

Revisiting the Gender Gap in Political Knowledge

Jennifer Jerit¹ · Jason Barabas¹

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Abstract Gender-based differences in political knowledge are pervasive in the United States and abroad. Previous research on the source of these differences has focused on resource differentials or instrumentation, with scholars arguing either that the gender gap is real and intractable, or that it is an artifact of the way the concept is measured. Our study differs from past work by showing that (1) male–female differences in political knowledge persist even when knowledge is measured with recommended practices, but that (2) knowledge gaps can be ameliorated. Across laboratory, survey, and natural experiments, we document how exposure to information diminishes gender-based differences in political knowledge. The provision of facts reduces—and often eliminates—the gender gap in political knowledge on questions covering a range of topics.

Keywords Gender gap · Knowledge · Experiment

Are men and women political equals? In some respects, they do not seem to be. Women report being less interested in politics than men, less efficacious about their participation, and less engaged in political activities beyond voting (Atekson and Rapoport 2003; Bennett and Bennett 1989; Preece 2016; Verba et al. 1997). Among

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✉ Jennifer Jerit
jennifer.jerit@stonybrook.edu
Jason Barabas
jason.barabas@stonybrook.edu

¹ Department of Political Science, Social and Behavioral Sciences Building, Stony Brook University, Stony Brook, NY 11794-4392, USA

the many male–female differences that researchers have documented, the gap in political knowledge may be the most worrisome. Knowledge is a crucial political resource, influencing everything from the organization of a person’s beliefs to their level of political involvement and attention to elite discourse. Furthermore, gender-based differences in knowledge are larger in magnitude than gender differences on other outcomes (Mondak and Anderson 2004), and though there is variation in the size of the gap across topics, the phenomenon has been documented worldwide (e.g., Ferrin and Fraile 2014; Fortin-Rittberger 2016; Fraile 2014a; Fridkin and Kenney 2014).

Yet, the gender gap defies easy explanation. Early studies viewed gender differences in knowledge through the lens of standard resource models of participation, making them fairly immutable (Verba et al. 1997). By contrast, recent research argues that the gender gap stems from measurement factors that are unrelated to knowledge (question wording, formatting, and the like). Indeed, the implication of this latter view is that knowledge among men and women would be indistinguishable were it not for flawed instrumentation. Despite the vast number of studies on this topic, it is not clear why—or whether—gender differences in knowledge exist.

Our study seeks to clarify the field’s understanding of this phenomenon by examining the conditions under which gender differences in knowledge can be altered. More specifically, we conduct a series of experiments in which informational resources are made equitable across gender groups and examine rates of learning by men and women. Our treatments extend recent observational work showing differential learning among men and women in “information rich” environments (Fraile 2014b; Ondercin et al. 2011). Unlike that work, however, we isolate the causal effect of information through the random assignment of people to treatment and control conditions. Our analysis shows that the gender gap is neither illusory nor immutable. Although significant gender based differences in political knowledge exist, a simple information treatment often reduces this gap. Moreover, unless women are markedly less interested in a topic, the oft-noted gender gap in knowledge disappears (i.e., men and women are indistinguishable in terms of the level of knowledge). Overall, our results indicate a substantial degree of malleability in the knowledge gap among men and women.

The Gender Gap in Political Knowledge: Real or Illusory?

The scholarly literature on the gender gap in knowledge has evolved from an argument about resource and socialization differences between men and women to a more diffuse body of work exploring the measurement properties of political knowledge questions. We begin by describing the development of this literature and then discuss how we contribute to it.

One View: Knowledge Gaps Reflect Real Differences Between Men and Women

For decades, researchers explained the gender gap in knowledge by noting that women have lower levels of traditional “resources” like education, income, and

occupational status (e.g., Verba et al. 1995). Differences in these resources were thought to contribute to the gap in knowledge because of their relationship with certain attitudes (e.g., efficacy, political interest) and behaviors (e.g., discussing politics, paying attention to the news). Even as the socioeconomic and political status of women has improved, researchers speculate that girls may be socialized to think differently about the political world than boys (e.g., Burns et al. 2001; Delli Carpini et al. 1996; Verba et al. 1997). This explanation gains support from studies showing that gender-based knowledge differences are observed early in life (Pereira et al. 2014; Wolak and McDevitt 2013), and it is consistent with research demonstrating that women reap a lower “return” than men from resources like education (Dow 2009).

While some portion of the gap in knowledge between men and women may have its roots in differential resources, this cannot be the entire explanation because the gap persists in many industrialized democracies where political power and other resources are more equitably distributed (e.g., Fortin-Rittberger 2016). Moreover, this perspective cannot explain why women do not take advantage of less costly informational resources, which have become more plentiful over time (Graber 1988). Perhaps as a result of these conceptual ambiguities, scholars have turned their attention to the measurement of political knowledge. In contrast to earlier research, this work argues that gender differences in knowledge are an artifact of questionnaire design.

Another View: Knowledge Gaps are Measurement Artifacts

The measurement argument has taken a variety of forms, but the basic claim is that if researchers change the way they *ask* survey questions, gender-based differences in political knowledge would diminish or disappear altogether. For instance, Mondak and Anderson (2004) examine the effect of including an explicit “Don’t know” option on political knowledge questions (also see Ferrin and Fraile 2014). They report that an explicit “Don’t know” option results in lower levels of knowledge for women because they are less likely than men to guess, stemming from differences in self-confidence (Mondak and Anderson 2004) and risk aversion (Lizotte and Sidman 2009). Likewise, Prior (2014) argues that verbal questions disadvantage women, who tend to store information in a visual rather than textual format. He shows that gender-based differences in knowledge decline when political knowledge questions are presented in a visual format.¹

Another variant of the measurement argument focuses on the topic of political knowledge questions. When knowledge questions focus on issues that are of direct relevance to women as a group—either because they ask about female politicians or policies that disproportionately affect women—the gender gap disappears and sometimes even reverses, with women having higher levels of knowledge than men (Dolan 2011; Hooghe et al. 2006; Stolle and Gidengil 2010; Shaker 2012; Sanbonmatsu 2003). For example, Fridkin and Kenney (2014) demonstrate that

¹ Additionally, women exhibit higher levels of knowledge when the survey setting allows them to draw upon procedural, rather than declarative, memory (Prior and Lupia 2008).

women know far less about their senators than men, but that this gap “closes sharply” in states represented by women senators. The implied mechanism is motivation—i.e., women have higher levels of knowledge on “gendered” topics (Dolan 2011, p. 98) because of the instrumental benefits of learning gender-relevant facts. But there are clear implications for measurement: Dolan (2011, p. 105) advises researchers “to examine new measures of this important concept,” with an eye toward “[developing] balanced measures of political knowledge that contain both traditional items and those that are more relevant to women.”² Taken together, these studies imply that levels of political knowledge among men and women would be similar were it not for the flaws in how researchers measure the concept.³

The measurement argument is compelling, but support for this perspective is incomplete. Mondak and Anderson (2004, p. 510) provide some of the most convincing evidence for the effect of survey instrumentation, yet they acknowledge that their results “in no way should be construed as offering a complete explanation of the gender gap in knowledge...[and] further effort to identify the remaining causes of the gender gap is warranted” (also see Fortin-Rittberger 2016). Indeed in the data we report below, we observe sizeable and statistically significant differences between men and women even when we follow “best practices” concerning DK options and visual tests of knowledge. As for the effect of gender-relevant topics, knowledge of female office holders is not always higher among women than men (e.g., Stolle and Gidengil 2010, Fig. 1 or Dolan 2011, Table 1). Moreover, the effect that some researchers attribute to motivation (i.e., a greater desire to learn about gender-relevant topics) might instead be due to the information environment (i.e., the greater newsworthiness of events involving female politicians). The latter possibility deserves consideration in light of evidence that the knowledge gap between men and women declines when information is broadly available (Fraile 2014b; Ondercin et al. 2011).

