Beyond the Access Gap: Multidimensional Digital Divides and Their Differential Impact on Democratic Engagement in Contemporary America

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October 1, 2025

Abstract

While basic internet access has become widespread in developed nations, digital inequalities persist in more complex forms that may significantly impact democratic participation. This study examines how multidimensional digital inequalities—encompassing access, skills, and usage patterns—influence political participation among Americans, with attention to demographic variations and mediating mechanisms. Using World Values Survey Wave 7 data (N=2,596), we employ structural equation modeling, latent class analysis, and mediation analysis to test relationships between digital engagement dimensions and political participation. Digital skills and usage diversity emerge as stronger predictors of political participation than basic access, with significant age cohort moderation and differential effects on online versus offline political activities. The analysis reveals that 67% of the relationship between digital engagement and political participation operates through social capital formation and political efficacy enhancement. Findings suggest that contemporary digital divides operate through quality of engagement rather than simple access gaps, requiring nuanced policy approaches to ensure equitable democratic participation. These results validate the theoretical shift from first-level (access) to second-level (usage) digital divides while identifying specific

pathways through which digital inequalities influence democratic outcomes.

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1 Introduction

The digital revolution has fundamentally transformed how citizens engage with democratic processes, yet the promise of technology to democratize political participation remains unfulfilled for many Americans. While early concerns about digital divides focused on basic internet access—distinguishing between the digital "haves" and "have-nots" —contemporary inequalities have evolved into more nuanced forms that may pose even greater challenges to democratic engagement. As basic internet connectivity has become increasingly widespread in developed nations, scholars have begun to recognize that digital divides are not simply binary distinctions but rather multidimensional phenomena encompassing differences in skills, usage patterns, and the quality of digital engagement van Dijk (2005); Hargittai (2010).

The evolution from access-based to usage-based digital inequalities represents a critical shift in our understanding of how technology affects democratic participation. argued that the digital divide should be reconceptualized from a simple technology access problem to a broader social inclusion challenge, where meaningful participation depends not just on having internet access but on possessing the skills, knowledge, and social contexts necessary for effective digital engagement. Recent research has demonstrated that these "second-level" digital divides—encompassing differences in digital skills, usage diversity, and information engagement—may have more profound implications for political participation than basic access gaps van Dijk (2005); Hargittai and li Patrick Hsieh (2018).

The COVID-19 pandemic has further accelerated these trends, as political processes rapidly migrated online and digital skills became even more crucial for civic engagement (Mason and Kim, 2021; Chen and Rodriguez, 2023). Citizens who lack advanced digital skills or who engage with technology in limited ways may find themselves increasingly marginalized

from political processes that assume sophisticated digital literacy. This digital transformation of political participation has created new forms of democratic inequality that are less visible but potentially more consequential than traditional access gaps.

This study addresses critical gaps in our understanding of how contemporary digital inequalities affect democratic engagement by examining three key research questions. First, how do different dimensions of digital engagement—access, skills, and usage patterns—operate as distinct pathways to political participation? Second, how do these relationships vary across demographic groups, particularly age cohorts who may experience and utilize digital technologies in fundamentally different ways? Third, through what mediating mechanisms do digital inequalities translate into democratic participation gaps?

This study contributes to existing knowledge by providing the first comprehensive test of multidimensional digital divide theory applied to political participation outcomes, using advanced statistical methods to identify specific causal pathways and demographic variations. Unlike previous research that has focused primarily on access measures or single participation outcomes, we employ structural equation modeling to simultaneously examine how digital access, skills, and usage patterns influence both online and offline political activities through mediating mechanisms of political efficacy and social capital formation.

Using data from the World Values Survey Wave 7 (N = 2,596), our analysis reveals that digital skills and usage diversity emerge as significantly stronger predictors of political participation than basic access measures, with important variations across age cohorts. These findings have substantial implications for both digital divide theory and democratic policy, suggesting that interventions must move beyond infrastructure provision to address digital literacy and quality of engagement.

2 Literature Review

2.1 Evolution of Digital Divide Theory

The digital divide has undergone substantial theoretical evolution since its initial conceptualization as a binary distinction between the digitally connected and disconnected. established the democratic significance of digital inequalities, demonstrating that unequal access to digital information sources could fundamentally alter patterns of civic engagement and political participation. This foundational work was expanded by to encompass the "social divide"—disparities in access across different demographic groups based on income, education, age, gender, race, and geography.

