Digital Democracy Divide: How Technology Attitudes Shape Democratic Engagement and Trust in Contemporary America

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Abstract

The digital transformation of democratic processes has created new dimensions of civic inequality extending beyond traditional access-based digital divides. This study examines how Americans' attitudes toward science and technology predict democratic participation and institutional trust, investigating whether these relationships operate through digital citizenship capabilities and vary across generational and socioeconomic lines. Using structural equation modeling with World Values Survey Wave 7 data from 2,596 American respondents (2017-2022), we develop and test a comprehensive theoretical framework integrating postmaterialist theory with digital citizenship theory and the civic voluntarism model. The study investigates six primary hypotheses examining direct effects of technology attitudes on democratic engagement, mediation through digital citizenship capabilities, and moderation by postmaterialist values, generational cohorts, and socioeconomic status. These analyses advance our understanding of how psychological orientations toward technology create new pathways to civic participation while potentially exacerbating existing democratic inequalities. The findings have significant implications for digital democracy initiatives and democratic inclusion in the digital age.

1 Introduction

The digital transformation of democratic processes has fundamentally altered how citizens engage with political institutions, participate in civic life, and consume political information. As governments increasingly digitize public services, conduct online consultations, and utilize social media for citizen engagement, the relationship between technology and democratic participation has become a critical concern for both scholars and policymakers Howard (2006). However, despite widespread recognition that digital divides can undermine democratic equality, existing research has predominantly focused on access-based barriers while overlooking

the psychological and attitudinal dimensions that shape how individuals relate to technology in democratic contexts.

Traditional conceptualizations of the digital divide have emphasized material constraints—internet access, device ownership, and basic digital literacy—as the primary barriers to democratic participation in the digital age Mossberger, Tolbert and McNeal (2008). While these access-based factors remain important, this narrow focus has obscured more nuanced psychological processes that influence how citizens perceive, adopt, and utilize technology for democratic engagement. Contemporary Americans exhibit considerable variation in their attitudes toward science and technology, ranging from enthusiastic embrace to skeptical resistance, yet we know surprisingly little about how these attitudual differences translate into patterns of democratic participation and institutional trust.

The emergence of what terms "communicative entitlements"—the fundamental capacity to participate meaningfully in democratic discourse—increasingly depends not merely on having access to digital tools, but on possessing positive attitudes toward technology that facilitate effective utilization of these tools for civic purposes. This shift from access to attitudes represents a critical evolution in digital divide research, suggesting that psychological orientations toward technology may be as consequential as material resources in shaping democratic outcomes. Furthermore, the integration of technology into democratic processes occurs within a broader context of changing value systems, generational transitions, and evolving information consumption patterns that collectively reshape the landscape of political participation (Inglehart and Welzel, 2005; Zukin et al., 2006).

Building on postmaterialist theory (Inglehart and Welzel, 2005), digital citizenship frameworks (Mossberger, Tolbert and McNeal, 2008), and the civic voluntarism model (Verba, Schlozman and Brady, 1995), this study examines how Americans' attitudes toward science and technology predict their democratic participation, institutional trust, and perceptions of democratic governance quality. We theorize that technology attitudes operate through complex mediated pathways involving digital citizenship capabilities—encompassing digital skills, access patterns, and usage behaviors—while being moderated by postmaterialist values and generational differences. This theoretical integration addresses a significant gap in existing literature by moving beyond simple access-based models to examine the psychological mechanisms through which technology attitudes influence democratic engagement.

1.1 Research Objectives and Hypotheses

This study addresses a fundamental question in contemporary democratic theory: How do individual attitudes toward science and technology influence democratic participation and institutional trust in the digital age? We develop and test six interrelated hypotheses that collectively examine direct effects, mediation mechanisms, and moderating conditions:

H1 (Direct Effects): Positive attitudes toward science and technology directly predict

higher levels of democratic participation and institutional trust, controlling for traditional predictors of civic engagement including education, income, age, and political interest.

H2 (Mediation): The relationship between technology attitudes and democratic outcomes is partially mediated by digital citizenship capabilities, including digital skills, internet usage patterns, and online civic engagement behaviors.

H3 (Postmaterialist Moderation): The effects of technology attitudes on democratic participation are stronger among individuals with postmaterialist value orientations compared to those with materialist orientations, reflecting postmaterialists' greater emphasis on self-expression and democratic participation.

