

The Construction of Digital Citizenship Meaning among Informatics Students as Aspiring Technology Professionals

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Abstract

This study aims to comprehensively understand the construction of digital citizenship meaning and the ethical-social responsibility of Informatics students as prospective technology professionals from the perspective of Civic Education. This study employed a qualitative approach with an Interpretative Phenomenological Analysis (IPA) design. The research was conducted at the Department of Informatics Engineering and Computer Science, Politeknik Negeri Ujung Pandang, involving 15 active sixth-semester students as key informants selected through purposive sampling. Data were collected through semi-structured in-depth interviews and analyzed systematically through five stages of IPA analysis. Results: The data analysis produced four superordinate themes that reconstruct the meaning of digital citizenship: 1) Digital citizenship as ethical awareness in digital space; 2) Reconstruction of Informatics students' identity from technology users to technology creators; 3) Technology and Artificial Intelligence (AI) ethics as a form of digital responsibility; and 4) The foundation of society-oriented technology. The informants construed that a single line of programming code carries direct social consequences for the public, requiring technology development to mitigate algorithmic bias, maintain the transparency of intelligent systems, and ensure the protection of user data privacy. This study successfully reconstructs the meaning of digital citizenship from merely "polite internet behavior" into "ethical-civic responsibility in technology design." Future technology professionals must possess a civic orientation that is internalized into every system and program code they create.

Keywords: Digital Citizenship; Digital Ethics; Civic Education; Informatics Students; Interpretative Phenomenological Analysis.

Introduction

The development of digital technology has brought significant changes to various aspects of human life, including the ways individuals communicate, access information, work, and participate in social life. These changes have caused the living space of citizens to no longer be limited to physical space, but to also expand into digital space (Amalia et al., 2025). This shift in space requires individuals not only to have the ability to use technology, but also to understand the norms, values, rights, and responsibilities of being a citizen within a digital environment (Pramesti et al., 2025). The concept of digital citizenship emerged as a response to this massive shift.

According to Pangrazio and Sefton-Green (2021), digital citizenship is the norm of appropriate and responsible behavior in technology use, encompassing aspects of digital literacy, digital ethics, digital security, and digital rights and responsibilities. This view shows that technological capability cannot be separated from the moral and social dimensions of digital life. Furthermore, Choi and Cristol (2021) expand the concept of digital citizenship by situating it as an integral part of democratic citizenship education. Digital citizens must not only be able to operate technology, but must also possess critical thinking skills, participate positively, and understand the social consequences of their digital activities. Therefore, digital citizenship is closely linked

to the formation of citizens' character in modern society.

The current digital landscape presents new and more massive challenges, particularly with the increasing role of technology students as prospective developers of digital systems. Informatics students are no longer in a passive position as consumers or users of technology, but rather as prospective professionals who will design, build, and determine the direction of development of the technological ecosystem used by the wider community. This strategic position causes Informatics students to bear far more complex responsibilities. The technical decisions they make such as system architecture design, data governance, application security, and algorithm development can have a direct, systemic impact on users' lives. Future technology professionals cannot be equipped with technical competencies (hard skills) alone; they also need strong ethical awareness and social responsibility.

Tsamados et al. (2021) assert that information technology has an intrinsic ethical dimension because technology actively influences the way humans interact, manage information, and make decisions. This ethical challenge is growing exponentially alongside the penetration of Artificial Intelligence (AI) across various sectors. On one hand, AI offers significant efficiency opportunities; on the other, it raises crucial issues such as data privacy, algorithmic bias, system opacity (black-box), and accountability in technology use. Floridi and Cowls (2019) state that AI development requires medical or humanitarian ethical principles (digital bioethics) that place humans at the center of technological decision-making (human-centric AI).

