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Digital Citizenship and Community Belonging Among University Students: The Mediating Role of Sustainable Education

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Abstract

The intersection of digital citizenship, sustainable education, and community belonging represents an emerging yet underexplored area of inquiry, particularly within Arab higher education contexts where institutional digitalization is accelerating alongside distinct sociocultural expectations around academic identity. This study aims to investigate the mediating role of sustainable education in the relationship between digital citizenship and community belonging among Egyptian university students. A quantitative cross-sectional survey design was employed with a main sample of 819 university students. Participants completed three validated instruments: the Revised Digital Citizenship Scale, the Sustainable Education Scale, and the Where I Belong Survey. Mediation analysis was conducted using Hayes' PROCESS macro with 5000 bootstrap resamples. Results reveal that digital citizenship is significantly and positively associated with both sustainable education and community belonging. Sustainable education, in turn, significantly predicts community belonging after controlling for digital citizenship, with the indirect effect accounting for approximately 38% of the total effect, consistent with partial mediation. These findings demonstrate that responsible digital engagement is associated with community belonging not only directly but also in a pattern statistically consistent with partial mediation through sustainability-oriented values including equity, inclusiveness, and democratic participation. These findings suggest theoretically informed directions for future intervention design, wherein integrating sustainable education principles into digital learning environments may warrant empirical investigation as a potential approach to cultivating ethically grounded, socially cohesive academic communities.

Keywords: digital citizenship; sustainable education; community belonging; higher education; mediation analysis; Egyptian university students

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Academic Editor: Grigorios L. Kyriakopoulos

Received: 29 March 2026
Revised: 19 April 2026
Accepted: 22 April 2026
Published: 25 April 2026

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1. Introduction

The rapid integration of digital technologies into higher education has brought renewed attention to the concept of digital citizenship, broadly defined as the responsible, ethical, and effective use of technology in navigating digital environments [1–3]. In the university context, digital citizenship encompasses a spectrum of competencies and values,

including digital ethics, online safety, information literacy, and respectful communication, all of which collectively shape how students engage within digital spaces [4–6]. As universities increasingly depend on digital platforms for learning and social interaction, cultivating responsible digital behaviors has become essential not only for academic success but also for fostering safe, inclusive, and ethically grounded campus communities [7–9].

Closely related to students' digital engagement is their sense of community belonging, defined as the degree to which students feel accepted, valued, included, and supported within their academic peer groups and broader university environment [10–12]. Research indicates that a strong sense of belonging is associated with reduced depressive symptoms, loneliness, and emotional distress, and with improved well-being among university students [13–15]. Beyond mental health, belonging meaningfully enhances academic motivation, self-efficacy, and persistence, with students reporting stronger peer connectedness being considerably less likely to disengage or withdraw from their studies [16–18].

Emerging scholarship suggests a meaningful relationship between active digital citizenship and students' sense of community belonging, wherein positive online interactions, digital collaboration, and ethical engagement collectively strengthen social ties and foster shared identity within academic communities [19–21]. Respectful and responsible participation in digital spaces, including learning management systems and social media platforms, has been associated with stronger peer connectedness and greater institutional affiliation [22–25]. Furthermore, ethical digital engagement promotes prosocial norms and intercultural communication, extending students' sense of belonging beyond immediate peer groups toward broader civic and global communities [8,26–28].

Despite the potential of digital environments to foster connection, university students continue to face significant challenges in sustaining genuine community belonging within increasingly digitalized academic settings [29,30]. Cyberbullying, cyberstalking, and digital harassment remain pervasive threats, generating fear, academic withdrawal, and diminished trust among peers, thereby directly eroding students' sense of safety and inclusion [31–35]. Compounding these risks, online and hybrid learning environments frequently produce feelings of isolation and alienation, as transactional or camera-off interactions fail to cultivate meaningful relational bonds [36–39]. Such fragmented digital social experiences underscore the urgent need for intentional, ethically grounded approaches to digital citizenship education that genuinely nurture belonging [40,41].