An Alternative: Gender Gaps Exist but Information Can Reduce Them

Building upon the idea that the availability of information is a critical determinant of knowledge (Barabas and Jerit 2009; Delli Carpini et al. 1994), observational and quasi-experimental studies show that women experience larger gains in knowledge than men in information-rich environments (e.g., Fraile 2014b; Ondercin et al. 2011). Despite the potential importance of this finding, these studies cannot definitively attribute learning to the availability of information. Ondercin et al. (2011) examine the effect of gender on candidate knowledge at multiple points in the 2000 U.S. presidential election, but they do not identify men or women who were exposed to campaign news (e.g., with a gender \times media usage interaction).⁴

² In technical terms, there is “differential item functioning” of traditional knowledge questions across gender groups (Pietryka and MacIntosh’s 2013; see Abrajano 2015 or Perez 2015 for similar findings with respect to different racial and ethnic groups).

³ McGlone et al. (2006) report that the gender gap in knowledge disappears when the survey interviewer is a woman.

⁴ Hansen and Pedersen (2014) adopt a similar approach in a study of Danish respondents (i.e., they examine levels of knowledge among men and women before and after an election).

Likewise, Fraile (2014b) examines whether the gender gap is reduced among participants in the 2009 Europolis project, a deliberative poll on the topic of immigration and climate change. In that case, however, it is difficult to determine whether learning was the result of information, discussion with other attendees, or the increased motivation participants might have felt as a result of being part of the event. Indeed, Fraile concludes the study by acknowledging the need to establish whether other information environments have a differential effect on men and women (2014b, p. 385).

We revisit the gender gap in a series of experimental studies in which we provide information to respondents and then determine whether there is differential “take-up” of that information by men and women. The exact presentation varies across studies, however, the treatments feature a brief (and fairly unobtrusive) presentation of general and policy-specific facts.⁵ One may question the decision to make informational resources equitable in the experiment when such resources are often unequal in real-world settings. However, a key advantage of experimentation is the ability to create “environments” that provide theoretical and/or analytical leverage (Morton and Williams 2010; also see Kuklinski et al. 2001). In the present case, it is useful—in our view, essential—to begin with a simple treatment (e.g., one that is not confounded by other elements like stereotype threat; see Murphy et al. 2007) in order to identify the conditions under which the gender gap in knowledge can be eliminated.

We hypothesize that the provision of information will help close the oft-noted knowledge gap between men and women. While this relationship may seem obvious, it is not a foregone conclusion. If gender differences are as stubborn as the resources view implies, increasing the availability of information would not reduce the gap, and might even worsen it according to the original “knowledge gap” hypothesis (e.g., Tichenor et al. 1970; Jerit et al. 2006). Furthermore, people do not always absorb factual information upon being exposed to it (e.g., Kuklinski et al. 2000; Nyhan and Reifler 2010; Hochschild and Einstein 2015). Finally, the fact that so few previous studies have been able to make the gap “disappear” (Mondak and Anderson 2004, p. 495) strongly suggests there are additional sources of the gender gap that have yet to be uncovered.

In the analyses below, we focus on four empirical quantities that we believe will bring clarity to the existing literature. First, we revisit a crucial question dividing past studies: is the gender gap real or apparent? Using proverbial “best practices” for measuring political knowledge, we examine baseline differences in knowledge among men and women across a variety of topics in the *untreated* conditions of our experiments. Recall that in this particular context, the measurement perspective predicts that gender differences should be modest at best. Second, we determine whether observed levels of knowledge for women increase when they are exposed to facts. In estimating the treatment effect of information among women, we will establish how responsive they are to factual information when it is made available.

⁵ The stimulus was devoid of interpretation or journalistic devices that might cause men and women to interpret the information differently. Research has shown that contemporary news coverage can be “marginalizing” (Bauer et al. 2016), and conveys the message that politics is a “man’s game” (e.g., Kahn and Goldenberg 1991; Kahn 1992, 1994).

Third, we compare levels of knowledge for men and women in the treatment group. Insofar as there is a difference in baseline levels of knowledge, that gap should be reduced considerably after men and women are exposed to information. Finally, we compare the change in knowledge for women to the change in knowledge for men by computing the difference-in-differences (DID). This final quantity will help us establish whether women experience differential gains in knowledge in response to an information treatment (as suggested by Ondercin et al. 2011) or whether women and men learn roughly equally from an information treatment. Taken together, these metrics will enhance our understanding of the nature and manipulability of gender differences in political knowledge.

Study 1: Informing Experiments on Two Convenience Samples

Our first study features experiments that were administered on undergraduate students enrolled in political science classes at a large public university ($N = 440$) and MTurk workers in the U.S. ($N = 274$) during the same 5-day period in the spring of 2013. The samples are non-representative in different ways (e.g., a lack of variation in educational attainment for students; a high proportion of females and liberals among MTurk respondents). However, we observe similar patterns across both samples and thus combine the samples in the empirical analyses below (separate analyses are shown in the Supplemental Appendix which is available from the authors).⁶ In both cases the manipulation is the presentation of information shown to respondents in the guise of answering an unrelated question (what Mutz 2011 calls an “indirect treatment”; see Kuklinski et al. 2000 or Gilens 2001 for examples).

Study 1 featured a between-subjects design with five conditions, including four treatment groups and one control group. Figure 1 shows a schematic of the study design.

Respondents in the treatment group were exposed to political information in the guise of an unrelated question asking, “If you had to pick one, which of the following news stories would you want to read?” There were four answer choices representing different topics in the news. Across all groups, the first three response options were the same (“A blood donation drive by the American Red Cross,” “Seatbelt usage trends over the last ten years,” and “Participation in recycling programs internationally”).⁷

The fourth response option was the experimental manipulation, and it varied across groups. In the (placebo) control group, the fourth option was “A biographical sketch of Governor Tom Corbett of Pennsylvania.” In the treatment conditions, the

⁶ The study was approved by the Human Subjects Committee at Florida State University (HSC No. 2013.10185). Student subjects were recruited to participate in exchange for extra credit and instructed to sign up through web-based appointment system. The MTurk respondents received \$1.00 for completing the survey. See Druckman and Kam 2011 or Berinsky et al. 2012 for more on the merits of convenience samples.