The field of Civic Education views this phenomenon as a genuine demand for an expanded reconceptualization of the meaning of citizenship itself. Civic Education can no longer confine itself to discussing the legal-formal relationship between citizens and the state within conventional space, but must also extend to how individuals exercise their agency responsibly in digital space. Fundamental values such as responsibility, humanity, justice, and social concern must be internalized as a moral compass in engineering technology. In line with the thinking of Agus et al. (2025), civic education aims to build citizens who are personally

responsible, capable of participating, and sensitive to social issues. This perspective is highly relevant for Informatics students, who will one day hold the technological power to shape the digital living environment of society.

A number of previous studies have explored the issue of digital citizenship at the student level. A study by Al-Abdullatif and Gameil (2020) demonstrates the importance of strengthening digital citizenship practices within higher education institutions. Recent research also confirms that digital literacy and ethical awareness have a significant correlation with responsible technology use, especially amid AI technology disruption (Febrianti et al., 2025). However, despite the studies mentioned above, a clear research gap remains. Most of the existing literature on digital citizenship still generally positions students as users of technology. In-depth studies on how Informatics students—particularly at the vocational higher education level oriented toward job readiness—construct their identity as prospective creators of technology who bear citizenship responsibilities remain very limited. Theoretical integration between the field of Civic Education and the formation of professional technological character has also not been widely formulated empirically. Yet Informatics students constitute a strategic group of actors holding the key to the future digital ecosystem and landscape. Based on this gap, this research aims to gain an in-depth understanding of how Informatics students construct the meaning of digital citizenship as prospective technology professionals from the perspective of Civic Education.

This research offers a novel contribution by reconstructing the concept of digital citizenship from merely "polite behavior of internet users" into "ethical-civic responsibility in technology design." The idea introduced through this study is that future technology professionals must possess a civic orientation in every line of code and every system they create. The research problems in this study are formulated as follows:

1. How is the meaning of digital citizenship constructed among Informatics students as prospective technology professionals, from the perspective of Civic Education?

2. How do Informatics students interpret ethical and social responsibility in the use and development of digital technology?

Method

This research employed a qualitative approach with an interpretative phenomenological design (Interpretative Phenomenological Analysis/IPA). This approach was used to understand students' subjective experiences and construction of meaning regarding digital citizenship as prospective technology professionals from the perspective of Civic Education. IPA was chosen because it is capable of exploring how individuals make meaning of experiences related to a particular phenomenon (Smith et al., 2022).

The research was conducted in the Department of Informatics and Computer Engineering, Ujung Pandang State Polytechnic. Informants were selected using a purposive sampling technique, with the criteria being active sixth-semester students in the Department of Informatics and Computer Engineering who had completed the Civic Education course and had experience in the use and development of digital technology. The research involved 15 students as the primary informants. Informants' identities were anonymized using codes I1 through I15.

Research data were collected through in-depth, semi-structured interviews. The interview guide was developed based on the research focus, which included: (1) the meaning of digital citizenship; (2) the identity of Informatics students as prospective technology professionals; (3) the ethics of technology development and digital responsibility; (4) the role of Artificial Intelligence (AI) in academic and professional life; and (5) the relationship between technology, society, and the values of Civic Education.

Interview data were analyzed using the stages of Interpretative Phenomenological Analysis (IPA) according to Smith et al. (2022). The analysis process was carried out through five systematic stages to capture the psychological essence and in-depth meaning-making of the informants. These stages of data analysis are summarized briefly in Table 1.

Table 1. Stages of Data Analysis in Interpretative Phenomenological Analysis (IPA)

Stage	Analysis Activity	Resulting Output
Reading the Transcript	Reading the interview transcripts repeatedly and re-listening to the audio recordings.	Thorough initial contextual understanding.
Initial Noting	Making marginal notes covering descriptive, linguistic, and conceptual aspects of the text.	A collection of initial reflective notes on the transcript draft.
Developing Emergent Themes	Transforming initial notes into meaningful phrases that capture the essence of the informants' experiences.	A list of tentative emergent themes.
Clustering Themes	Mapping and classifying emergent themes that share conceptual connections.	Final theme clusters (superordinate themes).
Composing Master Themes	Formulating the structure of master themes to be integrated into the results and discussion narrative.	Analysis results representing the informants' experiences.