It is within this gap that sustainable education emerges as a theoretically compelling and practically significant bridging framework. Sustainable education, understood as a holistic approach that cultivates social responsibility, critical thinking, and global awareness, may offer a moral and relational framework that instrumental digital skills alone do not provide [42–44]. Rather than treating sustainability as a discrete subject, this approach integrates environmental, social, and economic dimensions across disciplines, encouraging students to engage with complex global challenges through systems thinking and interdisciplinary inquiry [45–48]. Transformative sustainable education further emphasizes student agency, positioning learners as active participants and change agents capable of connecting local academic experiences to broader societal and planetary responsibilities [49,50].

Sustainable education is increasingly recognized as a foundational moral framework that equips students with the values necessary for responsible digital citizenship, positioning equity, justice, ethics, and care as guiding principles for online behavior [27,51,52]. Education for Sustainable Development explicitly cultivates learners' sense of ethical responsibility and social justice—values that translate directly into conscientious digital practices such as combating exclusion, respecting privacy, and resisting cyberbullying [53,54]. When sustainability-oriented values are integrated into digital learning environments, students may develop a digitally grounded identity that supports civic engagement, inclusive partic-

ipation, and critical use of technology [55–58]. At the individual level, this process operates through value internalization: sustained exposure to equity- and justice-oriented digital learning experiences shapes students' personal normative commitments, which in turn orient their social behavior toward inclusive participation and community identification.

Central to this study's theoretical argument is the proposition that sustainable education mediates the relationship between digital citizenship and community belonging by functioning as a proximal value-formation mechanism through which digital competencies are transformed into genuine social connectedness [51,59]. At the individual level, students who engage responsibly in digital environments internalize equity-, justice-, and inclusion-oriented norms that orient their social behavior toward inclusive participation and community identification [55–58]. Social Learning Theory suggests that sustainability-oriented values may be reinforced through peer modeling and digital self-efficacy, Systems Theory situates this internalization process within interconnected institutional structures that generate and sustain shared norms of inclusion and equity [27,51,57,59–62]. Although alternative pathways—including institutional climate, peer interaction quality, and academic engagement—constitute relevant contextual antecedents, they operate upstream of this individual-level value-formation process, functioning as enablers rather than proximal mechanisms [27,63]. Sustainable education thus directly captures the normative shift that deepens students' community belonging [64–66].

Despite growing theoretical interest in both digital citizenship and sustainable education, empirical research examining their joint influence on community belonging remains limited, particularly within university settings in the Arab world where institutional digitalization is accelerating alongside distinct sociocultural expectations around inclusion and academic identity. The present study addresses this gap by investigating the mediating role of sustainable education in the relationship between digital citizenship and community belonging among Egyptian university students. By doing so, it aims to produce actionable insights for higher education institutions seeking to design digital learning environments that are not only technologically proficient but also ethically grounded, socially cohesive, and sustainability-oriented.

2. Materials and Methods

2.1. Study Design

This study employed a quantitative cross-sectional survey design to examine the mediating role of sustainable education in the relationship between digital citizenship and community belonging among Egyptian university students. Data were collected from Egyptian university students during the first academic semester of 2025/2026, spanning the period from 17 September to 28 December 2025.

2.2. Participants

Two independent samples were deliberately recruited following methodological recommendations to validate measurement structures on a sample separate from that used for hypothesis testing, thereby reducing capitalization on chance and the risk of overfitting. A psychometric sample (N = 658) was used for scale validation, and a main sample (N = 819) was used for hypothesis testing. All participation was entirely voluntary, and informed consent was obtained from all participants prior to their involvement in the study.

