0 otherwise.

⁶ The original educational attainment variable from the CPS is a combination of two other variables. The first variable is the respondent's highest grade of school or year of college completed, with data available until 1992. Afterward, the CPS introduced a new measure of educational attainment that captures the highest degree or diploma attained by the respondent. To reconcile the two variables, this study follows Jaeger's (1997, 2002) method of imputing the highest grade completed. For example, this study imputes 2.5 years of education for those who answered that their highest grade or degree completed is "1st, 2nd, 3rd, or 4th grade" and 5.5 years for respondents whose highest grade or degree completed is "5th or 6th grade." Please see Jaeger's (2002) Table 2 (p. 10) for more detailed information on how to change the categorical responses to the highest grade completed.

⁷ The state is identified as the household's state of residence in the CPS data. Campbell (2009) utilized three levels of geographical data: the state, the metropolitan area, and the zip code. Unfortunately, the metropolitan area data has only been available since the 1990s, and the zip code information is not available in the CPS data. Although this paper attempted to measure relative education using the county as the geographical unit based on Federal Information Processing Standards (FIPS) county codes, these data are only available beginning in 1996. Given this condition, this study uses the best available geographical unit, the state, to capture individuals' social networks.

between *Education Rank* and *Time* (year dummies) to assess how individuals' educational ranking affects their voter turnout over time (H2). Finally, this study estimates the conditional effect of education rank on the relationship between individuals' formal educational level and voter turnout over time. The last two models, therefore, include an interaction term between *Educational Attainment* and *Education Rank*, and the same model is analyzed using two subsets of data, one from before and one from after 2000 (H3 and H4, respectively), to see what difference, if any, appears. The empirical analyses also control for other factors that are correlated with voter turnout and education, such as age, age squared, gender, race, and marital status.⁸ I estimate logistic regression models with time fixed effects captured using a set of year dummies, μ_t .⁹ There is an error term, ϵ_{it} , capturing omitted factors. Lastly, given the clustered nature of the educational environment at the birth cohort and geographic level, which may include schooling investments or reforms, the standard errors of all the models account for clustering by state and by year.

The interaction effect models using a new measure of education's relative value were chosen because they are more explicit ways to test the original theories of absolute and education values regarding voter turnout and to advance our understanding of education's effect on voter turnout over time by using a longer timeframe. This study's new measure for education's relative value overcomes the theoretical and methodological limitations of the prior work's measure. Combining the ideas of both Tenn (2005) and Campbell (2009) to determine an individual's position in terms of their educational rank within their geographic unit allows us to more accurately capture the original theory's concept of education's relative value: individuals' educational ranking in society considering the education-influenced competition with others for an employment and corresponding income. This new measure accounts for whom each individual competes against economically, socially, and politically for social status within the geographical unit where many scholars a that competition occurs (Campbell, 2009; Helliwell & Putnam, 2007; Persson, 2011, 2013; Tenn, 2005). This new measure of education's relative value also improves on the methodological limitations of previous studies' measures of its relative value. The new measure can distinguish the effect of relative education from the effect of age or generation; each individual is assigned to a unique value that is different from others in the same age cohort in the same geographic unit, thus increasing the variation in individuals' relative educational positions even within the same group (across age and states). In this way, the measure is improved in relation to multicollinearity concerns (e.g., high correlation between absolute and relative education values as well as high correlation between relative education value and age variables).

⁸ Table 2 in Appendix 1 presents descriptive statistics for all the variables used in this paper. By including age and age squared, this paper separates the relative effect of education from the effect of age to overcome the limitations of the relative education measure that Tenn (2005) and Campbell (2009) criticized. The gender variable is a dichotomous variable, coded 1 for female and 0 otherwise. The race variable is coded as a categorical variable with whites as the reference category. Marital status is coded as 1 for married respondents and 0 otherwise. As the CPS lacks data on partisanship, which has often been included in the voter turnout literature, this study could not control for the strength of respondents' partisanship. Lastly, this study does not include respondents' personal income for two reasons: (a) many studies on the relative education model have not controlled for income (Helliwell & Putnam, 2007; Nie et al., 1996; Persson, 2012; Tenn, 2005) and (b) there are no data on personal income in the CPS Voting and Registration Supplement, and other financial indicators, such as total household income or family income, are either unavailable or available only for limited time periods.

