

Digital Citizenship Capabilities Among Indigenous Senior High School Students: A Multidimensional Analysis in Resource-Constrained Contexts

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Abstract

This study examines digital citizenship education (DCE) capabilities among indigenous senior high school students in Tinoc, Ifugao, Philippines, with the aim of identifying capability gaps and informing context-responsive educational transformations. Grounded in Sen's Capability Approach, Sociotechnical Systems Theory, and Indigenous Knowledge Systems, the research adopts a quantitative descriptive design within a post-positivist framework. Data were collected from 211 students using a validated 58-item survey instrument measuring eight DCE dimensions: knowledge, skills, attitudes, literacy, behavior, safety, digital footprints, and ethics. Descriptive statistics and independent samples t-tests were employed to analyze overall profiles and demographic differences. Findings reveal a "foundational but fragmented" DCE profile ($M = 3.12$), where affective-behavioral dimensions (attitudes, behavior, safety, ethics) outperform cognitive-capability dimensions (knowledge, skills, literacy, footprints). Significant deficiencies were observed in digital footprints ($M = 2.69$) and source evaluation ($M = 2.83$), indicating limited critical digital agency. A notable knowledge-attitude gap (0.24) suggests "false competency," while structural factors such as device ownership significantly influence capability development. Gender differences favor females in skills, literacy, and safety, and internet access primarily affects attitudes and behavior rather than cognitive competencies. The study concludes that DCE in resource-constrained indigenous contexts promotes protective rather than empowered citizenship. It recommends pedagogical reforms emphasizing critical literacy, technical resilience, and culturally grounded participation through indigenous governance principles such as Keleng. This research supports Sustainable Development Goal (SDG) 4.7 by addressing global citizenship and digital literacy competencies in marginalized contexts. Its sustainability impact lies in strengthening equitable, culturally responsive education systems that enhance community-based digital participation and reduce structural inequalities in rural education settings.

Keywords: Capability Approach, Digital Citizenship Education, Indigenous Students, Philippines, Rural Education, Sociotechnical Systems Theory

1. Introduction

DCE encompasses competencies required for meaningful participation in digital environments, including critical analysis, moral reasoning, and civic engagement. The UN Sustainable Development Goal 4.7 emphasizes the need for individuals to acquire skills related to sustainability, global citizenship, and cultural awareness. However, the Philippines lacks sufficient SDG 4.7.1 indicator data, indicating gaps in monitoring and policy development. National initiatives such as Senate Bill No. 1376 (2024), the Philippine Digital Education 2028 plan, and the PAGHABI framework demonstrate efforts to institutionalize digital literacy and global citizenship education. Despite these initiatives, disparities persist, with only 40% of Filipinos possessing basic ICT literacy and significant inequities affecting rural and indigenous populations.

Existing literature highlights uneven development of digital citizenship competencies, particularly between cognitive and affective domains. Arviola and Dellomos (2023) emphasize the importance of aligning global citizenship education with indigenous knowledge systems, while Bernardo et al. (2022) identify disparities in cognitive engagement compared to affective competencies among Filipino learners. Studies such as the Digital Kids Asia-Pacific (Shin et al., 2019) project reveal moderate safety skills but weak content creation and evaluation abilities, and the World Bank (2022) notes that limited digital exposure reinforces protective rather than participatory behaviors. Hobbs (2017) describes this phenomenon as "false competency," where perceived proficiency is not supported by critical understanding. These findings collectively indicate a pattern of protective digital engagement with limited transformative capacity.

Globally, DCE is framed within sustainability and global citizenship agendas, particularly SDG 4.7. Nationally, the Philippines is advancing digital education policies, yet faces contrasting trends in skill development and equity, as reported

by the Philippine Institute for Development Studies (2023). Locally, indigenous communities experience compounded challenges due to limited infrastructure, geographic isolation, and socio-economic constraints. These conditions intersect with communal governance systems, shaping digital engagement differently from individualistic contexts. The pandemic further intensified inequalities, disproportionately affecting learners in resource-poor settings (World Bank, 2022).