Both samples were drawn from the same broader population of Egyptian university students across comparable institutions, disciplines, and academic years. As shown in Table 1, the two samples exhibited similar demographic distributions across gender, academic year, residence, and marital status, providing no evidence of systematic between-sample differences. This demographic comparability supports the assumption that the

factor structures, reliability estimates, and validity indices established in the psychometric sample are reasonably generalizable to the main analytic sample, though formal cross-sample invariance testing was not conducted and is acknowledged as a limitation. The mean age of the psychometric sample was 20.39 years (SD = 2.13, range = 18–26), while the mean age of the main sample was 20.29 years (SD = 1.74, range = 18–24). Demographic characteristics of both samples are presented in Table 1.

Table 1. Demographic Characteristics of Study Participants.

Variable	Category	Psychometric Sample		Main Sample	
		n	%	n	%
Gender	Male	263	40.0	302	36.9
	Female	395	60.0	517	63.1
Academic Year	First Year	185	28.1	194	23.7
	Second Year	171	26.0	235	28.7
	Third Year	176	26.7	220	26.9
	Fourth Year	126	19.1	170	20.8
Residence	Rural	278	42.2	358	43.7
	Urban	380	57.8	461	56.3
Marital Status	Single	540	82.1	665	81.2
	Married	118	17.9	154	18.8

Participants were recruited through a convenience sampling approach, with the online Google Form distributed via academic staff and student networks across six Egyptian public and private universities spanning multiple faculties and disciplines. Inclusion criteria required participants to be currently enrolled undergraduate students aged 18 years or older. To safeguard data quality, duplicate submissions were minimized through the Google Form's response-limit settings, which restricted submission to one response per account. Attention check items were embedded within the questionnaires to identify inattentive responding. In total, 1621 responses were initially received across both samples. Following data collection, 144 responses were removed due to incompleteness, straight-lining, or failure of attention check items, yielding a final retained dataset of 1477 participants, comprising the psychometric sample (N = 658) and the main analytic sample (N = 819). Responses were screened for incompleteness and straight-lining; invalid or incomplete responses were removed before analysis.

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2.3. Measures

The Revised Digital Citizenship Scale (DCS-R) [67] is a 19-item self-report instrument measuring four dimensions: Internet Political Activism (6 items), Technical Skills (3 items), Critical Perspectives (7 items), and Networking Agency (3 items). Items are rated on a 7-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). Confirmatory factor analysis conducted on the psychometric sample indicated acceptable model fit ($\chi^2/df = 4.012$, GFI = 0.907, CFI = 0.944, RMSEA = 0.068). Internal consistency was strong across all subscales and the total scale, with omega coefficients (ω) and alpha coefficients (α) all exceeding 0.80, and total scale reliability reaching $\omega = 0.900$ and $\alpha = 0.899$. To further evaluate construct validity, convergent validity was assessed using Average Variance Extracted (AVE), with values ranging from 0.52 to 0.61 across subscales, all exceeding the recommended threshold of 0.50.

The Sustainable Education Scale (SES) [68] is a 19-item instrument developed on the basis of human rights education, sustainable development, and social justice frameworks. The scale comprises four subscales: Equality in Education (7 items), Inclusiveness in Education (5 items), Quality in Education (3 items), and Democratic Education (4 items). Items are rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Confirmatory factor analysis supported adequate model fit ($\chi^2/df = 3.970$, GFI = 0.902, CFI = 0.936, RMSEA = 0.067). Reliability estimates were excellent across all subscales and the total scale, with total $\omega = 0.913$ and $\alpha = 0.913$. Convergent validity was supported by AVE values ranging from 0.54 to 0.63, all surpassing the 0.50 threshold.