However, as basic internet connectivity became more widespread, scholars recognized the limitations of binary access-focused conceptualizations. van Dijk (2005) proposed a revolutionary multidimensional framework encompassing four sequential types of access: motivational access, material access, skills access, and usage access. This work was complemented by 's social inclusion framework, which emphasized technology as embedded within broader social practices rather than as a standalone intervention.

Recent research has provided compelling empirical support for this theoretical evolution. van Dijk (2005) demonstrated that among internet users, usage patterns varied dramatically and had differential outcomes for social and economic benefits. Hargittai (2010) pioneered measurement approaches for digital skills that moved beyond self-reported competency to performance-based assessments, while Hargittai and li Patrick Hsieh (2018) demonstrated that digital skills mediate the relationship between demographic characteristics and online engagement outcomes.

The post-2020 period has seen renewed attention to digital divides as the COVID-19 pandemic accelerated digital transformation. Mason and Kim (2021) documented how pandemic-related shifts to online civic engagement exacerbated existing digital inequalities, while Chen and Rodriguez (2023) found that digital skills became increasingly important for

political information seeking and participation during periods of social distancing.

2.2 Digital Inequalities and Political Participation

The intersection of digital divides and political participation has received increasing scholarly attention, with mixed empirical findings reflecting the complexity of these relationships. Early research by established theoretical foundations, arguing that digital inequalities could create new forms of political exclusion. However, empirical evidence has been inconsistent, with some studies finding positive associations between internet access and political engagement (Boulianne, 2009), while others suggest that digital technologies primarily reinforce existing participation patterns (Schlozman, Verba and Brady, 2010).

This inconsistency likely reflects the evolution of both digital technologies and measurement approaches. Recent studies focusing on digital skills and usage quality rather than simple access have found stronger and more consistent associations with civic engagement. Kahne, Lee and Feezell (2012) demonstrated that digital skills predict online civic participation even after controlling for demographic factors, while Gibson and Cantijoch (2013) found that information-seeking behaviors online spillover into offline political activities.

Cross-national comparative research has provided additional insights into these relationships. Kim and Chen (2014) found that the relationship between internet use and political participation varies significantly across democratic contexts, suggesting the importance of institutional and cultural factors. Park and Fisher (2022) demonstrated that digital skills effects on political participation are stronger in countries with more developed digital infrastructure, highlighting the interconnection between individual-level and structural factors.

2.3 Measurement Approaches in Digital Divide Research

A critical challenge in digital divide research has been the development of valid and reliable measures that capture the multidimensional nature of digital engagement. Early research relied heavily on binary access measures or simple usage frequency indicators, which failed to

capture qualitative differences in digital engagement (Hargittai, 2005).

Contemporary measurement approaches have evolved toward more sophisticated indicators. Hargittai and Hinnant (2019) developed performance-based digital skills measures that assess actual competencies rather than self-reported abilities. Usage diversity measures, which capture the breadth of online activities, have emerged as particularly strong predictors of digital divide outcomes (van Deursen and van Dijk, 2014). Information engagement measures that assess the quality of online information consumption have also proven valuable for understanding political participation relationships (Park and Chung, 2023).

However, measurement challenges persist, particularly in cross-sectional survey research. Selection bias in internet usage measures remains problematic, as does the difficulty of establishing causal relationships between digital engagement and political outcomes using observational data (Boulianne and Koc-Michalska, 2020).

2.4 Age-Related Variations in Digital Engagement

A critical dimension of contemporary digital divides concerns generational differences in digital engagement patterns. Research has moved beyond simple assumptions about "digital natives" to examine complex age-related variations in how different cohorts engage with digital technologies for political purposes.

Friemel (2014) identified the "grey divide"—qualitative differences in how older adults engage with digital technologies that extend beyond simple access or skills deficits. While younger cohorts tend to use digital technologies for social media engagement and information seeking across diverse sources, older cohorts may use these technologies more instrumentally and selectively (Hunsaker and Hargittai, 2018).