⁹ Estimates here are produced using the `fixest` function in the R package, `Fast Fixed-Effects Estimations` (see more detailed information <https://cran.r-project.org/web/packages/fixest/fixest.pdf>).

Second, this is one of the first studies to examine the variations of both education values' effects on voter turnout over time. This study quantifies the impact of both of education's values on people's voting behavior over time using the longest timeframe to date by using interactions between each education value and time dummies. By testing the interaction hypotheses before and after 2000, this study also advances our knowledge of how differently the effect of individuals' formal education on voter turnout is varied depending on their relative educational ranking in relation to the educational attainment of others over time. The models employed in this study, thus, contribute to the discussion on the democratizing effect of education on voter turnout beyond 2000 in the literature on political behavior by reflecting changes in voter turnout and the educational environment in the recent two decades.

5 Results

Table 1 shows the results from the logistic regression analyses. The first two columns in Table 1 reveal the results of the model with the interaction term between an individual's level of education and time (Model 1, H1) and the interaction term between an individual's relative ranking in the competitive educational environment and time (Model 2, H2), respectively.¹⁰ The last two columns present the results of the model with the interaction term between the individual's level of education and their educational rank for the time periods before 2000 (Model 3, H3) and after 2000 (Model 4, H4).

In order to interpret the interaction effects in a more intuitive way, this study presents the marginal effects of education values on voter turnout.¹¹ Figures 2a and b show the marginal effects of an individual's years of education and their educational rank on their propensity to vote across the entire time period analyzed, from 1976 to 2018 (with 95% confidence intervals). Since a growing body of literature indicates that individuals' voting behaviors differ depending on the election type (Beer, 2017; Tolbert & Smith, 2005), this study shows the marginal effect of education values on voter turnout in midterm and presidential elections separately.¹² Figure 3 plots the direct effect of schooling on voting across a range of educational percentile rankings (with 95% confidence intervals) to show the conditional effect of individuals' relative rank in the educational environment on the relationship between their absolute educational attainment and their propensity to vote before and after 2000.

First, this study finds support for the Absolute Value of Education Hypothesis: the positive effect of individuals' formal education on voter turnout increases over time. The results show a positive relationship between an individual's level of education and their voting behavior across the time period from 1976 to 2018 (Model 1 in Table 1). As individuals become more educated, they are more likely to participate in voting. As shown in Fig. 2a, this positive effect of individual-level education on voting behavior has a greater magnitude in presidential elections than in midterm elections.

¹⁰ In Appendix 1, Table 3 shows the results of a bivariate analysis on the relationship between the absolute value of education and voter turnout (Model 5) and the relationship between the relative value of education and voter turnout (Model 6). The results show that an additional year of education increases individuals' propensity to vote, and individuals with higher educational positions are more likely to vote.

¹¹ Marginal effects and standard errors of the interaction models were calculated following Aiken and West (1991).

¹² Midterm elections show consistently lower voter turnout than presidential elections in the United States; therefore, previous studies have emphasized the importance of analyzing voter turnout separately for each type of election (Beer, 2017; Tolbert & Smith, 2005).

Table 1 Effects of Absolute and Relative Education on Voter Turnout (Logistic Models)