The Where I Belong Survey—Youth/Adult Version (WIBS) [69] is a 16-item scale measuring two dimensions: Interpersonal Belonging (5 items) and Context Belonging (11 items). Items 1–5 are rated on a 4-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree), while items 6–16 are rated on a 4-point scale ranging from 1 (I feel no belonging to this context) to 4 (I feel complete belonging to this context). Confirmatory factor analysis demonstrated good model fit ($\chi^2/df = 2.604$, GFI = 0.941, CFI = 0.975, RMSEA = 0.049). Reliability was excellent at the subscale and total levels, with total $\omega = 0.930$ and $\alpha = 0.932$. Convergent validity was supported by AVE values of 0.58 and 0.61 for Interpersonal Belonging and Context Belonging respectively, both exceeding the 0.50 criterion.

2.4. Translation and Cultural Adaptation

All three scales were originally developed in English and were translated into Arabic—the native language of the participants—and back-translated into English. The two translators selected for this process held doctoral-level qualifications in education or applied linguistics, demonstrated native-level Arabic proficiency, and had prior experience translating psychometric instruments in social science research. Both forward and backward translations were conducted independently to verify semantic equivalence and cultural appropriateness. Following the completion of the back-translation, all translators and two members of the research team convened in a structured consensus meeting to review and resolve any discrepancies in wording or meaning. Decisions regarding final item wording were reached collaboratively, with priority given to preserving the conceptual intent of each item over strict literal equivalence.

Prior to the main data collection, a pilot phase was conducted with a small convenience sample of 30 university students who were not included in either the psychometric or main samples. Participants were asked to complete all three translated instruments and to flag any items they found ambiguous, culturally unfamiliar, or difficult to interpret. Based on their feedback, minor wording adjustments were made to several items to improve clarity and naturalness in the Arabic context. Semantic, conceptual, and contextual equivalence were each systematically considered throughout the adaptation process. Particular attention was paid to items referencing digital civic practices and institutional participation, domains in which direct lexical equivalence sometimes required culturally appropriate rephrasing rather than literal word-for-word translation, to preserve the intended psychological construct across linguistic and cultural contexts.

2.5. Data Analysis

Data were analyzed using SPSS version 27 and AMOS version 26. Confirmatory factor analysis (CFA) was conducted on the psychometric sample to evaluate the structural validity of each scale. Pearson correlation coefficients were computed to examine bivariate associations among study variables. Common method variance was assessed using Harman's single-factor test, with the first extracted factor accounting for 37.58% of total variance, falling below the 40% threshold. This result is reported descriptively

only; Harman's single-factor test is widely recognized as an insufficient diagnostic for common method bias, and this result should not be interpreted as meaningful evidence against method-related inflation of associations. The possibility that observed correlations are partly attributable to common method variance therefore cannot be ruled out. The hypothesized mediation model was tested using Hayes' PROCESS macro (Model 4) with 5000 bootstrap resamples and 95% bias-corrected confidence intervals, enabling estimation of the total, direct, and indirect effects of digital citizenship on community belonging through sustainable education [70,71].

3. Results

3.1. Descriptive Statistics and Correlation Analysis

Prior to testing the hypothesized mediation model, Pearson correlation coefficients were computed to examine the bivariate associations among all study variables. Table 2 presents the correlation matrix for the subscale scores and composite totals of digital citizenship, sustainable education, and community belonging.

Table 2. Pearson Correlation Matrix for Digital Citizenship Subscales, Sustainable Education Subscales, and Community Belonging Subscales and Total Scores.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. IPA	1												
2. TS	0.61 **	1											
3. CP	0.63 **	0.61 **	1										
4. NA	0.58 **	0.59 **	0.57 **	1									
5. DC	0.86 **	0.80 **	0.89 **	0.77 **	1								
6. EE	0.43 **	0.45 **	0.44 **	0.43 **	0.52 **	1							
7. IE	0.39 **	0.35 **	0.37 **	0.35 **	0.44 **	0.58 **	1						
8. QE	0.42 **	0.41 **	0.42 **	0.39 **	0.49 **	0.61 **	0.54 **	1					
9. DE	0.39 **	0.38 **	0.39 **	0.37 **	0.46 **	0.56 **	0.51 **	0.54 **	1				
10. SE	0.50 **	0.49 **	0.50 **	0.47 **	0.58 **	0.89 **	0.80 **	0.78 **	0.78 **	1			
11. IB	0.40 **	0.42 **	0.36 **	0.35 **	0.45 **	0.39 **	0.32 **	0.33 **	0.33 **	0.42 **	1		
12. CTX-B	0.35 **	0.36 **	0.34 **	0.33 **	0.40 **	0.38 **	0.34 **	0.32 **	0.34 **	0.43 **	0.48 **	1	
13. CB	0.41 **	0.43 **	0.39 **	0.38 **	0.48 **	0.44 **	0.38 **	0.37 **	0.38 **	0.48 **	0.75 **	0.94 **	1