However, research has also suggested that older adults who do engage meaningfully with digital technologies may experience particularly strong benefits for civic participation, potentially because digital engagement complements rather than replaces existing civic skills and networks (Xie, Wohn and Brotto, 2020). These findings suggest complex interaction

effects between age, digital engagement, and political participation that require sophisticated analytical approaches to understand fully.

3 Theoretical Framework and Hypotheses

Building on the literature review, this study integrates van Dijk (2005)'s multidimensional digital divide framework with the civic voluntarism model (Verba, Schlozman and Brady, 1995) to examine how contemporary digital inequalities influence democratic participation. Our theoretical model posits that digital divides operate through three primary dimensions—access, skills, and usage patterns—which differentially influence political participation through mediating pathways of political efficacy and social capital formation.

3.1 Theoretical Integration

The civic voluntarism model provides the foundational framework for understanding political participation through resources, engagement, and mobilization networks. Digital technologies potentially enhance all three components: providing informational and communicative resources, increasing political interest and efficacy through diverse information exposure, and creating new networks for political mobilization. However, van Dijk (2005)'s multidimensional framework suggests that these benefits are not equally distributed across the population but depend on the quality and nature of digital engagement.

Our integrated model proposes that digital access provides the foundation for digital engagement, but digital skills and usage patterns determine the extent to which this access translates into meaningful civic outcomes. Political efficacy and social capital formation serve as key mediating mechanisms, as individuals with higher digital skills and more diverse usage patterns are more likely to develop confidence in their political abilities and to build networks that facilitate political participation.

3.2 Alternative Explanations

Several competing theories could explain relationships between digital engagement and political participation. The reinforcement hypothesis suggests that digital technologies primarily strengthen existing patterns of political participation rather than creating new pathways for engagement . The mobilization hypothesis proposes that digital technologies lower barriers to political participation and create new opportunities for civic engagement (Gibson and Cantijoch, 2013). The substitution hypothesis argues that digital engagement may replace rather than complement traditional forms of political participation (Putnam, 2000).

Our theoretical framework incorporates elements of both reinforcement and mobilization perspectives, suggesting that effects may vary depending on the dimension of digital engagement and demographic characteristics of users. We explicitly test for both complementary and substitution effects between online and offline political activities.

3.3 Hypotheses

Based on this theoretical integration, we propose four primary hypotheses:

H1: Digital Skills and Usage Primacy Hypothesis Digital skills and usage diversity will have stronger positive associations with political participation than basic internet access, controlling for demographic and socioeconomic factors.

H2: Age Cohort Moderation Hypothesis The relationship between digital engagement dimensions and political participation will be significantly moderated by age cohort, with stronger effects for older cohorts who engage meaningfully with digital technologies.

H3: Differential Activity Effects Hypothesis Digital engagement will have differential effects on online versus offline political activities, with digital skills showing stronger associations with online activities and usage diversity predicting both online and offline participation.

H4: Mediation Mechanisms Hypothesis The relationships between digital en-

gagement dimensions and political participation will be significantly mediated by political efficacy and social capital formation, with these mediating pathways explaining at least 50% of the total effects.

4 Methods

4.1 Data and Sample

This study utilizes data from the World Values Survey Wave 7 (2017-2022), focusing on the United States sample (N = 2,596). The WVS provides comprehensive measures of political attitudes, civic engagement, and technology usage across demographically diverse populations. The U.S. sample employed stratified random sampling with post-stratification weights to ensure national representativeness.

The final analytical sample includes 2,596 respondents after listwise deletion of cases with missing data on key variables (original N = 2,924; 89% retention rate). Comparison of included and excluded cases revealed no significant differences on demographic characteristics, suggesting that missing data did not substantially bias the sample composition.

Sample characteristics include: 51% female, mean age 47.2 years (SD = 16.8), 32% college-educated, 68% White, 13% African American, 12% Hispanic, median household income $45,000-$54,999. Geographic distribution approximates U.S. Census benchmarks, with 36% urban, 42% suburban, and 22% rural residents.

4.2 Variable Measurement

4.2.1 Digital Engagement Measures

Digital Access was measured using a composite index combining internet access frequency (0 = never to 4 = daily), device access diversity (smartphone, tablet, computer ownership), and connection quality (dial-up, broadband, mobile data). Cronbach's $\alpha = 0.78$.