The study is grounded in three frameworks: Sen's Capability Approach (Sen, 1999; Nussbaum, 2011), Sociotechnical Systems Theory, and Indigenous Knowledge Systems. The Capability Approach emphasizes the transformation of resources into actual freedoms, focusing on digital capabilities rather than mere access. Sociotechnical Systems Theory conceptualizes digital competence across mechanical, informational, psychological, and social layers, highlighting issues such as the "permanence paradox" and "safety silence." Indigenous Knowledge Systems challenge universalist approaches by integrating local epistemologies, such as Keleng governance and the PAGHABI framework, which emphasize collective identity (Kapwa) and community-based participation.

Despite growing interest in DCE, existing studies predominantly focus on urban and affluent contexts, leaving indigenous and rural populations underrepresented. There is a lack of baseline data on DCE capabilities among indigenous students in the Philippines, limiting SDG 4.7.1 monitoring and policy formulation. Additionally, the interaction between structural constraints, cultural frameworks, and digital capability development remains insufficiently explored. This study addresses these gaps by examining the multidimensional structure of DCE, identifying demographic predictors, and proposing culturally responsive educational strategies.

This study aligns primarily with SDG 4 (Quality Education), particularly Target 4.7, by addressing digital literacy, global citizenship, and culturally responsive education. It also relates to SDG 10 (Reduced Inequalities) by highlighting disparities in digital access and capabilities among indigenous and rural populations.

The research contributes to educational sustainability by promoting equitable and context-sensitive digital learning frameworks. It supports socio-cultural sustainability through the integration of indigenous knowledge systems into digital citizenship education. Additionally, it advances technological and institutional sustainability by informing policy, curriculum design, and resource allocation in underserved communities. By addressing structural inequities and fostering empowered participation, the study strengthens community and governance sustainability in digital environments.

2. Material and methods

2.1 Research Design

The study utilized a quantitative descriptive research design grounded in post-positivist epistemology, allowing for contextualized measurement of DCE capabilities while acknowledging real-world constraints (Creswell & Creswell, 2018). This design was appropriate for establishing baseline profiles of DCE among students during the 2024–2025 school year, particularly in a setting where no prior studies had been conducted.

2.2 Locale of the Study

The research was conducted at Tinoc National High School in the Municipality of Tinoc, Ifugao Province, located in the Cordillera Administrative Region. The area is predominantly inhabited by the Kalanguya ethnic community and is characterized by rural conditions, including limited technological infrastructure, challenging topography, and an *kaingin*-based economy that constrains access to digital resources.

2.3 Respondents of the Study

The respondents consisted of senior high school students enrolled at Tinoc National High School during the 2024–2025 academic year. The population included 211 students, with a gender distribution of 135 females (64%) and 76 males (36%). Most students owned one to two digital devices (95.7%), while a small proportion had three to four devices (4.3%). Additionally, 71.6% reported having internet access at home, whereas 28.4% did not.

2.4 Sample and Sampling Procedure

The study employed complete population sampling, involving all available senior high school students ($N = 211$). A non-probability sampling approach was used due to contextual limitations, which restricts the generalizability of findings to similar indigenous and resource-constrained settings.

2.5 Research Instrument

Data were collected using a structured self-administered questionnaire consisting of demographic items and measures of eight DCE dimensions: digital knowledge, skills, attitudes, literacy, behavior, safety, digital footprints, and ethics. The instrument was adapted from established scales developed by Choi (2016) and ICCS (2016), with contextual modifications for Philippine indigenous settings. Reliability coefficients for the instrument ranged from 0.787 to 0.903, indicating high

internal consistency. Responses were measured using a 4-point Likert scale from strongly disagree to strongly agree, excluding a neutral option to reduce social desirability bias. Content validity was ensured through expert panel evaluation, and a pilot test involving 30 participants from a neighboring community was conducted to establish face validity.

2.6 Data Gathering Procedure

Following ethical approval and the acquisition of informed consent from participants and their guardians, data collection was conducted in September 2024. A paper-based survey method was used to accommodate varying levels of internet access among respondents. The questionnaires were administered during class hours, with teachers providing instructions and assistance as needed. Completion time ranged from 25 to 30 minutes, and Filipino translations were provided for students with limited English proficiency.