Note. IPA = Internet Political Activism; TS = Technical Skills; CP = Critical Perspectives; NA = Networking Agency; DC = Digital Citizenship total; EE = Equality in Education; IE = Inclusiveness in Education; QE = Quality in Education; DE = Democratic Education; SE = Sustainable Education total; IB = Interpersonal Belonging; CTX-B = Context Belonging; CB = Community Belonging total. All correlations significant at $p < 0.01$ (**).

The results revealed significant positive correlations among all study variables ($p < 0.01$). At the subscale level, Internet Political Activism (IPA), Technical Skills (TS), Critical Perspectives (CP), and Networking Agency (NA) were moderately to strongly intercorrelated (r = 0.57–0.63), and each subscale demonstrated substantial associations with the digital citizenship total score (r = 0.77–0.89). Similarly, the four dimensions of sustainable education—Equality in Education, Inclusiveness in Education, Quality in Education, and Democratic Education—were positively interrelated (r = 0.51–0.61) and strongly associated with the sustainable education composite (r = 0.78–0.89). The two community belonging subscales, Interpersonal Belonging and Context Belonging, were also positively correlated (r = 0.48) and both strongly associated with the community belonging total score (r = 0.75 and 0.94, respectively).

At the composite level, digital citizenship was positively and moderately correlated with sustainable education (r = 0.582, $p < 0.001$) and community belonging (r = 0.478, $p < 0.001$). Sustainable education also demonstrated a significant moderate correlation

with community belonging (r = 0.484, $p < 0.001$). These bivariate associations collectively provided initial support for the plausibility of the hypothesized mediation model.

3.2. Mediation Analysis

The primary aim of this study was to examine whether sustainable education mediates the relationship between digital citizenship and community belonging. A simple mediation model (Model 4) was estimated using Hayes' PROCESS macro with 5000 bootstrap resamples and 95% bias-corrected confidence intervals. Table 3 presents the path coefficients, and Table 4 summarizes the total, direct, and indirect effects. The path diagram is illustrated in Figure 1.

Table 3. Unstandardized and Standardized Path Coefficients for the Mediation Model.

Outcome Variable	Predictor Variable	β (Std.)	B (Unstd.)	SE	t	*p*	R^2
Sustainable Education (M)	Digital Citizenship (X)	0.582	0.519	0.025	20.47	<0.001	0.339
Community Belonging (Y)	Sustainable Education (M)	0.311	0.245	0.029	8.59	<0.001	
Community Belonging (Y)	Digital Citizenship (X)	0.297	0.208	0.025	8.20	<0.001	0.293

Note. β = standardized coefficient; B = unstandardized coefficient; SE = standard error; M = Sustainable Education; X = Digital Citizenship; Y = Community Belonging. All paths significant at $p < 0.001$.

Table 4. Total, Direct, and Indirect Effects of Digital Citizenship on Community Belonging Through Sustainable Education.