H4 (Generational Moderation): Technology attitudes have stronger effects on democratic engagement among digital natives (born after 1980) compared to pre-digital cohorts, due to differences in technological socialization and comfort with digital civic engagement tools.

H5 (Information Mediation): Technology attitudes influence institutional trust through diverse digital information consumption patterns, with positive technology attitudes predicting greater use of varied online information sources and subsequently higher institutional trust.

H6 (Socioeconomic Conditioning): The democratic benefits of positive technology attitudes are conditioned by socioeconomic status, with stronger effects among higher-SES individuals who possess complementary resources to translate attitudes into civic action.

Our analysis utilizes data from the World Values Survey Wave 7 (2017-2022) United States sample (N=2,596) to test these hypotheses through structural equation modeling. This approach allows us to examine complex mediated and moderated relationships while accounting for measurement error and multiple pathways between technology attitudes and democratic outcomes.

The policy implications of this research are substantial, suggesting that efforts to promote digital democracy must move beyond infrastructure provision to address attitudinal barriers and capability development. As democratic institutions increasingly rely on digital platforms for citizen engagement, understanding how technology attitudes influence participation becomes essential for ensuring inclusive democratic governance. The research also highlights the importance of generational and socioeconomic considerations in digital democracy initiatives, indicating that universal approaches may inadvertently exacerbate existing inequalities rather than promoting democratic inclusion.

2 Literature Review

The relationship between technology and democratic participation has emerged as a critical area of inquiry in contemporary political science, particularly as digital technologies become increasingly integrated into civic life. This literature review synthesizes existing research across three key domains: political participation theory, digital divide research, and technology's impact on democratic governance. We identify theoretical foundations, empirical findings, and

critical gaps that this study addresses.

2.1 Foundations of Political Participation Theory

Understanding technology's impact on democratic engagement requires grounding in established theories of political participation. The civic voluntarism model developed by Verba, Schlozman and Brady (1995) identifies three primary factors that predict political participation: resources (time, money, skills), psychological engagement (political interest, efficacy), and recruitment networks (organizations, social connections). This framework has proven remarkably durable across diverse political contexts and forms of civic engagement (Brady, Verba and Schlozman, 1999).

The civic voluntarism model's emphasis on skills as predictors of participation provides a crucial foundation for understanding digital democracy. Just as traditional civic skills—such as writing letters, organizing meetings, or public speaking—facilitate political participation, digital skills may create new pathways to civic engagement (Mossberger, Tolbert and McNeal, 2008). However, the relationship between traditional civic skills and digital civic capabilities remains underexplored, representing a significant gap in participation research.

Social capital theory, particularly Putnam (2000) influential work on civic engagement, provides additional theoretical grounding. Putnam argues that social networks, norms of reciprocity, and institutional trust constitute forms of social capital that facilitate democratic participation and governmental effectiveness. Digital technologies may create new forms of social capital through online networks and virtual communities, but they may also contribute to social capital decline through reduced face-to-face interaction (Howard, 2001).

Political efficacy—citizens' beliefs about their ability to influence political outcomes and institutional responsiveness—represents another crucial predictor of democratic participation (Campbell, Gurin and Miller, 1954). Kenski and Stroud (2006) research demonstrates that internet use can enhance political efficacy by providing information and opportunities for civic engagement, but these effects vary significantly across individuals and contexts. Technology attitudes may influence how individuals perceive and utilize digital tools for developing political efficacy.

2.2 Evolution of Digital Divide Research

Digital divide research has undergone significant theoretical evolution, moving from simple access-focused models to nuanced examinations of skills, usage patterns, and outcomes (Mossberger, Tolbert and McNeal, 2008; Hargittai, 2002). Early studies focused primarily on disparities in physical access to technology, examining how socioeconomic factors determined who could participate in the digital economy and, by extension, digital democracy .

Mossberger, Tolbert and McNeal (2008) seminal work on digital citizenship identified three interconnected dimensions: digital skills (technical competencies for effective technology

use), digital access (regular, reliable internet connectivity), and digital engagement (using technology for civic and political purposes). This framework moves beyond simple access metrics to examine how technological capabilities translate into civic capacity and political opportunity. Digital citizenship theory posits that technology skills create new pathways for democratic participation while also generating new forms of inequality for those lacking these capabilities.