	Model 1	Model 2	Model 3 1976–1998	Model 4 2000–2018
	H1: Absolute Value of Education Hypothesis	H2: Relative Value of Education Hypothesis	H3: Pre-2000 Interaction Effect Hypothesis	H4: Post-2000 Interaction Effect Hypoth- esis
Years of Educa- tion	0.191*** (0.014)	0.185*** (0.013)	0.140*** (0.018)	0.189*** (0.022)
Educational Rank	0.007*** (0.001)	0.006*** (0.001)	0.001 (0.002)	0.006 (0.003)
Years of Educa- tion X Educa- tion Rank			0.001** (0.000)	0.000 (0.000)
Age	0.094*** (0.007)	0.095*** (0.006)	0.111*** (0.004)	0.076*** (0.006)
Age Squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)
Female	0.079*** (0.021)	0.079*** (0.020)	0.061** (0.023)	0.109*** (0.027)
African Ameri- can	0.330*** (0.066)	0.329*** (0.068)	0.212*** (0.063)	0.435*** (0.082)
Asian American	-0.992*** (0.074)	-0.984*** (0.067)	-0.693*** (0.126)	-0.999*** (0.059)
Other Race	-0.466*** (0.098)	-0.466*** (0.099)	-0.633*** (0.163)	-0.364*** (0.106)
Married	0.556*** (0.020)	0.554*** (0.020)	0.544*** (0.019)	0.569*** (0.024)
(Intercept)	-5.260*** (0.164)	-5.167*** (0.133)	-5.052*** (0.123)	-5.105*** (0.250)
Pseudo R-squared	0.133	0.133	0.121	0.140
Observations	1,538,904	1,538,904	861,663	677,241
AIC	3,192,273,152.209	3,193,272,258.128	1,630,998,186.424	1,562,257,929.744
BIC***	3,192,273,789.031	3,193,272,894.950	1,630,998,443.090	1,562,258,158.259
Log Likelihood	-1,596,136,524.105	-1,596,636,077.064	-815,499,071.212	-781,128,944.872

Unstandardized coefficients are presented, and robust standard errors are shown in parentheses for each coefficient, with clustering by educational environment (state and year). Year dummies are not shown in this Table. The results of the interaction terms between years of education and year dummies are not shown in Model 1 or Model 2, while the interaction terms between educational rank and year dummies are not shown in Model 3 or 4. The full model results are available in Appendix 1, Table 4. Significance level *, **, and *** indicate zero is not covered by the 90, 95, and 99 percent confidence interval, respectively

In midterm elections, the marginal effect of years of education has increased over time. The marginal effect of individual-level education on voting behavior in midterm elections was weakest in 1986 and strongest in 2018. The effect of absolute education in midterm elections was fairly consistent during the 2000s and early 2010s. In presidential elections, the marginal effect of absolute education also increased from 1996 to 2008. The positive effect slightly decreased from 2008 to 2012 and increased afterward.

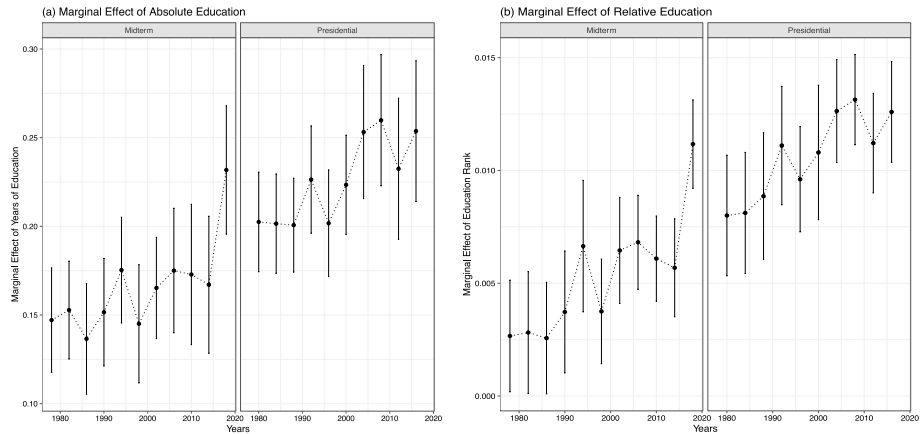


Fig. 2 **a** Marginal Effect of Years of Education on Voter Turnout Across Time. **b** Marginal Effect of Education Rank on Voter Turnout Across Time

Second, this study finds support for the Relative Value of Education Hypothesis: the positive effect of individuals' educational ranking in society on voter turnout should be increased over time. In Fig. 2b, the marginal effects of individuals' educational rank are positive across the time period analyzed, meaning that a higher educational rank is correlated with voting (Model 2 in Table 1). The slopes are upward regardless of election type