Effect Type	B	β (Std.)	SE	95% Bootstrap CI [LL, UL]	% of Total Effect
Total effect (X → Y)	0.335	0.478	0.022	[0.293, 0.378]	100.00%
Direct effect (X → Y)	0.208	0.297	0.025	[0.158, 0.258]	62.09%
Indirect effect via SE (X → M → Y)	0.127	0.181	0.016	[0.095, 0.157]	37.89%

Note. β = completely standardized effect; B = unstandardized effect; SE = standard error; CI = bias-corrected bootstrap confidence interval based on 5000 resamples.

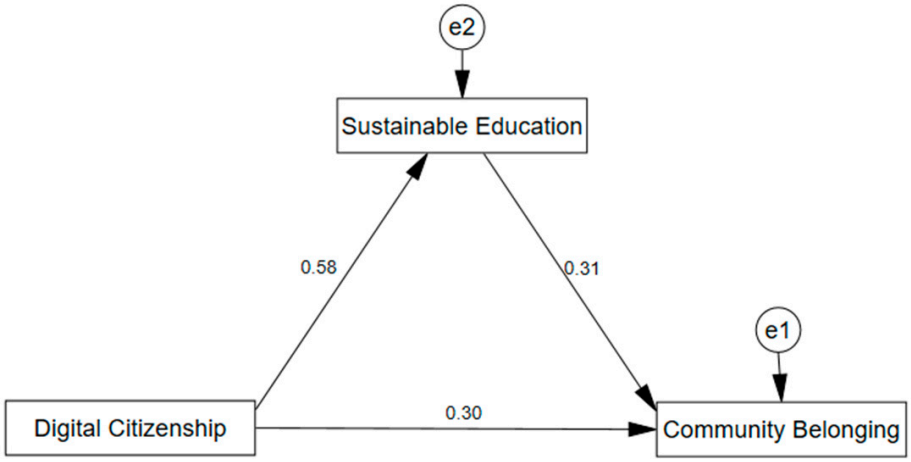


Figure 1. Path Diagram of the Mediation Model: Digital Citizenship, Sustainable Education, and Community Belonging.

With respect to the first path of the mediation model (path a; DC → SE), digital citizenship was a significant positive correlate of sustainable education (β = 0.582, B = 0.519, SE = 0.025, t = 20.47, $p < 0.001$), indicating that higher levels of digital citizenship were associated with greater sustainable education scores. The model explained 33.9% of the variance in sustainable education ($R^2 = 0.339$).

Regarding the second path of the mediation model (path b; SE → CB), sustainable education was significantly associated with community belonging after controlling for

digital citizenship (β = 0.311, B = 0.245, SE = 0.029, t = 8.59, $p < 0.001$). The direct effect of digital citizenship on community belonging (path c'; DC → CB) also remained statistically significant (β = 0.297, B = 0.208, SE = 0.025, t = 8.20, $p < 0.001$), accounting for 62.09% of the total effect. Together, digital citizenship and sustainable education explained 29.3% of the variance in community belonging ($R^2 = 0.293$).

Turning to the indirect effect, the bootstrap analysis demonstrated that sustainable education significantly mediated the relationship between digital citizenship and community belonging. As shown in Table 4, the indirect effect was statistically significant (B = 0.127, β = 0.181, SE = 0.016, 95% CI [0.095, 0.157]), given that the confidence interval did not include zero. The indirect effect accounted for 37.89% of the total effect (B = 0.335, β = 0.478, 95% CI [0.293, 0.378]). The total effect of digital citizenship on community belonging was significant (t = 15.56, $p < 0.001$), and the presence of a significant direct effect alongside a significant indirect effect indicated partial mediation. These results are statistically consistent with partial mediation by sustainable education in the relationship between digital citizenship and community belonging.

The mediation pattern observed in the present study suggests that while digital citizenship exerts a direct and meaningful influence on students' sense of community belonging, a substantial portion of this effect operates indirectly through the internalization of sustainable education values. Specifically, students who demonstrate higher levels of digital citizenship also tend to develop stronger orientations toward sustainable education principles—including social equity, inclusiveness, and democratic engagement—which, in turn, foster a deeper sense of community belonging within their academic environments.