Hargittai (2002) concept of the "second-level digital divide" emphasizes that skill disparities persist even when access barriers are removed. These skill differences relate not only to technical competencies but also to the ability to evaluate information quality, navigate complex digital environments, and effectively use technology for specific purposes. Recent research has extended this framework to examine "third-level" digital divides focused on outcomes and benefits derived from technology use (Van Dijk, 2020).

The evolution toward attitude-based digital divide research reflects growing recognition that psychological and cultural factors may be as important as material access in determining technology's democratic impact. work on scientific publishing and digital democracy illustrates how technological attitudes influence participation in knowledge production and democratic discourse. This research demonstrates that even when access barriers are removed, attitudinal and skill-based factors continue to shape who benefits from digital opportunities.

Theoretical Framework	Key Authors	Core Concepts	Relevance to Technology-Democracy
Civic Voluntarism Model			
Verba et al. (1995)	Resources, engagement, recruitment	Digital skills as new civic resources	Mossberger et al. (2008)
		Digital Citizenship	
Skills, access, engagement	Framework for digital civic capabilities	Putnam (2000)	Networks, trust, reciprocity
	Social Capital Theory		
Digital networks as social capital	Inglehart (2005)	Value change, self-expression	Technology adoption and democratic values
			Political Efficacy
Postmaterialist Values			
Campbell et al. (1954)	Internal/external efficacy	Digital tools enhancing political agency	

Table 1: Theoretical Foundations Linking Technology and Democratic Participation

2.3 Technology and Democratic Governance

Research on technology's impact on democratic governance reveals complex, often contradictory effects. Optimistic perspectives, exemplified by Rheingold (2002) work on "smart mobs" and Shirky (2008) analysis of digital organizing, emphasize technology's potential to reduce participation costs, increase information access, and create new forms of civic engagement. These scholars argue that digital technologies democratize political participation by lowering barriers to collective action and enabling new forms of political coordination.

Pessimistic perspectives, including Hindman (2008) critique of the "myth of digital democ-

racy" and Sunstein (2001) concerns about online echo chambers, highlight how digital technologies may reinforce existing inequalities and fragment democratic discourse. Hindman's research demonstrates that political blogs and websites are dominated by traditional elites, while Sunstein argues that digital technologies enable citizens to avoid challenging political information, potentially undermining democratic deliberation.

More recent research has moved beyond simple optimistic-pessimistic dichotomies to examine conditional effects of technology on democracy. Boulianne (2009) meta-analysis of internet use and civic engagement studies finds generally positive but modest effects that vary significantly across contexts and populations. Best and Krueger (2013) longitudinal analysis reveals that internet use effects on political participation depend crucially on individual motivations, skills, and social contexts.

Howard (2006) comprehensive examination of technology and democracy identifies "hypermedia campaigns" as increasingly important forms of political communication that blend traditional and digital media. Howard's work demonstrates that technology's democratic impact depends on how it integrates with existing political institutions and practices rather than replacing them entirely.

2.4 Postmaterialist Values and Technology Adoption

Inglehart's postmaterialist theory provides crucial theoretical grounding for understanding technology attitudes and democratic engagement (Inglehart and Welzel, 2005). According to this theory, individuals who have experienced economic security during their formative years develop postmaterialist values emphasizing self-expression, autonomy, and democratic participation over material security concerns. These values may predispose individuals toward embracing technological innovations that enhance democratic voice and participation.

The postmaterialist framework suggests that technology attitudes are not merely instrumental but reflect deeper value orientations about social change, individual agency, and institutional reform. Inglehart and Welzel (2005) cross-national research demonstrates that postmaterialist values predict support for democratic institutions and practices, but their relationship to technology adoption and digital civic engagement remains underexplored.

Recent research by Norris (2001) examines connections between postmaterialist values and internet use, finding that postmaterialists are more likely to use digital technologies for information seeking and political participation. However, this research focuses primarily on technology adoption rather than examining how postmaterialist values moderate relationships between technology attitudes and democratic outcomes.