⁷ We selected these particular options because they have been used as placebo topics in past experimental studies (e.g., Gerber and Green 2005) and we expected them to be non-reactive.

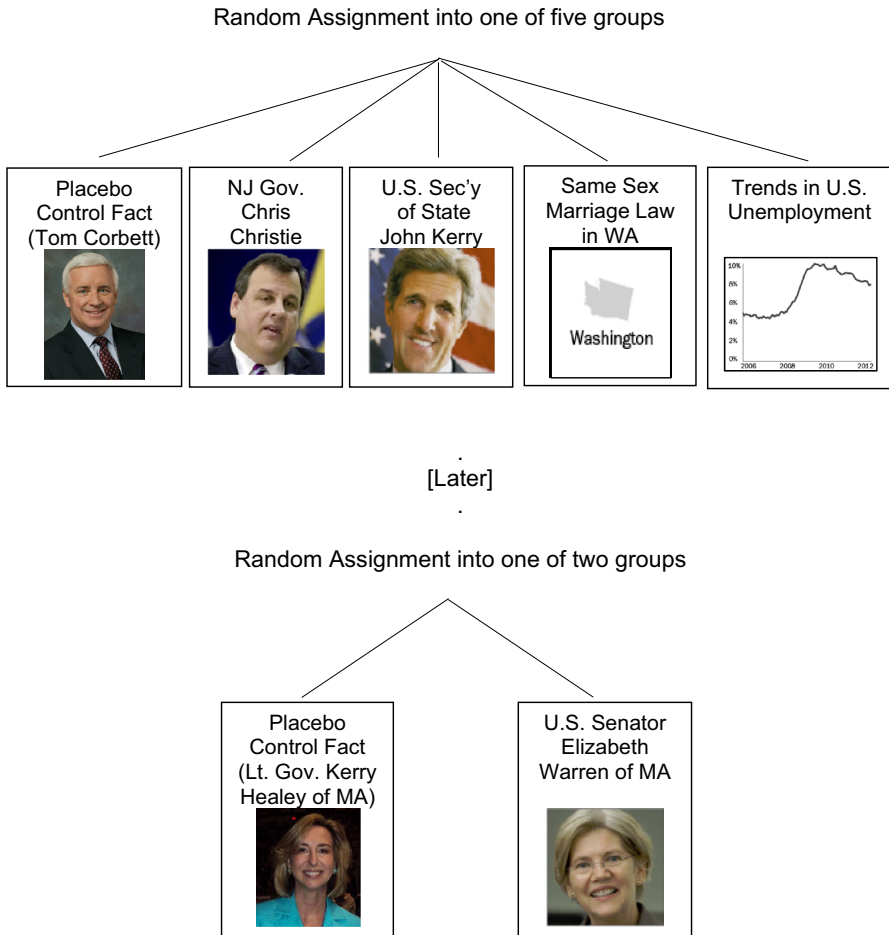


Fig. 1 Design schematic for Study 1

fourth option was either, “A biographical sketch of Governor Chris Christie of New Jersey,” “President Obama’s nomination of Massachusetts Senator John Kerry to be Secretary of State,” “Passage of a same sex marriage law in the state of Washington,” or “Unemployment declining from nearly 10% three years ago to under 8%.” Appearing on the same screen as the question were four small images that corresponded to the response options (e.g., a picture of Chris Christie or a graph representing the declining unemployment rate). The purpose of the news interest question was to expose respondents to information as they read the response options to this question.⁸

Next, all respondents were asked four political knowledge questions, each of which corresponded to one of the treatment topics in the news interest question (the

⁸ The information in the response options was truthful (not deceptive). This item was a question, so we recorded which option the respondent selected and analyze those data later.

ordering of the four items was randomized). There was a question asking respondents to identify the Governor of New Jersey (Chris Christie), President Obama's nominee for Secretary of State (John Kerry), the U.S. state that had recently passed a same-sex marriage law (Washington), and recent trends in the American unemployment rate (declining). Thus, respondents in the treatment groups were asked four knowledge questions, and they were randomly assigned to be treated on *one* of those topics. People in the control group received the same four questions but they were not treated on any of the topics. In the analyses we report later, we compare respondents in the treatment groups with the control group (i.e., those who were exposed to the placebo fact about Tom Corbett).

Later on in the questionnaire, subjects were re-randomized into two experimental groups. Respondents were asked the "If you had to pick one..." question with four response options. Across both conditions, the first three response options were the same ("A look at the Boston Celtics professional basketball team," "A recent voyage of the USS Constitution in Massachusetts," and "How Boston digs out after a massive snow storm."). For control respondents, the fourth option was "Former Lt. Governor Kerry Healey's possible run for the U.S. Senate in Massachusetts." For treated respondents, the fourth response option was "Elizabeth Warren's recent election to the U.S. Senate in Massachusetts." As in the previous experiment, a knowledge question followed the news interest item. Subjects were shown four images of female politicians and asked "Which one is Elizabeth Warren, the new senator for Massachusetts?"⁹

Study 1 had several other notable design features. The wording and format of the knowledge questions mimicked a 2013 News and Political Knowledge poll conducted by the Pew Research Center, which allows us to compare the percent correct among our subjects with a national benchmark. Following the recommendation of Prior (2014), the Pew questions were presented in a visual format and we implemented this formatting in our study (shown in the Supplemental Appendix). In addition to the topical variety of the question (e.g., Barabas et al. 2014), we followed Dolan's recommendation to include items that might be inherently more interesting to women (e.g., the question on Elizabeth Warren). Finally, and to avoid the confounding influence of personality factors on observed levels of knowledge across men and women (e.g., Mondak and Anderson 2004), there was no explicit "Don't know" option on our questions (also see Miller and Orr 2008). In other words, our questionnaire followed current "best practices" regarding the measurement of knowledge, especially as it relates to gender-based differences in political knowledge.¹⁰

⁹ Prior to the re-randomization of treatments, and for the Warren experiment only, subjects were first blocked on gender to explore possible heterogeneous treatment effects. Treatment probability was the same within blocks, the blocks are of similar large sizes ($n > 300$), and our main interest lies in effects for each gender block, all of which makes empirical analysis straightforward (Gerber and Green 2012, Chaps. 3–4).

¹⁰ The knowledge items did not include a "don't know" option, but subjects could refuse to answer by skipping to the next item. Few people skipped the knowledge questions, ranging from a low of .7% (same sex marriage, unemployment) to a high of 5.9% (Elizabeth Warren). Analyses of refusals as a separate outcome category indicate the treatments reduced incorrect answers (all $p < .10$ with p -values averaging .04) but had no significant effect on refusals (all $p > .05$ with p -values averaging .74), with the exception of the Warren item where both incorrect and refusals were reduced significantly ($p < .01$).