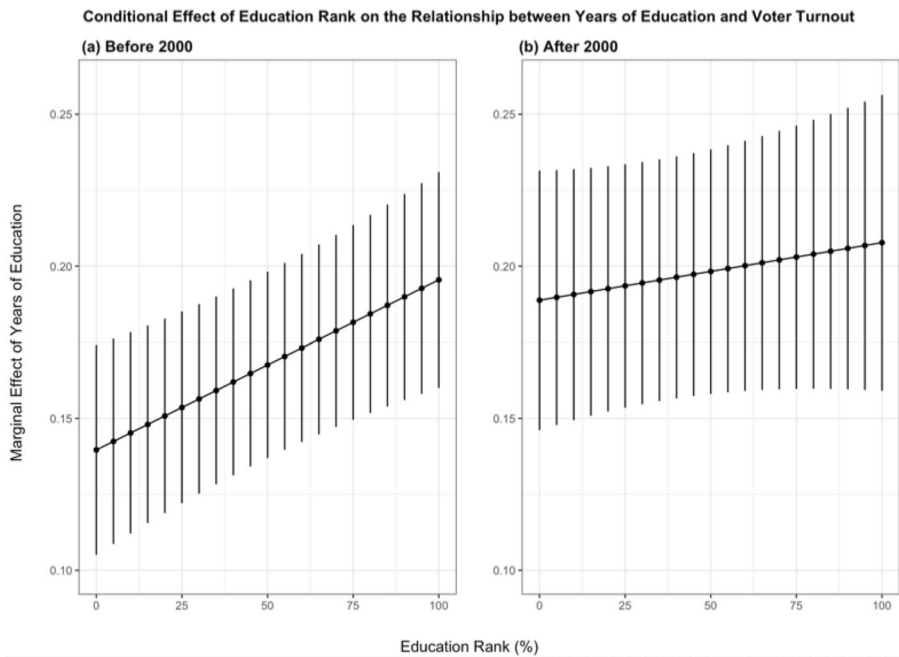


Fig. 3 **a** Conditional Effect of Relative Education on the Relationship Between Absolute Education and Voter Turnout Before 2000. **b** Conditional Effect of Relative Education on the Relationship Between Absolute Education and Voter Turnout After 2000

in Fig. 2b. This shows that the marginal effect of an individual's educational rank on their voting behavior has increased over time. The effect of educational rank on voting behavior has a greater magnitude in presidential elections than in midterm elections. As shown in Fig. 2b, the marginal effect of relative education has increased more dramatically since 2000. Hence, individuals with higher levels of relative education have been more likely to vote in more recent decades than in past decades.

Lastly, the empirical analyses show evidence for the Interaction Effect Hypotheses. The results reveal that competition in the educational environment influences how an individual's education correlates with their voting behavior (Models 3 and 4 in Table 1). While previous studies have found that the effect of an individual's education on their voting behavior decreases as others in the population achieve greater educational attainment, this study uncovers different patterns in the interaction between an individual's own level of education and his or her percentile rank relative to others in the period before and after 2000. Before 2000, the effect of individuals' absolute educational attainment on their voter turnout increased as their rank in their educational environment increased, as shown in Fig. 3a. However, since 2000, this marginal effect of individuals' educational attainment has remained consistently high across educational percentile rankings, as displayed in Fig. 3b. The marginal effect of education after 2000 is much larger than it was before 2000. In other words, the effect of education on voting behavior for people at the bottom of the percentile rankings for education after 2000 is greater than the effect at the 100th percentile rank before 2000. The results here confirm the sorting model's explanation of voter turnout before 2000. However, since 2000, the effect of individuals' educational attainment on their voting behavior has become larger than ever, and it has not been canceled out by their relative educational ranking.