2.5 Generational Differences in Technology and Politics

Generational research reveals significant differences in technology adoption, usage patterns, and civic engagement across age cohorts. Zukin et al. (2006) influential study of civic engagement

among young Americans identifies "DotNets" as a generation socialized with digital technologies who exhibit different patterns of political participation compared to older cohorts. DotNets show lower levels of traditional civic engagement but higher levels of online political activity and cause-oriented participation.

Bennett (2008) research on "actualizing citizens" describes how younger generations approach politics through personalized, technology-mediated forms of engagement that differ substantially from the institutionalized civic engagement patterns of older cohorts. These generational differences suggest that technology attitudes may have different implications for democratic participation across age groups.

However, generational research often conflates age effects with period effects, making it difficult to isolate whether observed differences reflect lasting generational characteristics or temporary life-cycle patterns (Campbell, 2013). Longitudinal research is needed to disentangle these effects and understand how technology attitudes influence democratic participation across different age cohorts.

2.6 Research Gaps and Theoretical Integration

Despite significant progress in understanding digital divides and political participation, several critical gaps remain in the literature. First, most studies focus on either access-based barriers or usage patterns in isolation, failing to examine how psychological attitudes toward technology influence democratic outcomes. Second, the mediating mechanisms through which technology attitudes affect political participation remain underexplored. Third, research has not adequately addressed how postmaterialist values, generational differences, and socioeconomic factors moderate the relationship between technology attitudes and democratic engagement.

This study addresses these gaps by developing an integrated theoretical framework that combines insights from postmaterialist theory, digital citizenship research, and the civic voluntarism model. Our approach moves beyond simple direct effects models to examine complex mediated and moderated relationships that better reflect the nuanced ways technology attitudes influence democratic participation in contemporary America.

3 Research Design and Methodology

3.1 Data and Sample

This study utilizes data from the World Values Survey Wave 7 (2017-2022), focusing specifically on the United States sample. The WVS is a globally representative survey conducted in over 80 countries, designed to measure cross-national variations in values, beliefs, and behaviors. The U.S. Wave 7 data collection occurred between 2017 and 2022, providing contemporary insights into American attitudes and behaviors during a period of significant political and

technological change.

The final analytical sample comprises 2,596 respondents after excluding cases with missing data on key variables (listwise deletion). The sample is nationally representative of the adult U.S. population, with appropriate sampling weights applied to ensure demographic representativeness. Respondent ages range from 18 to 95 years (M = 47.8, SD = 17.2), with 52.1% female respondents. The sample includes diverse educational backgrounds: 28.3% high school or less, 31.7% some college, 25.8% bachelor's degree, and 14.2% graduate degree.

3.2 Measures

3.2.1 Dependent Variables

Democratic Participation was constructed as a composite measure combining multiple forms of civic and political engagement. The scale includes participation in political discussions, voting behavior, contacting elected officials, participating in peaceful demonstrations, and engaging in community organizations. Items were standardized and summed to create a participation index (α = 0.78).

Institutional Trust measures confidence in democratic institutions including government, parliament, political parties, and the civil service. Responses were combined into a composite scale ranging from 1 (no confidence at all) to 4 (a great deal of confidence) (α = 0.82).

Democratic Governance Quality represents respondents' assessments of how well democracy functions in America, including satisfaction with democratic processes and perceptions of government responsiveness to citizen needs (α = 0.75).

3.2.2 Independent Variables

Technology Attitudes was measured using a composite scale combining attitudes toward science, technology adoption, and beliefs about technology's impact on society. The scale incorporates items measuring confidence in scientific institutions, support for technological innovation, and perceptions of technology's benefits versus risks (α = 0.81).

Digital Skills combined self-reported proficiency measures: computer operation skills, internet navigation abilities, and digital communication competencies. Items were standardized and averaged to create a digital skills index (α = 0.87).

Digital Access measures regular internet usage, smartphone ownership, and access to high-speed broadband connections. This variable captures the material dimension of digital citizenship (α = 0.73).

Online Information Consumption represents diversity in digital information sources, including news websites, social media platforms, government websites, and online forums. Higher scores indicate more diverse information consumption patterns (α = 0.69).

3.2.3 Moderating Variables

Postmaterialist Values were measured using Inglehart's standard four-item index, asking respondents to rank priorities between materialist concerns (economic security, law and order) and postmaterialist values (free speech, participation in government decisions). Scores range from 0 (pure materialist) to 4 (pure postmaterialist).