The credibility of the data was maintained through source triangulation, namely comparing experiences across informants, as well as member checking to ensure the correspondence between the researcher's interpretations and the informants' experiences.

In addition, documentation of the analysis process (audit trail) was carried out to maintain the transparency and credibility of the research (Ahmed, 2024).

Result and Discussion

The data analysis process using the Interpretative Phenomenological Analysis (IPA) approach on 15 informants produced four master themes representing the construction of meaning of digital citizenship among Informatics students as prospective technology professionals. These four themes comprehensively address the study's two research questions, in sequence. The first research question, concerning how students interpret digital citizenship within the framework of Civic Education, is thoroughly addressed through Theme 1 (ethical awareness), Theme 2 (identity reconstruction), and Theme 4 (society-oriented technology foundations). Meanwhile, the second research question, concerning the interpretation of ethical and social responsibility, is specifically addressed through the clusters of Theme 2 (systemic impact of code) and Theme 3 (technology and AI ethics). The structure of the relationships among the master themes, emergent themes, and indicator representations of meaning from the informants is summarized in Table 2.

Table 2. Matrix of the Construction of Meaning of Digital Citizenship among Informatics Students

Master Theme (Superordinate Theme)	Emergent Theme	Informants' Representation of Meaning
Digital citizenship as ethical awareness in digital space	- Internalization of cyber norms - Self-regulation in digital interactions - Respect for others' digital rights	- Interpreting cyberspace as a real social environment bound by moral rules. - Emphasizing the importance of self-control and

		information filtering for the sake of collective safety.
Reconstruction of Informatics students' identity: From technology users to technology creators	- Shift in sociological role - Awareness of the systemic impact of code/programs - Professional accountability	- Recognizing their strategic position as shifting from mere internet consumers to system architects. - Interpreting that a single line of programming code has a direct social impact on the public.
Technology and Artificial Intelligence ethics as a form of digital responsibility	- Mitigation of AI algorithmic bias - Transparency of intelligent systems - Protection of macro data privacy	- Rejecting the development of technology that is discriminatory or harmful to certain groups. - Interpreting digital responsibility as a commitment to safeguarding the confidentiality of user data.
Civic Education as the foundation of society-oriented technology	- Integration of humanistic values in IT - Reconceptualization of professional orientation - Design of inclusive technology.	- Making Pancasila and Civic Education a moral compass when designing applications. - Shifting the orientation of technology creation from mere profit to social welfare.

Based on the mapping presented in Table 2, the informants' psychodynamics and cognitive construction form a linear-circular flow that is mutually influencing. To understand how this internalization of values transforms from the

individual level to the professional axiological level, Figure 1 presents a theoretical model that integrates these four themes.

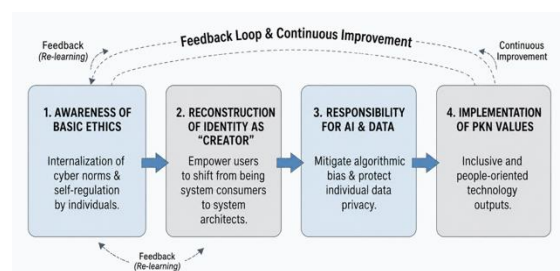


Figure 1. Flowchart of the Transformation of Professional Digital Citizen Awareness

A comprehensive elaboration of this theoretical model is examined in depth through descriptive narrative and interpretative analysis in the following section, beginning from the level of fundamental ethical awareness through to the operationalization of citizenship values within the technology profession.