6 Discussion and Conclusion

This study takes a novel approach to analyzing the interwoven relationships between the literature's dominant theories involving the effects of both absolute and relative education on voter turnout over time. This is a first effort to explicitly investigate the effect of the interaction between an individual's educational attainment and their educational environment on their voting behavior using longitudinal data. The results of four logistic regressions spanning 42 years illustrate that the absolute and relative education models capture dynamics between education and turnout. The positive effects of individuals' educational attainment and their relative educational ranking on their voter turnout have increased over time, and the effects are bigger in presidential than in midterm elections. However, the conditional effect of the competitiveness of the educational environment on the relationship between individuals' educational attainment and their voter turnout changed around the year 2000. Prior to 2000, any additional schooling had a greater impact on voter turnout. After 2000, this conditional effect seems to have disappeared—individuals' absolute education has a greater effect on voter turnout than it did before 2000—and this effect is consistent regardless of how competitive an individual's level of education is compared to their peers. From these results, this study concludes that the increasing positive effect of absolute education over time has led to increased voter turnout since 2000 despite education inflation. While individual's relative education explains the pattern of voter turnout in elections before 2000, it does not explain the pattern of voter turnout in elections since 2000. As such, this study highlights the utility of disaggregating the mechanisms between

education and voter turnout across time, instead of considering the absolute and relative values of education per se and as standalone mechanisms.

The findings in this study have implications for existing theories or concepts that have prevailed in the electoral behavior literature. Importantly, the finding that both the absolute and relative values of individuals' education predict voting behavior contributes to the consideration of the two values and theories as not mutually exclusive, but coexisting mechanisms. This consideration can help researchers to seek an understanding not of which value is the mechanism at play, but perhaps when and where do the different values of education have more or less influence. In turn, such disaggregated understandings can be used to develop nuanced policy recommendations for different country profiles seeking to increase voter turnout, for example.

Additionally, the findings in this study provide the advantage of nuance in terms of methodology. The inclusion of data that spans a longer timeframe enriches the robustness of this study in relation to previous studies involving shorter time spans, especially given the increased relative value of college education since 2000, which is captured in this study only. As such, continued research with longer time-spanning data is merited. Such longer time spans will continue to incorporate disruptive events, such as the economic recessions and the COVID-19 pandemic, which influenced the attainment of education via both literal constraints or delays, or continued shifts regarding how the value of higher education is perceived.

The analyses of this research contribute and connect a rich literature that seeks to explain individuals' voting behavior and has implications for policies designed to promote voter turnout through education. This study finds that the impact of education on voting is not only due to its effect on social status, widening the scope for education policy design consideration. Although greater competition for better social status has impeded the effect of absolute education on voter turnout as a predictor of political engagement before 2000, education still promotes voter turnout, and its positive effect is much stronger today. Education continues to play an important and positive role, creating an informed citizenry that can actively participate in democratic society and, in fact, may be more important today than ever before.

The results can be viewed in the context of a long-standing debate over education and political participation (Converse, 1972). While both absolute and relative education help increase voter turnout, education's enlightening (absolute) effects play an important role in fostering individuals' political engagements even if their relative rankings in society are lower than others' due to education inflation since 2000. The interaction effects in this research suggest that education can be a good approach to improve inequalities in democratic representation. Representatives in democracy may prefer to make a public policy reflecting certain groups of people's political, social, and economic preferences in society because they may be more actively engaged in political activities. Typically, this more active participation is associated with individuals who are more educated, high-income, White, male, and religious (Verba et al., 1995). This implies that low levels of political participation can cause unequal political representations in democracy. In this case, the findings of this research suggest that raising levels of education in population can improve the equality of democratic representativeness by mitigating the imbalance of individuals' participation rates (Persson, 2011).

Finally, this article underscores the need for further research that examines how different types of education affect individual voting behavior and what types of education should be prioritized to promote political participation. Although the positive effects of education have been well demonstrated in electoral behavior literature, it is still ambiguous what

aspects of education, such as students’ knowledge or performance in writing or math, affect voter turnout. As Marshall (2018) describes, civic and social science education are helpful to improve political participation. However, it remains unclear what specific educational component or environment accounts for the causal mechanism of the positive relationship between education and political participation. For instance, it is not apparent how mathematics might affect individuals’ levels of political knowledge, social trust, or political tolerance. Hence, further research could concentrate on disentangling how different types of education might encourage different forms of civic engagement beyond voter turnout.

Appendix 1

See Tables 2, 3 and 4.