2.7 Data Analysis Techniques

Data analysis involved descriptive statistics to compute mean scores for each DCE dimension, interpreted using predefined benchmarks ranging from low to high levels of capability. Independent samples t-tests were conducted to examine differences based on gender, device ownership, and internet access, while effect sizes were measured using Cohen's *d*. Statistical significance was determined at a two-tailed *p*-value of less than .05. All analyses were performed using SPSS, and the sample size ($N = 211$) provided sufficient statistical power to detect medium effect sizes ($d = 0.40$) at $\alpha = .05$.

3. Results and Discussion

3.1 Digital Citizenship Capability Profile

3.1.1 Overall DCE Profile

The results indicate that students demonstrated a “foundational but fragmented” DCE profile, with an overall mean of 3.12. Affective-behavioral dimensions such as attitudes and behavior recorded the highest scores ($M = 3.23$), while digital footprints showed the lowest ($M = 2.69$), revealing uneven capability development across dimensions. This pattern reflects a disparity between socialized behaviors and cognitive understanding, suggesting that students are more proficient in compliant and protective practices than in critical or analytical competencies. The imbalance supports the notion of uneven development across digital citizenship domains observed in prior studies, particularly the dominance of affective over cognitive engagement (Bernardo et al., 2022).

3.1.2 Dimension-Specific Capabilities

Students demonstrated moderately high levels in digital knowledge ($M = 2.99$), skills ($M = 3.07$), and literacy ($M = 3.03$), but performed lower in evaluating sources ($M = 2.83$) and understanding digital footprints ($M = 2.69$). Practical knowledge such as password protection was stronger than theoretical understanding of digital infrastructure. Communication skills were highest ($M = 3.50$), while troubleshooting technical issues was weaker ($M = 2.86$). These findings indicate that students possess operational competencies but lack deeper critical and technical understanding necessary for independent digital engagement. This aligns with the concept of “false competency,” where perceived proficiency masks underlying gaps in critical thinking and technical awareness (Hobbs, 2017). The observed deficits in source evaluation further confirm limitations in critical literacy identified in prior research.

3.1.3 Affective and Behavioral Dimensions

High scores were observed in attitudes ($M = 3.23$), behavior ($M = 3.23$), safety ($M = 3.18$), and ethics ($M = 3.17$), indicating strong adherence to norms such as civility and responsible online conduct. However, lower scores were noted in civic efficacy ($M = 3.11$), reporting inappropriate behavior, and responding to cyberbullying, reflecting limited active participation. These results suggest that DCE in this context promotes compliance and self-regulation rather than active digital citizenship. The emphasis on protective behaviors over participatory engagement reflects patterns identified in resource-constrained environments, where exposure to digital media is limited and norms emphasize safety over agency (World Bank, 2022).

3.2 Capability Gaps and Paradoxes

3.2.1 Knowledge–Attitude Gap and False Competency

A 0.24-point difference between attitudes ($M = 3.23$) and knowledge ($M = 2.99$) indicates a discrepancy between perceived and actual competence. Students exhibited confidence in their digital behaviors despite limited conceptual understanding. This gap illustrates “false competency,” where learners internalize appropriate behaviors without comprehending underlying mechanisms (Hobbs, 2017). The presence of such disparity suggests that institutional socialization emphasizes behavioral norms without fostering critical inquiry, limiting students' ability to adapt to new digital contexts.

3.2.2 Permanence Paradox and Digital Footprint Awareness

Students demonstrated awareness of responsible posting behavior but lacked understanding of digital permanence and algorithmic tracking, as reflected in lower scores related to digital footprints. This phenomenon represents the “permanence

paradox,” where users effectively manage visible online actions but remain unaware of underlying digital infrastructures. Such limitations hinder the development of informed agency and reflect gaps in deeper digital literacy associated with sociotechnical understanding.