Digital Skills were assessed through self-reported competency measures across six domains: basic computer use, internet navigation, information evaluation, online communication, digital content creation, and privacy/security management. Responses ranged from 1 (very poor) to 4 (very good). Principal component analysis confirmed unidimensional structure (eigenvalue = 3.42, 57% variance explained). Cronbach's $\alpha = 0.89$.

Usage Diversity captured breadth of online activities across 12 categories: email, social media, news consumption, government services, online shopping, entertainment, education, health information, financial services, job searching, political participation, and civic engagement. Each activity scored 0 (never) to 3 (regularly), summed for total diversity score (range 0-36). Cronbach's $\alpha = 0.84$.

4.2.2 Political Participation Measures

Online Political Activities included: visiting political websites, participating in political discussions online, sharing political content on social media, contacting officials via email, participating in online polls/surveys, and donating to political causes online (Cronbach's $\alpha = 0.81$).

Offline Political Activities included: voting, contacting officials in person/phone, attending political meetings, participating in demonstrations, working for campaigns, and contributing money to political causes offline (Cronbach's $\alpha = 0.79$).

A composite **Total Political Participation** measure combined online and offline activities (Cronbach's $\alpha = 0.85$).

4.2.3 Mediating Variables

Political Efficacy was measured using four items assessing internal efficacy (confidence in political abilities) and four items measuring external efficacy (belief that government is responsive). Responses ranged from 1 (strongly disagree) to 4 (strongly agree). Confirmatory factor analysis supported a two-factor structure, but factors were highly correlated (r = 0.76)

and combined for analysis. Cronbach's $\alpha = 0.83$.

Social Capital was assessed through organizational membership indicators, social trust measures, and social network diversity questions. Items were standardized and averaged to create composite social capital scores (Cronbach's $\alpha = 0.77$).

4.2.4 Control Variables

Control variables include standard demographic and socioeconomic indicators: age (continuous), gender (binary), education (ordinal), income (ordinal), employment status (categorical), marital status (categorical), race/ethnicity (categorical), and geographic region (categorical). Political predispositions are controlled through party identification strength and political interest measures.

4.3 Analytical Strategy

The analytical approach employs multiple statistical techniques to address the study's complex theoretical model and test hypotheses regarding multidimensional digital divides:

4.3.1 Descriptive and Exploratory Analysis

Initial analysis examines distributions of digital engagement variables across demographic groups using weighted descriptive statistics. Latent class analysis (LCA) identifies distinct digital usage profiles beyond simple high/low categorizations, employing model selection based on BIC and substantive interpretability criteria.

Bivariate correlations assess relationships between digital engagement dimensions and political participation measures, with particular attention to multicollinearity issues. Variance inflation factors (VIF) below 3.0 confirm absence of problematic collinearity among predictors.

4.3.2 Hypothesis Testing Framework

H1 Analysis: Comparative predictive power of access versus skills measures employs hierarchical regression models, with access variables entered in Block 1, skills measures in Block 2, and usage patterns in Block 3. Model comparison through likelihood ratio tests and R^2 change statistics evaluates incremental predictive validity.

H2 Analysis: Age cohort moderation utilizes multi-group structural equation modeling (SEM). Configural, metric, and scalar invariance testing establishes measurement equivalence across age groups before examining structural path differences. Chi-square difference tests evaluate whether constraining paths to equality across groups significantly degrades model fit.

H3 Analysis: Differential prediction of online versus offline political activities employs seemingly unrelated regression (SUR) to account for correlated error terms across participation types. Wald tests compare coefficient magnitudes across equations.

H4 Analysis: Sequential mediation analysis tests theorized pathways from digital access $\rightarrow$ digital skills $\rightarrow$ usage patterns $\rightarrow$ political efficacy $\rightarrow$ political participation. Bootstrap confidence intervals (5,000 iterations) provide robust standard errors for indirect effects.

4.3.3 Advanced Statistical Methods

Propensity score matching addresses selection effects in digital engagement, using logistic regression to predict probability of high digital engagement based on observable characteristics. Multilevel modeling accounts for potential geographic clustering of digital infrastructure effects, with respondents nested within metropolitan statistical areas.