Table 2 Descriptive Statistics

Statistic	N	Mean	St. Dev	Min	Pctl(25)	Pctl(75)	Max
Survey Year	1,637,249	1996	12.8	1976	1984	2008	2018
Voter Turnout	1,637,249	0.6	0.5	0	0	1	1
Years of Education	1,637,249	12.9	3.1	0	12	16	18
Education Rank	1,637,249	62.3	27.4	1	47.1	86.6	100
Age	1,637,249	49.8	16.3	25	36	62	99
Age-squared	1,637,249	2,747.0	1,738.0	625	1,296	3,844	9,801
Female	1,637,249	0.5	0.5	0	0	1	1
Married	1,637,249	0.7	0.5	0	0	1	1
State	1,637,249	28.8	15.4	1	16	41	56

Table 3 Bivariate analyses on effects of absolute and relative educations on voter turnout (Logistic Models)

	Model 4	Model 5
Years of Education	0.177*** (0.012)	
Education Rank		0.022*** (0.001)
Intercept	- 1.714*** (0.138)	- 0.782*** (0.073)
Pseudo R-squared	0.047	0.062
Observations	1,637,249	1,637,249
AIC	3,841,305,255.076	3,782,653,528.537
BIC	3,841,305,279.693	3,782,653,553.154
Log Likelihood	- 1,920,652,625.538	- 1,891,326,762.269

Unstandardized coefficients are presented, and robust standard errors are shown in parenthesis for each coefficient, clustering by educational environment (year and state). Significance level *, **, and *** indicate zero is not covered by the 90, 95, and 99 percent confidence interval, respectively

Table 4 Effects of absolute and relative educations on voter turnout (Logistic Models)

	Model 1	Model 2	Model 3 1976–1998	Model 4 2000–2018
Years of Education	0.191*** (0.014)	0.185*** (0.013)	0.140*** (0.018)	0.189*** (0.022)
Education Rank	0.007*** (0.001)	0.006*** (0.001)	0.001 (0.002)	0.006 (0.003)
Years of Education X Education Rank			0.001** (0.000)	0.000 (0.000)
Age	0.094*** (0.007)	0.095*** (0.006)	0.111*** (0.004)	0.076*** (0.006)
Age Squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)
Female	0.079*** (0.021)	0.079*** (0.020)	0.061** (0.023)	0.109*** (0.027)
African American	0.330*** (0.066)	0.329*** (0.068)	0.212*** (0.063)	0.435*** (0.082)
Asian American	-0.992*** (0.074)	-0.984*** (0.067)	-0.693*** (0.126)	-0.999*** (0.059)
Other Race	-0.466*** (0.098)	-0.466*** (0.099)	-0.633*** (0.163)	-0.364*** (0.106)
Married	0.556*** (0.020)	0.554*** (0.020)	0.544*** (0.019)	0.569*** (0.024)
1978	-0.105*** (0.030)	-0.400*** (0.013)	-0.614*** (0.011)	
1980	-0.068 (0.037)	-0.020 (0.021)	0.069*** (0.010)	
1982	-0.042 (0.059)	-0.288*** (0.018)	-0.484*** (0.016)	
1984	-0.059* (0.024)	-0.024 (0.015)	0.081*** (0.007)	
1986	-0.045 (0.030)	-0.481*** (0.014)	-0.695*** (0.025)	
1988	-0.248*** (0.013)	-0.262*** (0.007)	-0.109*** (0.010)	
1990	-0.276*** (0.021)	-0.600*** (0.012)	-0.746*** (0.016)	
1992	-0.423*** (0.025)	-0.248*** (0.016)	0.017 (0.011)	
1994	-0.650*** (0.049)	-0.850*** (0.020)	-0.832*** (0.022)	
1996	-0.509*** (0.019)	-0.550*** (0.023)	-0.363*** (0.018)	
1998	-0.390*** (0.066)	-0.809*** (0.028)	-0.958*** (0.019)	
2000	-0.612*** (0.035)	-0.443*** (0.016)		

Table 4 (continued)