4. Discussion

The present study examined whether sustainable education mediates the relationship between digital citizenship and community belonging among Egyptian university students. Results confirmed a partial mediation model, wherein digital citizenship was significantly associated with sustainable education and community belonging, while sustainable education independently predicted belonging after controlling for digital citizenship. The indirect effect accounted for approximately 38% of the total effect, indicating that sustainable education functions as a meaningful but incomplete statistical explanator of the association. These findings suggest that digitally engaged students tend to report greater social connectedness, and that this association is statistically consistent with partial indirect association through sustainability-oriented values including equity, inclusiveness, and democratic participation.

The observed associations align with and extend prior scholarship in meaningful ways. The direct link between digital citizenship and community belonging corroborates findings by Galioto et al. [22] and Thacker et al. [25], who demonstrated that responsible online engagement strengthens peer connectedness and institutional affiliation. The observed association between digital citizenship and sustainable education is consistent with Lozano-Díaz and Fernández-Prados [51] and Emejulu and McGregor [27], who suggested that critical digital engagement may foster justice-oriented civic values. Furthermore, the pathway from sustainable education to belonging resonates with Buchholz et al. [8] and Fajri et al. [28], who linked ethically grounded digital practices to prosocial norms.

The partial mediation pattern also parallels Cleofas and Labayo [26] and Blayone et al. [65], suggesting that democratized, sustainability-embedded digital learning environments foster inclusive community identification among undergraduate students. Within the Egyptian context, equity and democratic participation may carry particular salience for social connectedness. Egyptian university students navigate digital spaces shaped by collectivist norms, traditionally hierarchical educational structures, and growing aspirations

for civic participation, conditions under which sustainability-oriented values may serve as meaningful anchors of shared academic identity and belonging.

It is important to note that the present findings are associational in nature and do not demonstrate the effectiveness of sustainability-integrated digital interventions. The following recommendations are therefore proposed as theoretically grounded directions for practice rather than empirically validated prescriptions. Universities should deliberately integrate sustainable education principles—including social equity, democratic participation, and cultural inclusiveness—into digital learning curricula rather than focusing exclusively on technical proficiency. Instructional designers and faculty should create online learning experiences that promote ethical reflection, collaborative problem-solving, and intercultural dialogue, thereby potentially transforming digital competencies into genuine social bonds. Student affairs professionals should leverage digital platforms to build intentional communities grounded in shared sustainability values. These approaches are especially relevant in contexts like Egypt and broader Arab higher education systems and warrant empirical testing through longitudinal and experimental designs before firm institutional conclusions can be drawn.

These approaches are especially relevant in contexts like Egypt and broader Arab higher education systems, where digital transformation is accelerating alongside distinct sociocultural expectations around academic identity and communal belonging. Specifically, Egyptian university students are embedded within collectivist cultural norms that prioritize group harmony and communal obligation, operate within traditionally teacher-centered pedagogical structures that shape expectations of institutional authority, and increasingly engage with digital civic spaces amid growing aspirations for participatory education; these contextual factors likely amplified the observed associations between sustainability-oriented values and community belonging in the present sample.

Several limitations should be considered when interpreting these findings. First, the cross-sectional design precludes causal inference; all observed associations should therefore be interpreted as correlational rather than causal, and longitudinal or experimental designs are needed to establish temporal precedence. Second, reliance exclusively on self-report measures introduces susceptibility to social desirability bias. Common method variance was assessed only via Harman's single-factor test, which is widely regarded as a limited standalone diagnostic, and this constitutes a methodological limitation. Third, the sample was drawn entirely from Egyptian universities, potentially limiting generalizability to other cultural or institutional contexts. Fourth, the model explained approximately 29% of variance in community belonging, underscoring that it represents a partial explanatory framework rather than a comprehensive account; individual-level factors such as personality traits, institutional factors such as teaching quality, and sociocultural factors such as family support remain unexamined. Finally, some conceptual overlap among sustainable education components—particularly inclusiveness, equality, and democratic engagement—and community belonging may have inflated observed associations.