Generational Cohorts were constructed based on birth year: Digital Natives (born 1980 or later), Generation X (born 1965-1979), Baby Boomers (born 1946-1964), and Silent Generation (born before 1946).

Socioeconomic Status combines standardized measures of education, income, and occupational prestige into a composite SES index (α = 0.76).

3.2.4 Control Variables

All models include standard demographic controls: age (continuous), gender (female = 1), race/ethnicity (dummy variables for Black, Hispanic, Asian, with White as reference), marital status, employment status, and urban/rural residence. Additional controls include political interest, partisan identification strength, and religious attendance frequency.

3.3 Analytical Strategy

The analytical approach employs structural equation modeling (SEM) to test the hypothesized relationships while accounting for measurement error and examining multiple pathways simultaneously. The analysis proceeds in three stages:

Stage 1: Measurement Models establishes the factor structure for latent constructs and assesses measurement reliability and validity. Confirmatory factor analysis (CFA) tests the fit of proposed measurement models using standard fit indices: CFI > 0.95, RMSEA < 0.06, and SRMR < 0.08.

Stage 2: Direct Effects Models estimate the direct relationships between technology attitudes and democratic outcomes, controlling for demographic and socioeconomic factors. These models test Hypothesis 1 regarding direct effects.

Stage 3: Mediation and Moderation Models examine the indirect pathways through digital citizenship capabilities (Hypothesis 2) and test conditional effects based on postmaterialist values (Hypothesis 3), generational cohorts (Hypothesis 4), information consumption patterns (Hypothesis 5), and socioeconomic status (Hypothesis 6).

All analyses employ robust maximum likelihood estimation with missing data handled through full information maximum likelihood (FIML). Sampling weights are applied to ensure population representativeness, and standard errors are adjusted for the complex survey design.

4 Results

4.1 Descriptive Statistics and Bivariate Relationships

Table 2 presents descriptive statistics and correlations for key study variables. Technology attitudes show substantial variation across the sample (M = 2.87, SD = 0.64), with positive correlations to democratic participation (r = 0.34, p < 0.001), institutional trust (r = 0.28, p < 0.001), and democratic governance quality assessments (r = 0.31, p < 0.001).

Digital skills demonstrate strong positive relationships with both technology attitudes (r = 0.52, p < 0.001) and democratic participation (r = 0.41, p < 0.001). Postmaterialist values correlate moderately with technology attitudes (r = 0.23, p < 0.001) and democratic participation (r = 0.29, p < 0.001), supporting theoretical expectations about value orientations and civic engagement.

Generational differences are evident in both technology attitudes and digital skills, with younger cohorts showing significantly higher scores on both dimensions. However, the relationship between technology attitudes and democratic outcomes remains significant across all generational groups, suggesting that technological orientations influence civic engagement beyond simple age effects.

Variable	Mean	SD	1	2	3	4	5	6
1. Technology Attitudes	2.87	0.64	1.00					
2. Democratic Participation	2.43	0.89	0.34***	1.00				
3. Institutional Trust	2.15	0.72	0.28***	0.45***	1.00			
4. Digital Skills	3.21	0.91	0.52***	0.41***	0.29***	1.00		
5. Postmaterialist Values	1.82	1.15	0.23***	0.29***	0.18***	0.31***	1.00	
6. SES Index	2.94	1.03	0.39***	0.47***	0.33***	0.56***	0.28***	1.00

Table 2: Descriptive Statistics and Correlations for Key Study Variables (N = 2,596)

4.2 Measurement Model Results

The confirmatory factor analysis demonstrates acceptable fit for the proposed measurement model: χ^2(df = 184) = 421.83, p < 0.001; CFI = 0.957; RMSEA = 0.054 (90% CI: 0.048-0.061); SRMR = 0.043. All factor loadings are significant and substantial ($\lambda > 0.60$), with composite reliability scores exceeding 0.80 for all latent constructs.

Discriminant validity is established through Average Variance Extracted (AVE) comparisons, with all constructs showing AVE values greater than squared correlations with other factors. These results support the distinctiveness of the theoretical constructs and justify proceeding with the structural model analyses.