Empirical Results for Study 1

We estimate the four quantities described earlier through a series of *t*-tests and difference-in-difference (DID) tests. Before we present the results of those analyses, we briefly describe how our samples compare to the 2013 Pew survey.

Student and MTurk respondents displayed higher levels of knowledge (in the aggregate) than Pew respondents, which might be expected given the higher average level of education for both samples. For example, roughly three quarters of respondents in the control groups of our study gave the correct answer to the items about Chris Christie, John Kerry, and Washington's same sex marriage law and even more (80%) provided the right answer on the unemployment question. The corresponding percent correct for those questions in the Pew sample was 73, 62, 60, and 70%, respectively. Additionally, 43% of Pew respondents could identify Elizabeth Warren, while nearly half of the student and MTurk subjects got the question correct.¹¹ Notably, with the exception of one item in the Pew sample, women underperformed men by 7 to 12% points ($p < .02$ for all items in the raw Pew data).¹²

Turning to the data from Study 1, Figs. 2 and 3 compare levels of knowledge for men and women across the control and treatment conditions (with the panels corresponding to the four knowledge questions described earlier). The control condition represents baseline differences in political knowledge between men and women. The treatment condition shows what happens when both men and women were exposed to information that should have helped them answer the knowledge item.¹³

We consider the results for each question separately, but one feature that is immediately apparent is the presence of a sizeable gender gap in the control condition (the left-most set of columns). The average size of the gap is 16% points and it ranges from 9% points (in the case of same sex marriage; Fig. 2) to 24% points (in the case of Elizabeth Warren; Fig. 3). Even though we followed recommended practices—assessing knowledge visually on a range of issues topics without an explicit “Don't know” option—there is a persistent and sizeable difference in observed levels of knowledge between men and women. If nothing else, this result corroborates previous claims about the difficulty of making the gap “disappear” (Mondak and Anderson 2004).

Yet as Fig. 2 illustrates, an information treatment is effective at diminishing the size of the gap. When it comes to identifying Chris Christie as the Governor of New Jersey (Panel A), a statistically significant ($p < .05$) 16% point gap in the control condition (i.e., $.67 - .82 = -.16$ after rounding) diminishes to 4% points in the treatment condition (i.e., the difference between $.85$ and $.89$, which is n.s.). Moreover, this pattern is driven largely by the sizable knowledge gain among women (they go from $.67$ to $.85$ correct for an 18% point treatment effect; $p < .01$,

¹¹ Differences in knowledge between student subjects and MTurk respondents were minimal (i.e., p -values averaged $p = .34$ for all cases and p -values averaged $.53$ for controls only).

¹² Men and women were indistinguishable in their knowledge of Elizabeth Warren ($p = .42$).

¹³ We employ the symbols “♀” for women and “♂” for men to aid in the presentation of results.

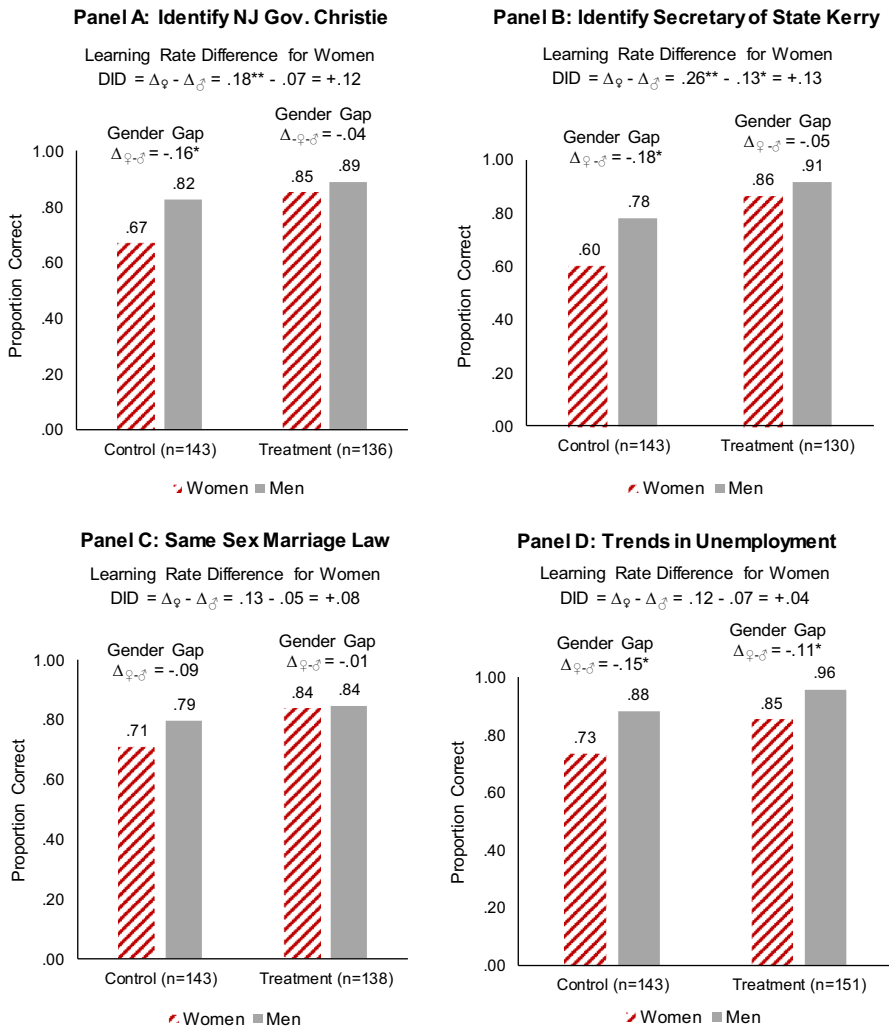


Fig. 2 Gender gaps in knowledge across experimental groups, Study 1. *Note* The differences in levels of knowledge between women (♀) and men (♂) as noted above in the column bars may not reflect the reported change (shown as Δ) due to rounding. *DID* difference-in-differences (i.e., Δ = difference for women from treatment group to control group, Δ = difference for men from treatment group to control group, $DID = \Delta - \Delta$). ****** $p < .01$, ***** $p < .05$, two-tailed t tests

two-tailed). Nevertheless, the learning gain among women was not significantly larger than that of males (who went from .82 to .89 correct), as indicated by the non-significant DID calculation at the top of Panel A (i.e., $.18 - .07 = .12$, with rounding). While the knowledge gains for women are larger than men in an absolute sense, the difference between the treatment effects was not statistically significant ($p < .21$).