1. Digital Citizenship as Ethical Awareness in Digital Space

This first theme describes how informants construct digital citizenship as extending beyond mere technical or instrumental ability to access the internet. Informants interpreted digital space as a new social environment demanding moral compliance equivalent to that of physical space. This phenomenon is reflected in the following informant statement:

"At first I thought digital citizenship was just about knowing how to use the internet safely and not spreading hoaxes. However, after learning more deeply, it's about how we uphold ethics and respect other people's privacy rights on the internet, just as we live as neighbors in the real world." (Informant I3, personal communication, 2026).

A similar statement was also expressed by another informant, who emphasized the importance of self-regulation when interacting in cyberspace:

"We have freedom of speech on social media, but that freedom is limited by other people's right to feel safe. So, for me, digital citizenship is the awareness to control oneself in order not to harm others digitally." (Informant I9, personal communication, 2026).

The general views of other informants (I2, I4, I10, and I8) further reinforced the finding that digital activity is not merely an interaction between screens, but a dignified relationship between human beings. These interview results indicate that the informants had deeply internalized norms of cyber behavior. This ethical awareness emerged as students' adaptive reaction to the high levels of polarization, cyberbullying, and disinformation prevalent within the local digital ecosystem. Informants identified that moral degradation in cyberspace stems from internet users' failure to project real-world moral law into virtual interactions.

This interpretation aligns with the conceptualization of Pangrazio and Sefton-Green (2021), who state that digital citizenship is a norm of appropriate and responsible behavior in technology use. Informants no longer viewed technology as a value-free entity, but rather as an integrated public space with moral consequences. This critical and reflective character of digital citizens in using digital media reflects the strengthening of the pillar of democratic awareness within the cyber environment, as affirmed by Choi and Cristol (2021).

2. Reconstruction of Informatics Students' Identity: From Users to Creators of Technology

The second theme identifies a shift in the sociological and professional identity experienced by final-year Informatics Engineering students. Informants no longer viewed themselves merely as consumers (users) who utilize applications, but as architects or creators who determine how a digital system operates. This experience of identity change was conveyed by one informant:

"In the past, if an application had a bug or a data leak, I could only get angry as a user. Now, my position has changed. I am the one designing the database and writing the code. I realize that a single line of wrong or insecure code can endanger the data of thousands of people." (Informant I7, personal communication, 2026).

Awareness of the significant impact of the technology products they create has triggered the growth of a more specific sense of civic responsibility. Another informant added:

"As prospective Informatics graduates, our job isn't just to build sophisticated applications that sell well in the market. We are the people who build digital infrastructure. This new identity makes me think that these coding skills have a real social impact." (Informant I12, personal communication, 2026).

Deep reflections from I4, I6, I15, and I13 also revealed a psychological manifestation in the form of moral responsibility inherent to technical expertise (technical accountability). When an Informatics student realizes that the programming logic they construct can dictate the social behavior of thousands of people, they experience what may be called a "maturation of sociological role." They understand that a software bug or security vulnerability is no longer merely a technical computing problem, but a professional moral failure that threatens citizens' right to feel safe.

This shift in perspective offers a new theoretical contribution to the study of digital citizenship. Most prior research, such as the studies by Al-Abdullatif and Gameil (2020) or Pangrazio and Sefton-Green (2021), tends to position students as passive subjects who need to be taught digital literacy for the sake of personal security or self-protection from cybercrime.

The findings of this study, in contrast, demonstrate that higher technology education is able to stimulate the reconstruction of students' identity—from merely being polite internet users to becoming active agents responsible for the comfort and security of the wider community's digital ecosystem through the technology products they themselves engineer. This new identity bridges the gap between the ethics of the computing profession (such as the ACM Code of Ethics) and the responsibility of defending the nation within the cyber domain.