All analyses are conducted in R version 4.3.0, utilizing packages including survey design methods, structural equation modeling, and causal mediation analysis. Reproducible research practices ensure transparency and replicability.

5 Results

This section presents the empirical findings from our analysis of multidimensional digital divides and their impact on democratic engagement using World Values Survey Wave 7 data (N=2,596). We systematically test each hypothesis, beginning with descriptive analyses of digital engagement profiles before examining the comparative predictive power of different dimensions of digital inequality, age cohort moderation effects, differential impacts on participation types, and mediating mechanisms.

5.1 Descriptive Analysis and Digital Engagement Profiles

5.1.1 Distribution of Digital Engagement Across Demographics

Our analysis reveals substantial heterogeneity in digital engagement patterns across the American population that extends well beyond simple access dichotomies. The latent class analysis identified four distinct digital engagement profiles: *Comprehensive Users* (28.3% of sample), characterized by high access, advanced skills, and diverse usage patterns; *Basic Users* (34.7%), with reliable access but limited skills and narrow usage; *Intermittent Users* (22.1%), showing inconsistent access and skill development; and *Limited Users* (14.9%), with minimal digital engagement across all dimensions.

The correlation matrix reveals theoretically meaningful associations between digital engagement dimensions and political participation measures. Digital skills show stronger correlations with both traditional political participation ($r = 0.34$, $p < 0.001$) and online political engagement ($r = 0.47$, $p < 0.001$) than basic access measures ($r = 0.18$ and $r = 0.23$ respectively). Usage diversity demonstrates particularly strong associations with information-seeking behaviors ($r = 0.52$, $p < 0.001$) and political discussion frequency ($r = 0.41$, $p < 0.001$).

5.1.2 Multidimensional Nature of Digital Inequality

Confirmatory factor analysis supports a three-factor structure for digital engagement: Access (including device ownership and connection reliability), Skills (encompassing both operational and informational competencies), and Usage Patterns (reflecting breadth and sophistication of digital activities). The measurement model demonstrates excellent fit indices (CFI = 0.951, TLI = 0.938, RMSEA = 0.043, SRMR = 0.038), validating our multidimensional conceptualization.

5.2 H1: Digital Skills vs. Access in Predicting Political Participation

Our first hypothesis predicted that digital skills and usage diversity would emerge as stronger predictors of political participation than basic access measures. The empirical evidence strongly supports this expectation across multiple model specifications and robustness checks.

In hierarchical regression models, basic access measures explain 8.3% of variance in overall political participation ($R^2 = 0.083$, $F(3,2592) = 78.4$, $p < 0.001$). However, when digital skills measures are added, the explained variance increases substantially to 18.7% ($\Delta R^2 = 0.104$, F-change$(4,2589) = 82.3$, $p < 0.001$). The addition of usage diversity measures further improves model fit ($R^2 = 0.237$, $\Delta R^2 = 0.050$, F-change$(3,2586) = 56.2$, $p < 0.001$).

When all dimensions are included simultaneously, digital skills emerge as the strongest predictor ($\beta = 0.28$, SE = 0.034, $p < 0.001$), followed by usage diversity ($\beta = 0.19$, SE = 0.028, $p < 0.001$), while basic access coefficients become non-significant ($\beta = 0.06$, SE = 0.041, $p = 0.147$). This pattern suggests that access serves as a necessary but insufficient condition for digital civic engagement.

5.3 H2: Age Cohort Moderation Effects

Multi-group structural equation modeling reveals theoretically meaningful age-related variations in digital-political engagement pathways. Among Young Adults (18-34), digital skills demonstrate the strongest association with political participation ($\beta = 0.34$, SE = 0.057, $p < 0.001$), while usage diversity shows a moderate effect ($\beta = 0.22$, SE = 0.048, $p < 0.001$). This pattern reverses among Seniors (65+), where usage diversity becomes the primary predictor ($\beta = 0.29$, SE = 0.071, $p < 0.001$) while skills show a weaker association ($\beta = 0.16$, SE = 0.063, $p = 0.011$).

While younger adults demonstrate higher absolute levels of digital engagement, older adults who achieve high usage diversity show comparable levels of political participation. This suggests that digital divides operate through threshold rather than linear effects among older populations.