Identify Massachusetts Senator Elizabeth Warren

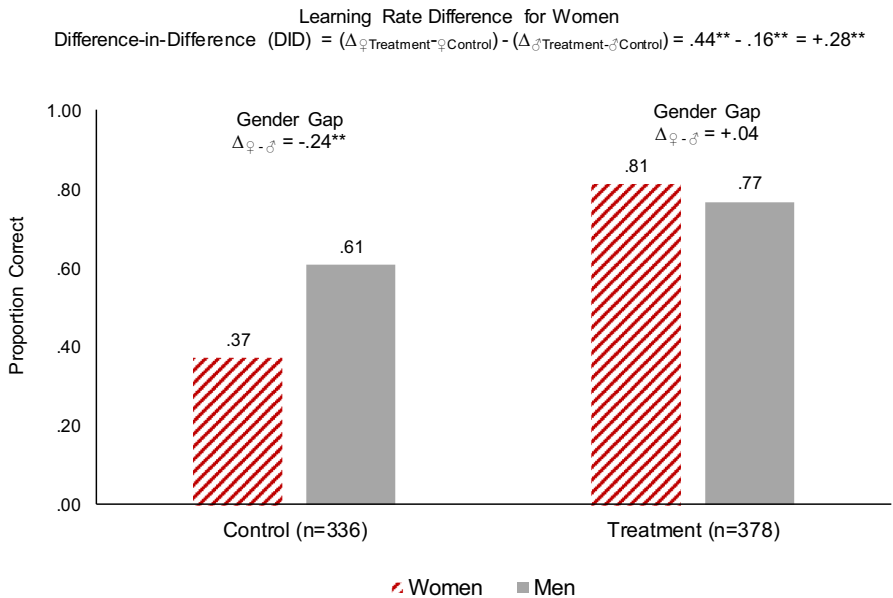


Fig. 3 Gender gaps in knowledge across experimental groups, Study 1. *Note* The differences in levels of knowledge between women (♀) and men (♂) as noted above the column bars may not reflect the reported change (shown as Δ) due to rounding. ** $p < .01$, * $p < .05$, two-tailed t tests

The same pattern appears in Panels B and C. On the John Kerry question (Panel B), a statistically significant and substantively large gender gap is observed in the control condition (18 points; $p < .05$). This difference all but vanishes in the treatment condition where there is only a 5-point difference between men and women ($p < .36$). Once again, this pattern is driven mainly by the behavior of women, who show a .26 treatment effect (going from .60 to .86 correct; $p < .01$). The DID is slightly larger in Panel B (i.e., $.26 - .13 = .13$), but it is not statistically significant ($p < .20$) because men also exhibit a learning effect (going from .78 to .91 correct). Panel C shows the results for the item on passage of a same sex marriage law in Washington. On this topic a 9% point gap in the control condition *disappears completely* in the treatment group. Women once again exhibit a substantively large 13% point treatment effect (going from .71 to .84 correct; $p < .08$), but the DID (i.e., $.13 - .05 = .08$) is not statistically significant ($p < .42$).

The pattern for the question on unemployment (Panel D) departs from the other panels. In the control condition, there is a large and statistically significant 15% point difference between men and women, with men having higher knowledge (.73 versus .88; $p < .05$). Both groups have higher knowledge in the treatment condition, but a statistically significant 11% point gap remains ($p < .05$). Compared to the other items in Fig. 2, the increase in knowledge for women across treatment and control was more modest (from .73 to .85 for a gain of .12; $p < .07$). Given the roughly similar increase in knowledge for both groups, the DID between the

treatment effects for men and women was not statistically significant ($.12 - .07 = .04, p < .59$).¹⁴

Figure 3 shows the results for the knowledge question about Elizabeth Warren, an item where some might expect women to have greater knowledge due to the nature of the topic (Dolan 2011). Yet there is a large and statistically significant gap in knowledge among men and women in the control group on this item (24% points; $p < .01$). Although women have significantly lower levels of knowledge in the control group, they have a slight information *advantage* in the treatment condition (by 4% points; $p < .30$). This increase represents a 44-point treatment effect for women (from .37 to .81; $p < .01$). Men, by contrast, improve by only 16% points (.61 to .77; $p < .01$). The difference between these two differences is 28% points and it is statistically significant ($.44 - .16 = .28; p < .01$).

To summarize Figs. 2 and 3, there is almost always an observable gender gap in political knowledge among people in the control conditions, despite the use of survey practices that should counteract this tendency. Consistent with our expectations, however, a randomly assigned information treatment reduced gender-based differences in knowledge. Moreover, the learning gains of women were often dramatic, leading to substantial treatment effects. Yet, men also learned from the treatments, and as a result, the DID generally was not significant (i.e., the difference between the treatment effects for men and women was not significant).¹⁵ Study 1 reveals that although gender differences in knowledge are stubborn (i.e., they persist despite instrumentation improvements), the gap can be ameliorated through the provision of information.

Study 2: Informing Experiments on a National Sample

The purpose of Study 2 was to replicate the findings from our previous study on a national sample using different issues. Our second empirical study features experiments that were administered by YouGov in a national survey ($N = 1000$) from December 14–21, 2015.¹⁶

¹⁴ We can augment the size of the control group by using respondents who were treated in other conditions (recall that treated respondents were shown one of the stories but asked all four knowledge questions). Using an enlarged control group (with more statistical power), the results are similar in terms of direction and substantive magnitude. Three patterns, in particular, are worth noting. First, in Panel C, the gender gap in the control group is 8 points and significant ($p < .05$; double digit gaps remain in the other panels and are significant at $p < .01$). Second, female learning effects average 17.5 points across the panels in Fig. 2 ($p < .05$ or better). Third, even with more cases, all DID in Fig. 2 are insignificant.

¹⁵ We analyzed the subset of respondents who selected the treatment topic in response to the news interest question. The patterns were similar to Figs. 2 and 3. Among respondents selecting the treatment topic, knowledge differences between men and women in the treatment group vanish to the point of insignificance (unemployment was the only exception). Later we report on gender differences in which of the four news items a respondent selected.

¹⁶ YouGov uses a matching algorithm with respect to gender, age, race, and education to produce an internet sample that approximates the demographic makeup of known marginals for the general population of the United States from the U.S. Census Bureau's American Community Survey (see Ansolabehere and Rivers 2013). The completion rate for the study was 30%, and it was approved by the Human Subjects Committee at Stony Brook University (#2014-2858-R1).