The relevance of the ACM Code of Ethics and Professional Conduct in this context is crucial as a global moral compass guiding this process of identity reconstruction. The code of ethics formulated by the Association for Computing Machinery asserts that every technology professional is obligated to integrate social welfare and respect for human rights into every system they design (Wolf et al., 2019). When the informants became aware of the systemic impact of their programming code, they were, indirectly, already practicing the core ACM principles of avoiding harm and

upholding social justice (Wolf et al., 2019). The unification of this internationally scaled professional ethical responsibility with local values of national defense demonstrates that students' new identity as creators is no longer free of value, but rather firmly bound to a moral commitment to protect citizens' digital rights (Widder et al., 2023).

3. Technology and Artificial Intelligence Ethics as a Form of Digital Responsibility

The third theme highlights informants' views on modern technological disruption, particularly Artificial Intelligence (AI). Informants constructed the idea that technical expertise in developing intelligent algorithms must be balanced with an understanding of its ethical implications, such as algorithmic bias, systemic discrimination, and personal data protection. One informant expressed both concern and ethical commitment:

"When we were learning to build an AI model for data classification, our lecturer warned us about bias. If the training data is biased, the AI's decisions will be unfair to certain groups. That's when I understood that building AI requires great moral responsibility so as not to create new forms of injustice." (Informant I5, personal communication, 2026).

The issue of data accountability was also a crucial concern in informants' interpretations, particularly regarding user privacy:

"AI development is extremely data-hungry when it comes to personal information. As someone who will manage that system in the future, I interpret digital responsibility as a commitment to protecting the public's data privacy and being transparent about how the algorithm works." (Informant I14, personal communication, 2026).

Similar concerns regarding the transparency of black-box AI systems were expressed by I4, I8, I13, and I15, who felt that a lack of algorithmic clarity could violate citizens' right to information. Students highlighted how current social media algorithms are designed to maximize user engagement at the expense of users' mental health or by fueling political polarization. This is the point at which informants redefined their digital responsibility: refusing industry commissions if a system's design would harm the social fabric. These empirical views of the

informants validate the argument of Tsamados et al. (2021) regarding the intrinsic ethical dimension of information technology that actively engineers human interaction.

The integration of artificial intelligence into the Informatics curriculum ultimately demands fulfillment of the principles of human-centric AI: beneficence, non-maleficence, autonomy, justice, and explicability (Floridi & Cowls, 2019). The Informatics students in this study successfully constructed the meaning that a technology professional's digital responsibility is no longer merely about ensuring a program is bug-free, but about ensuring that the algorithms they create do not harm humanistic values and social justice.

4. Civic Education as the Foundation of Society-Oriented Technology

The final theme explores the relevance of the Civic Education course in shaping the thinking paradigm of engineering students. Informants constructed the values of nationhood, humanity, and justice learned in Civic Education as a moral compass, or philosophical foundation, for the technology profession they will pursue. This reflection was expressed by one informant:

"The Civic Education course initially felt theoretical and far removed from the world of coding. However, when we discussed human rights and social concern, I immediately connected it to web accessibility. Technology must be inclusive—it should be usable by people with disabilities too. That's a way of putting humanistic values into practice through my profession." (Informant I1, personal communication, 2026).

This internalization of societal values also influenced their future professional vision:

"Civic Education gave me the perspective that the technology we create must be oriented toward the public good, not merely toward chasing corporate profit. Pancasila values such as social justice must be reflected in the digital systems we build for public service." (Informant I11, personal communication, 2026).

A synthesis of interpretations from other informants (I11 and I13) affirmed that the nation's digital sovereignty can be achieved if local developers possess a spirit of national defense manifested through cyber protection. This construction of meaning demonstrates that

Civic Education has succeeded in fulfilling its function of reconceptualizing the role of citizens in the modern era. Civic Education is no longer trapped in conventional legal-formal indoctrination, but has transformed into a catalyst that fosters civic orientation among prospective technology professionals.

This phenomenon aligns with the vision of Agus et al. (2025) regarding the urgency of shaping a type of citizen oriented toward social justice (a justice-oriented citizen). Through this integration, Informatics students grow not only into competent technocrats, but also into cyber citizens with a high degree of social sensitivity for designing digital spaces that are safe, ethical, and democratic.