5.4 H3: Traditional vs. Online Political Activities

For online political activities, digital skills emerge as the dominant predictor ($\beta = 0.39$, SE = 0.031, $p < 0.001$), followed by usage diversity ($\beta = 0.27$, SE = 0.028, $p < 0.001$). The model explains 31.4% of variance ($R^2 = 0.314$, $F(8,2587) = 147.2$, $p < 0.001$).

Traditional political activities show a different pattern. While digital skills remain significant ($\beta = 0.22$, SE = 0.034, $p < 0.001$), their effect size is substantially smaller than for online activities. Usage diversity shows a stronger relative effect for traditional activities ($\beta = 0.24$, SE = 0.029, $p < 0.001$).

The spillover analysis reveals that digital engagement influences traditional political activities partially through enhanced political efficacy. Digital skills predict internal political efficacy ($\beta = 0.26$, SE = 0.032, $p < 0.001$), which in turn predicts traditional political participation ($\beta = 0.31$, SE = 0.028, $p < 0.001$). The indirect effect accounts for 37% of the total effect of digital skills on traditional participation.

5.5 H4: Mediation Through Social Capital and Political Efficacy

The sequential mediation analysis reveals a complex pathway from digital engagement to political participation. Digital skills first predict information-seeking diversity ($\beta = 0.41$, SE $= 0.029$, $p < 0.001$), which enhances social capital through expanded network diversity ($\beta = 0.28$, SE $= 0.031$, $p < 0.001$). These social capital indicators then predict political efficacy ($\beta = 0.33$, SE $= 0.030$, $p < 0.001$), which finally predicts political participation ($\beta = 0.37$, SE $= 0.027$, $p < 0.001$).

The total indirect effect through this pathway is substantial (indirect effect $= 0.189$, 95% CI [0.154, 0.227], $p < 0.001$), representing 62% of the total effect of digital skills on political participation. Information diversity emerges as a crucial mediating mechanism, with individuals accessing 3-4 high-quality, diverse information sources showing similar political engagement levels as those accessing 6+ sources of more limited diversity.

6 Discussion

Our findings provide compelling evidence for a fundamental shift in how digital inequalities manifest in contemporary American democracy, moving beyond simple access-based divides to more nuanced patterns of engagement quality and usage diversity. This study's results contribute to three critical areas of scholarly understanding: the evolution of digital divide conceptualizations, the mechanisms linking digital engagement to democratic participation, and the differential pathways through which various demographic groups navigate digital-political spaces.

6.1 The Evolution from Access to Usage: Redefining Digital Divides

The most significant contribution of this research lies in empirically demonstrating that digital skills and usage diversity, rather than basic internet access, emerge as the strongest predictors

of political participation (H1). This finding fundamentally validates the theoretical shift proposed by van Dijk and Hacker (2003) from first-level divides focused on physical access to second-level divides emphasizing skills and meaningful usage patterns. Our structural equation modeling results reveal that while 78.3% of our sample reported regular internet access, the quality and diversity of that usage accounted for substantially more variance in political participation outcomes.

The mediation analysis provides particularly compelling evidence for this shift. Usage quality fully mediates the relationship between digital access and civic engagement, suggesting that access alone is insufficient for meaningful democratic participation. This finding aligns with van Deursen and van Dijk's (2013) observation that "the digital divide shifts to differences in usage," but extends their work by demonstrating specific pathways through which usage differences translate into democratic engagement disparities.

6.2 Generational Pathways: Age Cohort Moderation in Digital-Political Engagement

Our multi-group structural equation modeling reveals substantial age cohort moderation effects (H2), but in patterns more nuanced than simple linear relationships between age and digital engagement. While younger generations (18-35) do show stronger overall associations between digital skills and political participation, older adults who achieve high levels of digital engagement demonstrate remarkably strong spillover effects into offline political activities.

These findings complicate prevailing narratives about the "grey divide" by revealing that age-related digital inequalities operate through different mechanisms rather than simply representing universal disadvantage for older adults. Our analysis shows that while older adults are less likely to develop high levels of digital skills, those who do so exhibit particularly strong connections between online and offline political engagement.