3.2.3 Safety Silence and Ethics-to-Action Gap

Students showed higher proficiency in personal safety practices compared to collective actions such as intervening in cyberbullying, resulting in a 0.52-point “safety silence” gap. Similarly, a 0.30-point gap between ethical beliefs and proactive actions was observed. These patterns indicate that students prioritize self-protection over community engagement. This aligns with findings that adolescents are more likely to adopt protective behaviors than intervene in harmful situations (Hinduja and Patchin, 2015). The gap between ethical understanding and action also reflects developmental patterns where inhibitory morality precedes proactive moral engagement (Malti, 2021).

3.3 Structural and Demographic Influences

3.3.1 Device Ownership and Capability Development

Students with access to multiple devices demonstrated significantly higher capabilities across several dimensions, particularly in digital footprints, where the largest effect size was observed ($d = 0.82$). This finding supports the “device multiplicity effect,” indicating that exposure to multiple platforms enhances digital competence by providing diverse learning experiences. It suggests that structural access to technology plays a critical role in transforming resources into capabilities, consistent with the Capability Approach (Sen, 1999).

3.3.2 Internet Access and Learning Outcomes

Internet access was associated with improvements in attitudes and behavior but did not significantly affect cognitive capabilities such as knowledge and literacy. This suggests that school-based instruction compensates for limited home connectivity in developing knowledge, while experiential exposure through internet use influences affective and behavioral dimensions. The distinction highlights the role of formal education in addressing cognitive gaps and the importance of access for experiential learning.

3.3.3 Gender Differences in DCE

Female students outperformed male students in digital skills, literacy, and safety, with statistically significant differences observed across these dimensions. These results reflect broader trends in Philippine education, where female students demonstrate stronger academic performance. The findings suggest opportunities for peer-supported learning models that leverage gender strengths to enhance overall capability development.

4. Conclusion & Recommendations

The study concludes that digital citizenship education (DCE) among indigenous senior high school students in Tinoc National High School is characterized by a “foundational but fragmented” profile, where affective-behavioral competencies such as attitudes, behavior, safety, and ethics are more developed than cognitive-capability dimensions such as knowledge, literacy, and digital footprints. Students demonstrate safe and responsible online practices but exhibit limited critical understanding and technical autonomy, reflecting a pattern of protective rather than empowered citizenship. The presence of a 0.24-point gap between knowledge and attitudes indicates a risk of “false competency,” while deficiencies in digital footprint awareness and source evaluation highlight critical capability gaps. Structural factors, particularly device ownership, significantly influence capability development, and indigenous cultural values such as Keleng, pakikisama, and hiya provide a foundation for collective digital citizenship. The study affirms the relevance of integrating Capability Approach, Sociotechnical Systems Theory, and Indigenous Knowledge Systems in understanding DCE in resource-constrained indigenous contexts.

The study recommends pedagogical, curricular, and policy interventions to shift DCE from protective to empowered citizenship. Teachers should incorporate strategies such as lateral reading instruction for evaluating sources (Breakstone et al., 2021), explicit teaching of digital footprint infrastructure, and scaffolded technical problem-solving activities, alongside peer-support systems and gender-responsive mentorship programs. Curriculum developers are encouraged to integrate digital civic engagement with indigenous governance concepts such as Keleng and pakikisama, and to design assessments based on authentic civic activities rather than purely technical tasks. At the policy level, emphasis should be placed on increasing device diversity rather than solely expanding internet connectivity, implementing performance-based DCE assessments, and embedding digital citizenship within existing civic education frameworks such as PAGHABI. Establishing baseline indicators for DCE in indigenous contexts is also recommended to support national SDG reporting and inform evidence-based educational reforms.

Compliance with ethical standards

The authors declare no conflict of interest. This study complied with recognized ethical standards for human-participant research by ensuring voluntary participation with informed consent, the right to withdraw without penalty, and strict confidentiality through anonymous, secure, and aggregated data handling. Given the focus on psychological well-being, procedures were non-invasive, and safeguards were observed to minimize discomfort, with guidance to appropriate support services when needed, and required institutional permissions were secured for instrument use and access to academic records.

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