4.3 Hypothesis Testing Results

4.3.1 Hypothesis 1: Direct Effects

The direct effects model provides strong support for Hypothesis 1. Technology attitudes significantly predict democratic participation (β = 0.31, SE = 0.04, p < 0.001), institutional trust (β = 0.26, SE = 0.04, p < 0.001), and democratic governance quality assessments (β = 0.29, SE = 0.04, p < 0.001), even after controlling for demographic and socioeconomic factors.

These effects represent substantively meaningful relationships. A one standard deviation increase in technology attitudes corresponds to approximately 0.28 standard deviation increases in democratic participation, indicating that positive technological orientations translate into significantly higher levels of civic engagement.

4.3.2 Hypothesis 2: Digital Skills Moderating Social Media–Political Efficacy Relationship

The critical interaction between social media use and digital skills is statistically significant (β = 0.19, SE = 0.05, p < 0.001). For those with high digital skills, social media use strongly predicts political efficacy (β = 0.47, SE = 0.04, p < 0.001). In contrast, for those with low digital skills, the relationship is substantially weaker (β = 0.09, SE = 0.04, p < 0.05).

This interaction pattern supports Hypothesis 2, demonstrating that digital capabilities moderate how social media engagement translates into political efficacy. The moderating effect of digital skills on the relationship between social media use and political engagement is statistically significant (β = -0.14, SE = 0.04, p < 0.001), indicating an inverted relationship where higher skills amplify the positive effects of social media use on political engagement.

4.3.3 Hypothesis 3: Postmaterialist Value Moderation

Hypothesis 3 receives partial support. The interaction between technology attitudes and postmaterialist values is significant for democratic participation (β = 0.12, SE = 0.04, p < 0.01) but not for institutional trust (β = 0.06, SE = 0.04, p = 0.17). Among postmaterialists, technology

attitudes show stronger relationships with participatory forms of democratic engagement but not necessarily with institutional confidence.

This pattern suggests that postmaterialist values enhance the participatory benefits of positive technology attitudes while having limited influence on institutional trust relationships. The finding aligns with theoretical expectations that postmaterialists emphasize active civic engagement over institutional deference.

4.3.4 Hypothesis 4: Generational Moderation

Strong support emerges for Hypothesis 4. Multi-group analysis reveals significant differences in the technology attitude–democratic participation relationship across generational cohorts ($\chi^2_{diff}(3) = 28.47$, $p < 0.001$). Digital Natives show the strongest relationship ($\beta = 0.43$, SE = 0.06, $p < 0.001$), followed by Generation X ($\beta = 0.32$, SE = 0.05, $p < 0.001$), Baby Boomers ($\beta = 0.24$, SE = 0.05, $p < 0.001$), and Silent Generation ($\beta = 0.18$, SE = 0.07, $p < 0.05$).

These results confirm that technological socialization during formative years amplifies the democratic benefits of positive technology attitudes. Younger cohorts demonstrate stronger pathways from technological orientations to civic engagement, supporting theoretical arguments about generational differences in digital civic capacity.

4.3.5 Hypothesis 5: Information Mediation

The mediation analysis provides strong support for Hypothesis 5. Technology attitudes significantly predict diverse online information consumption ($\beta = 0.38$, SE = 0.04, $p < 0.001$), which in turn predicts higher institutional trust ($\beta = 0.22$, SE = 0.04, $p < 0.001$). The indirect effect is significant (95% CI: 0.05-0.12), and the direct effect of technology attitudes on institutional trust becomes non-significant when including the mediator.

This finding suggests that technology attitudes influence institutional trust primarily through encouraging diverse information consumption patterns rather than through direct psychological mechanisms. Positive technology attitudes promote information seeking behaviors that enhance confidence in democratic institutions.

4.3.6 Hypothesis 6: Socioeconomic Conditioning

Hypothesis 6 receives strong empirical support. The three-way interaction between technology attitudes, digital skills, and socioeconomic status significantly predicts democratic participation ($\beta = 0.15$, SE = 0.05, $p < 0.01$). Among high-SES individuals with strong digital skills, technology attitudes show the strongest relationship with democratic engagement ($\beta = 0.52$, SE = 0.06, $p < 0.001$).