The present findings suggest several directions for future research. Longitudinal designs are needed to establish temporal ordering among the study variables, and experimental designs are warranted to provide causal evidence that the present cross-sectional design cannot supply. Future studies should replicate the proposed model across diverse cultural and institutional contexts—including Arab, Western, and East Asian settings—to assess the generalizability of the mediation mechanism. Researchers are encouraged to examine additional mediators and moderators, particularly faculty support and campus climate, which are theoretically compelling antecedents of belonging that may substantially account for the unexplained variance, alongside individual-level, and sociocultural variables, to develop more comprehensive explanatory models of community belonging.

Qualitative and mixed-methods approaches would further deepen understanding of how students internalize sustainability values within digital environments.

5. Conclusions

This study provides cross-sectional, correlational evidence statistically consistent with sustainable education partially accounting for the association between digital citizenship and community belonging among Egyptian university students, contributing a theoretically grounded model to an underexplored area of higher education research. The findings demonstrate that responsible digital engagement is associated with belonging not only directly but also indirectly in a pattern consistent with partial mediation through sustainability-oriented values that partially account for the participating students' social and institutional connectedness. These findings should be interpreted within the boundaries of what the model can explain. Digital citizenship and sustainable education together accounted for approximately 29% of the variance in community belonging, indicating that the proposed model captures a meaningful but limited portion of a complex outcome shaped by numerous individual, institutional, and sociocultural factors not examined here. These results offer theoretically grounded directions for future research and intervention design, suggesting that embedding equity, inclusiveness, and democratic engagement within digital learning environments represents a promising avenue worthy of empirical investigation, with the potential to contribute to the development of academically motivated, ethically grounded, and genuinely connected student communities. Future longitudinal and experimental studies incorporating additional predictors—including faculty support, campus climate, personality traits, and family context—are needed before broader conclusions about the determinants of community belonging can be drawn.

Author Contributions: Conceptualization, Y.H.R., E.A., N.A. and B.M.B.; methodology, Y.H.R., E.A., N.A. and B.M.B.; software, Y.H.R., E.A., N.A. and B.M.B.; validation, Y.H.R., E.A., N.A. and B.M.B.; formal analysis, Y.H.R., E.A., N.A. and B.M.B.; investigation, M.F.E. and M.A.N.-a.; resources, M.F.E. and M.A.N.-a.; data curation, M.F.E. and M.A.N.-a.; writing—original draft preparation, Y.H.R., E.A., N.A. and B.M.B.; writing—review and editing, Y.H.R., E.A., N.A. and B.M.B.; visualization, Y.H.R., E.A., N.A. and B.M.B.; supervision, Y.H.R.; project administration, Y.H.R.; funding acquisition, Y.H.R. Y.H.R. contributed approximately 30% of the total author contributions. E.A., N.A. and B.M.B. collectively contributed approximately 50%. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Re-search Ethics Committee of the Faculty of Education at Al-Azhar University, Dakahlia, Egypt (protocol code Ref. No. EDU-REC-2025-175, approval date 16 September 2025).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors thank all participants for their valuable contribution to this study.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

CFA	Confirmatory Factor Analysis
CI	Confidence Interval

DCS-R	Revised Digital Citizenship Scale
DC	Digital Citizenship
CTX-B	Context Belonging
CB	Community Belonging
CP	Critical Perspectives
DE	Democratic Education
EE	Equality in Education
IB	Interpersonal Belonging
IE	Inclusiveness in Education
IPA	Internet Political Activism
NA	Networking Agency
QE	Quality in Education
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SE	Sustainable Education
SES	Sustainable Education Scale
SPSS	Statistical Package for the Social Sciences
TS	Technical Skills
WIBS	Where I Belong Survey

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