As in Study 1, the treatment is the exposure to political facts in the guise of answering a question about their news interests. Respondents were asked, “If you had to pick one, which of the following news stories would you want to read?” The first question had four answer choices, three of which were constant across treatment and control conditions (“Travel to a tropical island,” “A talk show featuring comedians,” and “The success of a new prescription drug”). The second response option was the experimental manipulation and it was either “Background on all Supreme Court members” (control) or “All three women on the Supreme Court” (treatment).¹⁷ Shortly thereafter respondents were asked, “There are nine justices on the Supreme Court of the United States. How many are women?”¹⁸

The second news interest question was about party control of the U.S. Senate. The three response options that were constant across conditions were, “The music from a band on a concert tour,” “Participation in recycling programs internationally,” and “A report on weather conditions around the nation.” The third response option was either “A story on the members of the U.S. Senate” (control) or “A story on the 54 Republicans the in U.S. Senate” (treatment). Respondents were later asked, “Which of the following shows the number of seats each party holds in the U.S. Senate?” with an image of four different party arrangements.¹⁹

Empirical Results for Study 2

The analyses proceeded in the same manner as Study 1 with the results shown in Fig. 4. Once again, a large gender gap appears in the control condition for both items despite the use of recommended practices for measuring knowledge. In the case of the Supreme Court question (Panel A), a statistically significant ($p < .01$) 15% point gap in the control condition (i.e., $.37 - .51 = -.15$) diminishes to 7% points in the treatment condition (i.e., the difference between $.76$ and $.69$, which is n.s. at $p < .07$). As was the case with Study 1, the gap diminishes largely as a result of the very sizable knowledge gain among women (they go from $.37$ to $.69$ correct for a $.32$ treatment effect; $p < .01$). But the learning gain among women was not significantly larger than that of men (who went from $.51$ to $.76$ correct), as indicated by the non-significant DID (i.e., $.32 - .25 = .07$; $p < .24$). Thus, both men and women show impressive learning gains on the Supreme Court question.

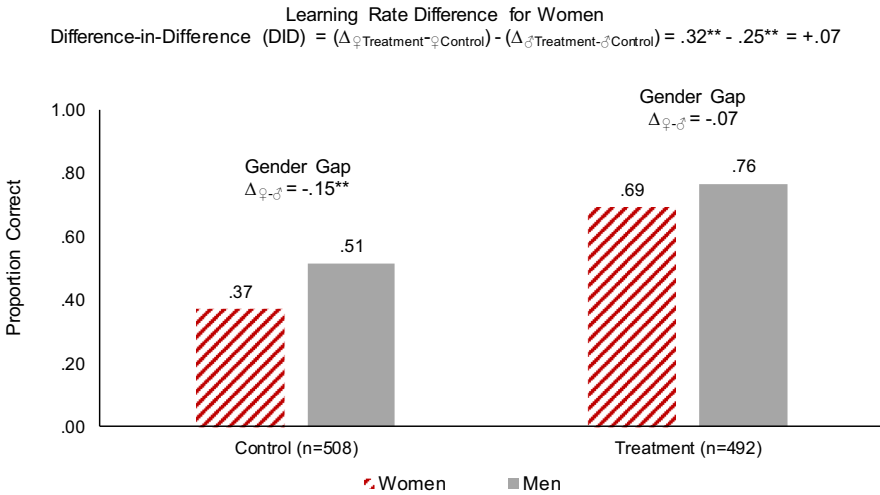
The pattern for the Senate control question (Panel B) is slightly different. A significant gender gap in the control condition (18 points; $p < .01$) remains significant in the treatment condition (16 points; $p < .01$). Both men and women have double-digit learning effects in response to the treatment (12 and 10% points;

¹⁷ The formatting of items in Study 2 was identical to Study 1 (e.g., there were images corresponding to response options).

¹⁸ The outcome occurred one or two questions later, depending on its placement relative to a related opinion question (not analyzed here). The other knowledge item has the same structure.

¹⁹ As with Study 1, the questions were based upon a national survey conducted by Pew Research Center in March–April of 2015. In the Pew survey 33% knew the correct answer regarding three women among nine justices while 52% could say that Republicans controlled 54 of the 100 seats in the U.S. Senate. At the time of this writing, information regarding gender differences on these two items was not available from Pew.

Panel A. Number of Women on U.S. Supreme Court



Panel B: Political Party Control of U.S. Senate

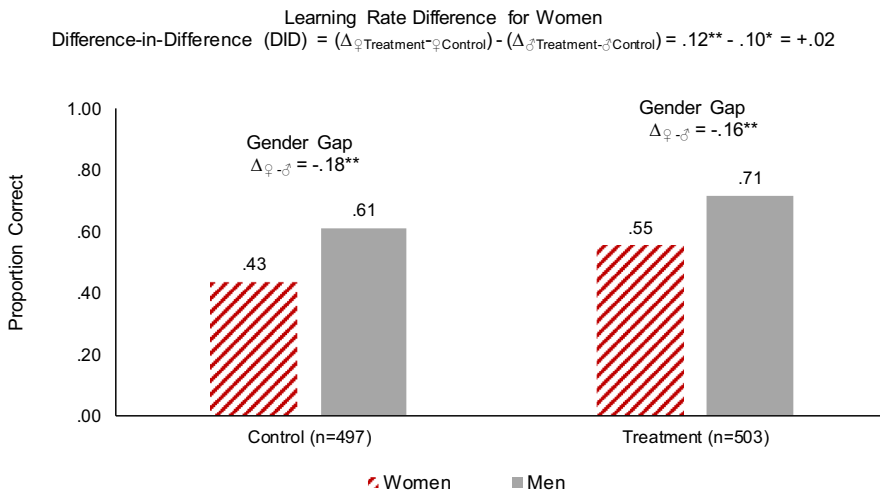


Fig. 4 Gender gaps in knowledge across experimental groups, Study 2. *Note:* The differences in levels of knowledge between women (\varnothing) and men (σ) as noted above the column bars may not reflect the reported change (shown as Δ) due to rounding. $^{**} p < .01$, $^* p < .05$, two-tailed t tests

$p < .01$ and $p < .05$ respectively), but the difference between the treatment effects ($.12 - .10 = .02$) is insignificant ($p < .78$).²⁰

²⁰ Figure 4 presents the results using unweighted data, however the patterns are identical with weighted data (e.g., the DID for Panels A and B are .07 and .02, respectively; both n.s.).

Discussion of Studies 1 and 2: The Mechanism Behind Learning

Taken together, Studies 1 and 2 provide a fresh look at the gender gap across a variety of issues and different subject populations. In contrast to the measurement perspective, the gender gap persists even when recommended practices are used, suggesting that the phenomenon is real (and not merely an artifact of questionnaire design). And yet, gender differences are not immutable. A brief and fairly unobtrusive information treatment can reduce the gap in knowledge between men and women. In the two cases where a significant knowledge gap remained after information provision (unemployment [Study 1] and Senate control [Study 2]) women were *less* likely to select that topic in their response to the news interest item.²¹ This pattern speaks to the potential role for motivation, in the sense that there may need to be some minimal level of interest in order to reap the benefits of information. We remain cautious in our interpretation of the news interest question because a person's level of interest was not randomly assigned. However, as long as women expressed equivalent levels of interest in a topic relative to men, they exhibited substantial learning effects. Moreover, in auxiliary analyses not reported here, the treatment effects we observe are *not* due to variation in the response styles of men and women. Using other questions from Study 1, we find no gender differences in overall attentiveness (as measured by performance on Instructional Manipulation Checks), self-reported attention to the questionnaire, time spent answering questions, or other items gauging attentiveness/satisficing.