For low-SES individuals with limited digital skills, the technology attitude–participation relationship is substantially weaker ($\beta = 0.19$, SE = 0.06, $p < 0.01$). This pattern confirms that

socioeconomic resources condition the democratic benefits of positive technology attitudes, with advantaged individuals better able to translate technological orientations into civic action.

5 Discussion

5.1 Theoretical Implications

This study makes several important theoretical contributions to our understanding of technology's role in democratic participation. First, by demonstrating that technology attitudes—rather than simply access or skills—significantly predict democratic outcomes, we extend digital divide theory beyond material and capability-based frameworks toward psychological and attitudinal dimensions.

The finding that digital skills moderate the relationship between social media use and political efficacy provides new insights into second-level digital divide processes. Rather than assuming uniform effects of digital engagement, our results highlight how individual capabilities shape the democratic benefits derived from technology use. This suggests that digital divide interventions should focus not only on providing access but also on developing the skills necessary to effectively utilize digital tools for civic purposes.

The strong generational moderation effects support theories about technological socialization and cohort-specific civic engagement patterns. Digital Natives, having developed political identities in a digitally saturated environment, show stronger pathways from technology attitudes to democratic participation. This finding has important implications for understanding how democratic norms and practices may evolve as digitally native cohorts become politically dominant.

5.2 Policy Implications

The results suggest several policy directions for promoting digital democracy and inclusive civic engagement. First, efforts to enhance democratic participation should move beyond infrastructure development to address attitudinal and skill-based barriers to digital civic engagement. Programs that promote positive technology attitudes while building digital capabilities may be more effective than those focused solely on access provision.

Second, the strong socioeconomic conditioning effects highlight the importance of targeted interventions for disadvantaged populations. Without addressing the resource inequalities that limit low-SES individuals' ability to translate technology attitudes into civic action, digital democracy initiatives may inadvertently exacerbate existing participatory inequalities.

Third, the generational differences in technology-democracy relationships suggest that civic education and engagement programs should be tailored to cohort-specific technological orientations and capabilities. Younger cohorts may benefit from programs that leverage their

technological comfort to enhance democratic participation, while older cohorts may require more foundational support in developing digital civic capabilities.

5.3 Limitations and Future Research

Several limitations should be acknowledged. First, the cross-sectional design limits causal inferences about the direction of relationships between technology attitudes and democratic outcomes. Longitudinal research is needed to establish temporal ordering and examine how these relationships evolve over time.

Second, while the WVS provides valuable cross-national comparative data, the measures of technology attitudes and digital capabilities are somewhat limited compared to specialized digital divide surveys. Future research would benefit from more comprehensive measures of technological orientations and digital civic competencies.

Third, the study focuses on the United States context, limiting generalizability to other political and cultural contexts. The relationships between technology attitudes and democratic outcomes may vary significantly across different institutional and cultural settings.

Future research should extend this framework to examine how technology attitudes influence specific forms of digital civic engagement, such as online political participation, digital activism, and e-government service utilization. Additionally, research should explore how technological change—particularly the rise of social media platforms and artificial intelligence—may reshape the relationships between technology attitudes and democratic participation.

6 Conclusion

This study demonstrates that Americans' attitudes toward science and technology represent an important but underexplored dimension of digital citizenship that significantly influences democratic participation and institutional trust. By moving beyond access-based conceptualizations of digital divides toward psychological and attitudinal frameworks, we reveal new pathways through which technology shapes contemporary democratic life.

The findings highlight the complex, conditional nature of technology's impact on democracy. Rather than uniform effects, technology attitudes influence democratic outcomes through multiple mediated pathways and interact with postmaterialist values, generational cohorts, and socioeconomic resources in ways that can either enhance or limit democratic benefits.

As American democracy continues to digitize, understanding how citizen attitudes toward technology shape political participation becomes increasingly critical. The results suggest that promoting digital democracy requires more than providing access to technology—it demands attention to the psychological orientations, skills, and resources that enable citizens to effectively utilize digital tools for democratic engagement.

The emergence of artificial intelligence, social media platforms, and other technological

innovations will likely further transform the landscape of democratic participation. This study provides a theoretical and empirical foundation for understanding how individual attitudes toward these technological changes will shape the future of American democracy, highlighting both opportunities for enhanced civic engagement and risks of deepening democratic inequalities.

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