Curricular Contextualization: The Domain of Integration between Civic Education and Computer Science

To understand specifically how the meanings described above were formed, this study identifies the curricular intersection points where this process of internalization occurred. Based on the informants' reflections, the Civic Education course content that left the deepest impression and was most successfully transformed into computer science was the material on Citizens' Rights and Obligations, as well as Indonesia's Geopolitics and Geostrategy (National Sovereignty).

When the material on rights and obligations was taught, Informatics students automatically projected it onto issues of cybersecurity and users' data privacy rights. They interpreted ensuring consumer data security as a manifestation of fulfilling citizens' human rights within the digital world.

On the other hand, the material on national sovereignty and national defense was transformed by students into the concept of digital sovereignty. Given that Indonesia's current digital landscape is still dominated by foreign infrastructure platforms, the informants felt that their coding skills served as a modern weapon to free the nation from digital colonialism.

This curricular connection demonstrates that an interdisciplinary learning model between the humanities (Civic Education) and the exact sciences (Informatics) is not only feasible, but an absolute prerequisite for

producing engineering graduates with a strong sense of national character. This contextualization expands the theory of Civic Humanism into the era of artificial intelligence, in which binary code must be subordinate to civilized humanistic values.

Synthesis of the Construction of Meaning of Digital Citizenship

Overall, the four master themes identified in this study are interwoven and form a single circular unity in constructing the meaning of digital citizenship for prospective technology professionals. This construction of meaning is no longer instrumental-passive in nature, but has transformed into an axiological-active responsibility. The Informatics students in this study successfully constructed the understanding that every line of programming code, database architecture, and artificial intelligence model they design constitutes a tangible form of implementing the rights, obligations, and social responsibilities of a cyber citizen.

This finding simultaneously affirms that the integration of the field of Civic Education with technology education has proven capable of giving rise to a new concept referred to as professional civic orientation. In this study, professional civic orientation is defined as a paradigm that positions ethical awareness and social responsibility as an inherent dimension—not an addition—to professional competence in the field of technology.

This paradigm has three main characteristics. First, it is integrative in nature, uniting technical competencies (hard skills) with citizenship values (humanity, justice, social responsibility) as an inseparable unity within professional practice. Second, it is active-anticipatory in nature, in which technology professionals do not wait for negative impacts to occur before acting ethically, but instead proactively anticipate the social consequences of every technical decision—from system architecture design to algorithm development—before the product is used by the wider community. Third, it is transformative with respect to professional identity, as it changes the way students and technology professionals view themselves: from mere technicians who work according to

client specifications, into cyber citizens who carry a public mandate through every technology product they create. Thus, professional civic orientation functions as a conceptual bridge between two domains that have long been regarded as separate—value-oriented civic education and competency-oriented technical education—while simultaneously offering a proposed framework for the development of the Civic Education curriculum in vocational higher engineering education.

Conclusion

Based on the Interpretative Phenomenological Analysis (IPA), this study concludes two main points regarding the construction of meaning of digital citizenship among Informatics students: Informatics students undergo a profound reconstruction of their sociological identity, shifting from mere users to creators of technology. Within the framework of Civic Education, they interpret cyberspace as a genuine social environment, in which their role as system architects carries a civic responsibility to design technology oriented toward the public good. Ethical responsibility is concretely understood through an awareness of the systemic impact of every line of programming code. Amid the disruption of AI, this is manifested through a commitment to mitigating algorithmic bias, maintaining system transparency, and ensuring the protection of users' data privacy. This study reconstructs the concept of digital citizenship from merely "polite internet behavior" into "ethical responsibility in technology design." The implication is that Civic Education in technology-focused higher education institutions needs to be integrated with computing ethics in order to shape professionals who possess a civic orientation.

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