Finally, one concern with Studies 1 and 2 relates to the nature of the effects we report—in particular, whether we show evidence of learning or just short-term recall. We address this issue in our third study in which we leverage naturally occurring variation in media attention to major policy issues (Medicare, immigration) and examine knowledge of men and women before and after these news events. While it may seem unremarkable that the gender gap diminishes when there is forced exposure to an experimental manipulation, showing that it dissipates in response to a real-world news treatment constitutes powerful evidence regarding the power of information. Indeed, we will show that learning is particularly dramatic among the subset of women who were exposed to news coverage about the two issues.

Study 3: The Gender Gap and Naturally Occurring Information Treatments

In Study 3 we utilize data from a previously published study (Barabas and Jerit 2010) that examined the effect of a naturally occurring information treatments on the public's knowledge about Medicare and a new citizenship test launched by the U.S. Citizenship and Immigration Service (USCIS). We provide a detailed

²¹ On unemployment the double-digit difference was sizeable at $p = .12$; on Senate control the difference was significant at $p = < .01$. There were no significant differences between men and women in the likelihood of selecting the other treatment topics (p 's range from .39 to .98).

discussion of the research design in the context of the first issue (the Medicare announcement) and then briefly review the design when we present the results for the second issue (the new citizenship test).

In our reanalysis of the Medicare announcement, we focus on 163 individuals (73 women, 90 men) who were interviewed before and after a 2007 government announcement on Medicare as part of panel survey administered by Polimetrix.²² Our interest is the comparison of knowledge among women and men before the announcement (Time 1) and after it (Time 2). In those analyses, we will distinguish men and women based upon their likelihood of being exposed to news coverage about the trust fund. Knowledge was assessed with an item that asked: “According to news reports, both Social Security and Medicare are facing financial problems in the future. If Congress doesn’t take any action, which of these two programs is expected to be the first to not have enough money to cover all benefits—Medicare or Social Security?”²³ The correct answer at the time of the survey was unambiguously Medicare. Following the analytical decisions in the original article, respondents were coded as giving the correct answer (labeled “1”) if they selected Medicare and zero otherwise.

Empirical Results for Study 3

Our primary focus in Study 3 is to illustrate the effects of information provided to men and women in natural settings. To do so, we use a slightly different presentation—focusing on groups of women and men who were “exposed” or “unexposed” to news coverage about the trust fund. Insofar as the provision of information reduces gender-based differences in knowledge, this effect should be *most pronounced* among respondents who are exposed to media coverage containing the key fact on the relative financial health of the two programs.²⁴ Panels A and B of Fig. 5 show the comparison for women and men, respectively, before the announcement (Time 1) and after it (Time 2).

Panel A shows levels of knowledge for exposed women (solid lines) and unexposed women (dashed lines) before and after the trust fund announcement. Learning among women who were exposed to news coverage about the trust funds is substantial, an 11% point increase between T1 and T2. The corresponding

²² Every spring the trustees overseeing Medicare and Social Security release a report outlining the financial trajectory of the programs. In 2007 news coverage of Medicare peaked because the program’s finances (the “trust fund”) had fallen below a specific threshold, triggering a call for legislative action. In the original study, the authors estimated the causal effect of information on knowledge and attitudes (i.e., there were no analyses by gender).

²³ The answer choices provided in random order were “Medicare,” “Social Security,” or “Both programs will exhaust their funds within the same year.”

²⁴ Media exposure was measured with a question that asked, “How have you been getting most of your information about current events?” If respondents replied television, they were asked which channel from a list of network and cable sources. If they replied newspapers, they were asked to indicate which one. The survey data were then paired with media content analyses, such that “exposed” individuals represent people who report using a source that actually provided the exhaustion date information (see Barabas and Jerit 2010 for details).

figure for unexposed women is a 13% point *decrease* in knowledge.²⁵ The resulting difference in difference (for women) is 24% points ($p < .05$), a substantial effect that is broadly consistent with the treatment effects observed for women in the informing experiments. Panel B shows an analogous set of comparisons for male respondents. At Time 1, there is almost no difference in the percent correct between exposed and unexposed men (.01; $p < .96$), while the corresponding difference at Time 2 is larger, but still modest (.03; $p < .79$). The resulting difference in difference is small (4% points) and insignificant.

Comparing Panels A and B, there is a substantial difference between the two DID figures (e.g., the 24-point DID for women versus the 4-point DID for men). While exposed men have higher overall levels of knowledge (.46 and .50) than women (.37 and .48) at both time points, males realize almost no increase in knowledge in comparison to females.²⁶ This differential rate of learning is similar to the patterns observed in Studies 1 and 2 even though considerably more time elapsed between the exposure to information and the measurement of knowledge. As a result, we have greater confidence that the increase in observed levels of knowledge from Studies 1 and 2 reflects genuine learning, rather than an increase in short-term recall.

In our last series of analyses, we examine learning among men and women in response to media coverage of a new citizenship test launched by the USCIS (also reported in Barabas and Jerit 2010).²⁷ These data were collected as part of the 2008 Cooperative Campaign Analysis Project (CCAP) a multi-wave Internet survey administered by YouGov/Polimetrix. Knowledge was assessed with an item that asked, “The U.S. Citizenship and Immigration Services (USCIS) is in charge of the naturalization process and applications to become an American citizen. Did this government agency take any of the following actions recently: Design a new naturalization test for immigrants to become U.S. citizens?” Response options were “Yes” (the correct answer), “No,” and “Don’t Know.” This survey also included a detailed series of questions that allowed us to identify people who were exposed to media coverage about the citizenship test.

As shown in Panel C, learning among high exposure women is substantial: a non-significant difference between exposed and unexposed women grows to nearly 20% points ($p < .01$). The resulting difference-in-difference (for women) is 24% points ($p < .05$). Panel D shows an analogous set of comparisons for male respondents. At both points in time there is an 8% point difference knowledge for exposed and unexposed men. The resulting DID is small (roughly 1% point) and insignificant.²⁸ Like the comparison for Medicare, information take-up among high exposure women is larger, in an absolute sense, than it is for high exposure men. The

²⁵ Both changes are insignificant ($p < .41$ and $p < .21$, respectively), which is likely due to the small size of the subgroups ($n = 27$ and 46, respectively).

²⁶ The difference between the two DIDs is 20 points but it is insignificant ($p < .26$).

²⁷ On October 1, 2008, the USCIS introduced a new version of the test immigrants take to become U.S. citizens. The old test had been widely criticized for being too easy.

²⁸ The difference of these difference-in-differences (DIDID) is 24 points ($p < .07$). Although the CCAP study is based on a panel design, YouGov/Polimetrix added new cases in later waves. This is why, in Fig. 5, the n for Time 2 is larger than the n at Time 1.