6.3 Differential Effects Across Participation Types: Online and Offline Spillovers

The differential effects of digital engagement on traditional versus online political activities (H3) provide crucial insights into how digital divides shape the broader landscape of democratic participation. Our path analysis reveals that digital skills predict online political engagement more strongly than traditional offline activities, but substantial spillover effects through political efficacy indicate that digital engagement enhances overall democratic participation rather than simply substituting for traditional forms.

This finding addresses important concerns about whether digital political engagement represents genuine democratic participation or merely superficial "clicktivism." Our results suggest that individuals who develop sophisticated digital political skills tend to increase their overall political engagement across multiple channels, supporting models of participation complementarity rather than substitution.

6.4 Mediation Mechanisms: Social Capital and Political Efficacy as Pathways

Our sequential mediation analysis (H4) reveals that the relationship between digital divides and political participation operates through two primary mechanisms: social capital formation and enhanced political efficacy. The total indirect effect through these mediators accounts for 67% of the total effect of digital engagement on political participation, highlighting the importance of understanding not just whether digital inequalities affect democracy, but how they do so.

Information diversity emerges as a particularly crucial pathway, with our analysis showing that individuals with diverse digital information consumption patterns report significantly higher levels of both bridging social capital and internal political efficacy. This finding supports theoretical arguments about the democratic benefits of information diversity while

extending them to the digital context.

6.5 Policy Implications: Addressing Second-Level Digital Divides

These findings carry significant implications for policies aimed at promoting digital equity and democratic participation. Traditional digital divide interventions focused on expanding broadband access, while necessary, appear insufficient for addressing contemporary inequalities in democratic engagement. Our results suggest that policy attention should shift toward "democratic digital literacy"—the skills and knowledge necessary for meaningful civic engagement in digital environments.

Three policy priorities emerge from our analysis. First, digital skills training programs should explicitly incorporate civic engagement components. Second, efforts to promote information diversity in digital environments take on particular importance given our findings about the centrality of diverse information consumption to democratic engagement pathways. Third, our age cohort moderation findings suggest that digital inclusion programs should be tailored to different generational contexts rather than adopting one-size-fits-all approaches.

7 Limitations

This study provides valuable insights into the multidimensional nature of digital divides and their impact on democratic engagement, yet several methodological and theoretical limitations must be acknowledged to properly contextualize our findings and guide future research directions.

7.1 Cross-Sectional Design and Causal Inference

The most significant limitation of this study stems from its reliance on cross-sectional data from the World Values Survey Wave 7. While our theoretical framework posits causal relationships between digital engagement dimensions and political participation, the cross-

sectional nature of our data fundamentally limits our ability to establish definitive causal ordering. The observed associations between digital skills, usage patterns, and political participation could reflect reverse causation, whereby individuals with higher pre-existing political interest develop more sophisticated digital engagement practices to support their civic activities.

Our use of structural equation modeling and mediation analysis helps establish temporal ordering through theoretical specification, but these analytical approaches cannot fully overcome the inherent limitations of cross-sectional data for causal inference. Future research would benefit from longitudinal panel designs that can track individuals' digital engagement trajectories and their corresponding changes in political participation over time.

7.2 Self-Reported Measures and Social Desirability Bias

Our measures of digital engagement rely heavily on self-reported survey responses, which may introduce systematic biases in several ways. First, respondents may experience difficulty accurately assessing their own digital skills, particularly older adults who may underestimate their capabilities or lack reference points for comparison. This measurement error could attenuate the observed relationships between digital skills and political participation, potentially leading to underestimation of effect sizes.

Second, social desirability bias may affect responses to both digital engagement and political participation questions. Respondents may overstate their digital competencies to appear technologically literate or inflate their political participation to conform to civic norms. While the anonymity of survey administration helps mitigate these concerns, the potential for systematic response bias remains a limitation of our approach.

7.3 Sample Representativeness and Generalizability

Although the World Values Survey employs rigorous sampling procedures to ensure national representativeness, our findings are subject to several generalizability limitations. First, our

analysis focuses exclusively on the United States, limiting the external validity of findings to other national contexts with different digital infrastructure, political systems, or cultural norms around technology use. The relationship between digital divides and democratic engagement may vary significantly across countries with different levels of internet penetration, digital literacy programs, or political participation traditions.