	Model 1	Model 2	Model 3 1976–1998	Model 4 2000–2018
2002	–0.602*** (0.021)	–0.929*** (0.015)		–0.752*** (0.010)
2004	–0.797*** (0.107)	–0.348*** (0.048)		0.204*** (0.007)
2006	–0.633*** (0.050)	–0.855*** (0.026)		–0.654*** (0.016)
2008	–0.797*** (0.096)	–0.286*** (0.047)		0.295*** (0.013)
2010	–0.635*** (0.098)	–0.841*** (0.052)		–0.691*** (0.026)
2012	–0.620*** (0.123)	–0.348*** (0.055)		0.122*** (0.007)
2014	–0.811*** (0.098)	–1.071*** (0.050)		–0.958*** (0.007)
2016	–0.923*** (0.125)	–0.450*** (0.062)		0.106*** (0.009)
2018	–1.068*** (0.089)	–0.800*** (0.051)		–0.325*** (0.019)
Years of Education X 1978	–0.044*** (0.006)			
Years of Education X 1980	0.011** (0.004)			
Years of Education X 1982	–0.039*** (0.008)			
Years of Education X 1984	0.010* (0.004)			
Years of Education X 1986	–0.055*** (0.007)			
Years of Education X 1988	0.009** (0.003)			
Years of Education X 1990	–0.040*** (0.006)			
Years of Education X 1992	0.035*** (0.004)			
Years of Education X 1994	–0.016 (0.009)			
Years of Education X 1996	0.010** (0.004)			
Years of Education X 1998	–0.046*** (0.008)			
Years of Education X 2000	0.032*** (0.004)			
Years of Education X 2002	–0.026*** (0.002)			

Table 4 (continued)

	Model 1	Model 2	Model 3 1976–1998	Model 4 2000–2018
Years of Education X 2004	0.062*** (0.007)			
Years of Education X 2006	-0.016** (0.006)			
Years of Education X 2008	0.068*** (0.006)			
Years of Education X 2010	-0.019* (0.009)			
Years of Education X 2012	0.041*** (0.008)			
Years of Education X 2014	-0.024*** (0.007)			
Years of Education X 2016	0.062*** (0.008)			
Years of Education X 2018	0.040*** (0.006)			
Education Rank X 1978		-0.004*** (0.001)		
Education Rank X 1980		0.002** (0.001)		
Education Rank X 1982		-0.004*** (0.001)		
Education Rank X 1984		0.002*** (0.000)		
Education Rank X 1986		-0.004*** (0.001)		
Education Rank X 1988		0.002*** (0.000)		
Education Rank X 1990		-0.003*** (0.001)		
Education Rank X 1992		0.005*** (0.001)		
Education Rank X 1994		0.000 (0.001)		
Education Rank X 1996		0.003*** (0.000)		
Education Rank X 1998		-0.003*** (0.001)		
Education Rank X 2000		0.004*** (0.001)		
Education Rank X 2002		-0.000 (0.000)		
Education Rank X 2004		0.006*** (0.001)		

Table 4 (continued)

	Model 1	Model 2	Model 3 1976–1998	Model 4 2000–2018
Education Rank X 2006		0.000 (0.001)		
Education Rank X 2008		0.007*** (0.001)		
Education Rank X 2010		–0.000 (0.001)		
Education Rank X 2012		0.005*** (0.001)		
Education Rank X 2014		–0.001 (0.001)		
Education Rank X 2016		0.006*** (0.001)		
Education Rank X 2018		0.005*** (0.001)		
(Intercept)	–5.260*** (0.164)	–5.167*** (0.133)	–5.052*** (0.123)	–5.105*** (0.250)
Pseudo R-squared	0.133	0.133	0.121	0.140
nobs	1,538,904	1,538,904	861,663	677,241
AIC	3,192,273,152.209	3,193,272,258.128	1,630,998,186.424	1,562,257,929.744
BIC	3,192,273,789.031	3,193,272,894.950	1,630,998,443.090	1,562,258,158.259
Log Likelihood	–1,596,136,524.105	–1,596,636,077.064	–815,499,071.212	–781,128,944.872

Unstandardized coefficients are presented, and robust standard errors are shown in parenthesis for each coefficient, clustering by educational environment (state and year). Significance level *, **, and *** indicate zero is not covered by the 90, 95, and 99 percent confidence interval, respectively

Declarations

Conflict of interest The author has no relevant financial or non-financial interests to disclose.

Human or Animal Participants The author has not done a research involving Human Participants and/or Animals.

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