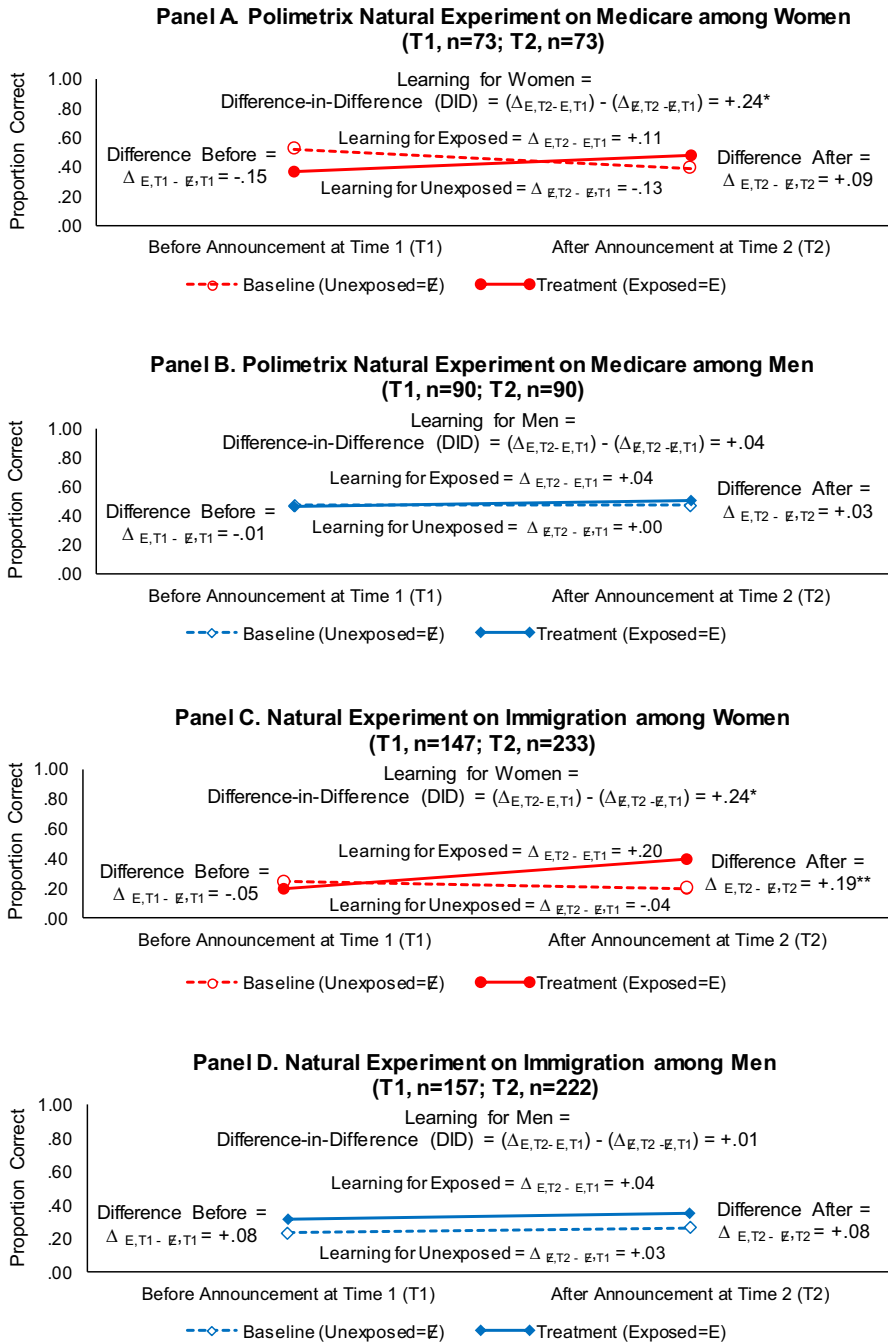


Fig. 5 Natural experiments for medicare and immigration in polimetrix/CCAP. *Note* The differences in levels of knowledge may not reflect the reported change (shown as Δ) due to rounding. ** $p < .01$, * $p < .05$, two-tailed t tests

similarity in the patterns across the informing experiments and the two natural experiments demonstrates that even the most persistent group-based differences in knowledge can be ameliorated when information is broadly available.²⁹

Conclusion

Across three separate empirical studies we found that information, supplied either through the controlled setting of a randomized experiment or a “real-world” news treatment, can reduce or in some cases eliminate the oft-noted male advantage in political knowledge. This is an important finding because it demonstrates that the gender gap in knowledge is *not* immutable, as one might expect based solely upon the political resources possessed by men and women. Similarly, in contrast to the original knowledge gap hypothesis which states that information “infusions” have an uneven effect on learning across groups (Jerit et al. 2006, p. 267; also see Tichenor et al. 1970), there was no evidence that gender differences in knowledge worsened as a result of our treatments. It is encouraging that a phenomenon that has been referred to as “enduring and strong” (Fraile 2014a, p. 262) and “one of the most robust findings in the study of political behavior” (Dow 2009, p. 117) can be so effectively ameliorated across a variety of empirical studies, experimental and naturally occurring.

At the same time, differences in knowledge between men and women are *regularly observed* in opinion data. In the data we report here, there were significant gender gaps in the 2013 survey by Pew Research Center as well as the untreated conditions of our informing experiments. What accounts for this apparent contradiction? One explanation may lie in a “gendered psyche” that ordinarily prevents women from fully engaging in civic life (Lawless and Fox 2010, p. 12; also see Kanthak and Woon 2015), and that may in turn make them less interested in politics even when information is broadly available. Analysis of the news selection items (from Studies 1 and 2) indicates that when women are less interested in a topic (as they were for unemployment and Senate control), information does not eliminate the knowledge gap (see Fig. 2, Panel D and Fig. 4, Panel B). Thus, an important topic for future research has to do with the manner in which politics is covered and whether that presentation is off-putting to women (Bauer et al. 2016; Kahn and Goldenberg 1991; Kahn 1992, 1994). People have a limited attention span for politics (Lupia 2016), but women may be turning away from political news at a rate greater than men because of how it is presented.

It is possible to reduce—and in some cases eliminate—gender-based differences in knowledge. This is a remarkable finding if only because previous researchers have been largely *unable* to make this gap disappear (e.g., Mondak and Anderson 2004, p. 495). It is even more notable that (high exposure) women showed larger

²⁹ Our results are consistent with Ondercin et al. (2011), but the addition of evidence from controlled experiments as well as a natural experiment in which we isolate exposed and unexposed people extends their findings. We also take a different approach to analyzing differential effects and employ an explicit DID test of men versus women rather than a comparison of marginal effects versus the null (see Table 3 in Ondercin et al. 2011).

absolute learning gains than (high exposure) men in response to real-world political events that received substantial news coverage. But there is no simple recipe for increasing the amount of news, on any topic. Complex institutional incentives determine whether a political issue receives media coverage, resulting in an ebb and flow in which some topics receive the lion share of media coverage while others receive none at all (Boydston 2013). This underscores the importance of understanding the conditions under which men and women reap equal gains in political knowledge (e.g., the qualitative features of news coverage that foster interest and learning). This may be among the more challenging questions that face future researchers, but it also may be one of the most important. Systematic differences in any political resource—knowledge or otherwise—are a cause for concern and merit sustained investigation.

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