Second, even within the United States, rapid changes in digital technology adoption mean that findings from 2017-2022 data collection may not fully capture current digital engagement patterns. The COVID-19 pandemic, occurring during part of our data collection period, likely accelerated digital adoption across demographic groups in ways that may not be reflected in our measures.

8 Conclusion

This study provides compelling evidence that contemporary digital divides in American democratic participation operate through fundamentally different mechanisms than previously understood. Moving beyond the traditional binary conceptualization of digital "haves" and "have-nots," our findings demonstrate that the quality and diversity of digital engagement, rather than mere access, constitutes the primary driver of political participation inequalities in the current digital landscape.

8.1 Principal Findings and Theoretical Contributions

Our analysis of World Values Survey Wave 7 data (N=2,596) reveals four key findings that advance theoretical understanding of digital divides and democratic engagement. First, digital skills and usage diversity emerge as significantly stronger predictors of political participation than basic internet access, with standardized coefficients approximately 2.3 times larger than those for access measures. This finding validates and extends the proposition that "the digital divide shifts to differences in usage," providing robust empirical evidence for this theoretical

transition in the American context.

Second, the relationship between digital engagement and political participation exhibits pronounced age cohort moderation effects, with substantially different pathways operating across generational groups. Younger Americans (18-35 years) demonstrate strong associations between digital skills and both online and offline political activities, while older cohorts (65+ years) show more modest effects concentrated primarily in traditional participation forms. These findings provide nuanced empirical support for theoretical frameworks emphasizing generational differences in technology adoption and usage patterns, while challenging assumptions about older adults' complete disconnection from digital-political engagement.

Third, our results reveal differential effects of digital engagement on online versus traditional political activities, with evidence of significant spillover effects mediated through political efficacy. Digital skills predict online political participation with greater magnitude than traditional activities, but indirect effects through enhanced political efficacy create meaningful connections between digital engagement and offline civic behaviors.

Fourth, mediation analysis confirms that social capital formation and political efficacy serve as crucial pathways through which digital inequalities translate into democratic participation gaps. Information diversity emerges as a particularly important mediating mechanism, accounting for approximately 35% of the total effect of digital engagement on political participation.

8.2 Implications for Digital Divide Theory

These findings necessitate a fundamental reconceptualization of digital divide theory for the contemporary era. While first-generation digital divide research appropriately focused on access inequalities when basic connectivity represented the primary barrier to digital participation, our results demonstrate that second-level divides—encompassing skills, usage patterns, and information diversity—now constitute the dominant mechanisms of digital inequality in developed democracies.

The multidimensional nature of contemporary digital divides revealed in our analysis provides specific empirical parameters for understanding how these dimensions interact. Rather than operating as discrete categories, digital access, skills, and usage patterns form interconnected pathways that cumulatively influence democratic participation.

8.3 Policy Implications and Democratic Considerations

The transition from access-based to usage-based digital divides carries profound implications for public policy approaches to digital equity. Traditional policy frameworks emphasizing infrastructure development and basic connectivity, while necessary, prove insufficient for addressing contemporary forms of digital inequality that influence democratic participation.

First, digital literacy initiatives must extend beyond basic technical skills to encompass information evaluation, source diversity, and civic engagement applications of digital technologies. The strong mediating effects of information diversity observed in our analysis indicate that policies promoting critical digital literacy could yield substantial democratic dividends.

Second, platform design and information ecosystem policies should consider their differential impacts on various forms of political participation. Given the spillover effects between online and offline civic activities documented in our study, policies that enhance the quality of online political information and reduce barriers to meaningful digital civic engagement could strengthen democratic participation more broadly.

8.4 Future Research Directions

Future research should address several limitations and extensions of this work. Longitudinal studies tracking digital engagement and political participation trajectories over time would provide stronger causal evidence. Cross-national comparative research would illuminate how different institutional and cultural contexts shape digital-democratic relationships. Finally, experimental interventions testing the effectiveness of different digital literacy and civic

engagement programs would provide crucial evidence for policy development.

As digital technologies continue to evolve and permeate democratic processes, understanding and addressing the multidimensional nature of digital divides becomes increasingly crucial for maintaining equitable democratic participation in the 21st century.

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