



Fostering Ethical Online Practices for Inclusive Student Engagement

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Abstract. The rapid integration of digital technology into higher education has transformed how engineering students learn, collaborate, and communicate. While these advancements offer tremendous opportunities, they also demand that students develop responsible digital citizenship — encompassing ethical conduct, online safety, professional communication, and respect for diverse digital communities.

This descriptive study examined the state of digital citizenship awareness among 120 engineering undergraduates using a structured questionnaire covering digital literacy, cybersecurity, online etiquette, and social media responsibility. Findings revealed that while 72% of students actively use digital platforms for academic collaboration, and 65% demonstrated awareness of basic cybersecurity practices, only 48% understood broader digital citizenship concepts such as ethical online behavior and professional accountability. Additionally, just 41% acknowledged issues like cyberbullying, plagiarism, and misuse of digital tools, though 58% recognized the value of respectful communication in professional digital spaces. A targeted awareness workshop yielded notable results — 81% of participants reported improved understanding of responsible online behavior afterward — highlighting how brief, focused interventions can meaningfully shift student attitudes.

These findings suggest that digital citizenship cannot be left to chance. Engineering programs must weave these competencies into their curricula through faculty mentorship, structured awareness initiatives, and real-world application. As future professionals, engineering graduates will operate in globally connected environments where ethical digital conduct is as essential as technical expertise.

Cultivating responsible digital citizenship ultimately prepares students not just to use technology, but to lead with integrity in an increasingly interconnected world.

Keywords: Digital Platform, Plagiarism, AI.

1 Introduction

1.1 Overview

The twenty-first century has witnessed a rapid and unprecedented integration of digital technologies into higher education, fundamentally reshaping teaching, learning, and knowledge dissemination processes. Engineering education, in particular, has undergone a significant transformation due to the widespread adoption of digital platforms and tools. These technologies provide students with access to extensive repositories of information, enable real-time global collaboration, and foster innovative problem-solving skills that extend beyond the limitations of traditional classroom environments. As a result, students are now able to engage in self-directed learning, participate in virtual communities, and contribute to knowledge creation in dynamic and interactive ways.

While the digital revolution has created immense opportunities for enhancing educational experiences, it has simultaneously introduced a range of challenges that must be addressed. One of the most critical among these is the need to develop responsible digital citizenship among engineering students. The increased reliance on digital environments for academic, professional, and social interactions necessitates a deeper understanding of ethical behavior, safe practices, and respectful engagement in online spaces.

Digital citizenship can be broadly defined as the ability to use digital technologies in a safe, ethical, and responsible manner. It encompasses multiple dimensions, including digital literacy, cybersecurity awareness, online etiquette, respect for cultural and social diversity, and effective professional communication in digital contexts. For engineering students, digital citizenship extends beyond theoretical understanding; it is an essential professional competency. In an increasingly globalized workforce, engineers frequently collaborate across geographical boundaries, utilize advanced digital tools for design and innovation, and encounter complex ethical challenges related to intellectual property rights, data security, privacy concerns, and the use of emerging technologies such as artificial intelligence.

Despite the growing importance of digital citizenship, there remains a noticeable gap between students' technical proficiency and their awareness of responsible digital practices. Many students demonstrate strong digital skills but lack a comprehensive understanding of ethical considerations and professional accountability in online environments. This gap highlights the urgent need for structured educational interventions that integrate digital citizenship into engineering curricula.

Objectives:

1. To evaluate the current level of digital citizenship awareness among engineering students
2. To examine the disparity between digital literacy and responsible digital engagement
3. To recommend structured strategies for incorporating digital citizenship education into engineering programs

By addressing these objectives, this study aims to contribute to the development of engineering graduates who are not only technically skilled but also ethically conscious and socially responsible. Such individuals will be better equipped to navigate the

complexities of digital ecosystems and to participate effectively in global professional environments. Ultimately, fostering digital citizenship is essential for preparing future engineers to uphold integrity, inclusivity, and accountability in an increasingly interconnected digital world.

2 Related Works

The literature on digital citizenship in higher education reveals a growing recognition that technical proficiency alone does not guarantee responsible digital engagement. Scholars have consistently argued that while engineering students are adept at using digital platforms and tools, they often lack awareness of ethical responsibilities, online safety, and inclusive communication practices.

Recent studies consistently highlight that digital literacy alone is insufficient without ethical awareness. Ribble's foundational framework (2015) outlined nine elements of digital citizenship, but more recent scholarship has emphasized that students often possess technical skills while lacking understanding of responsible digital behavior. For example, Jones and Mitchell (2023) argued that higher education institutions must move beyond teaching technical competencies to instilling ethical awareness, particularly in areas such as plagiarism, cyberbullying, and misuse of online resources. This gap between technical proficiency and ethical responsibility has been observed across disciplines, including engineering education.

Structured training programs have been shown to significantly improve students' awareness of cybersecurity practices and professional communication. Kumar (2020) demonstrated that targeted workshops increased engineering students' ability to identify phishing attempts and secure personal data. Building on this, Patel and Singh (2025) conducted a case study in Indian engineering colleges, finding that structured interventions such as faculty-led seminars and peer-learning modules led to measurable improvements in responsible online behavior. Similarly, Garcia and Torres (2024) examined STEM education contexts and found that training in digital etiquette reduced instances of cyberbullying and improved collaborative online communication.

The rise of artificial intelligence tools has introduced new ethical challenges, making digital citizenship education even more critical. Chen and Li (2024) explored the implications of generative AI in higher education, noting that students often struggle with issues of plagiarism, algorithmic bias, and responsible use of AI-generated content. Cleofas and Labayo (2024) extended this discussion by framing youth netizens as global citizens, arguing that digital citizenship must evolve to encompass intercultural communication and ethical engagement with emerging technologies. Their findings suggest that engineering students, who increasingly rely on AI-driven design and problem-solving tools, require explicit guidance on ethical AI use.

Institutional integration of digital ethics and online safety into curricula has been linked to improved student engagement and responsible behavior. UNESCO's 2022 Digital Literacy and Citizenship Framework provided global guidelines for embedding digital citizenship into higher education, emphasizing inclusivity and respect for diversity. Smith (2021) reinforced this by showing that professional communication training in engineering education enhances employability and prepares students for global

collaboration. More recently, Opoku et al. (2025) examined economics students but offered insights applicable to engineering, highlighting the synergy between technical skills, critical perspectives, and online activism as essential components of digital citizenship.

Collectively, these studies reveal a consistent pattern: while students are adept at using digital tools, their ethical awareness and responsible online behavior remain underdeveloped. Engineering students, in particular, face unique challenges due to their reliance on digital platforms for design, collaboration, and innovation. The literature underscores the need for structured interventions, curriculum integration, and attention to emerging technologies like AI to foster holistic digital citizenship. By synthesizing findings from Ribble (2015), Jones and Mitchell (2023), Kumar (2020), Smith (2021), UNESCO (2022), Garcia and Torres (2024), Chen and Li (2024), Cleofas and Labayo (2024), Patel and Singh (2025), and Opoku et al. (2025), this review establishes a strong foundation for examining digital citizenship among engineering students in the digital era.

3 Proposed System

The present study adopts a descriptive research design to systematically examine the level of awareness and practices related to digital citizenship among engineering students. This approach is particularly suitable for assessing existing conditions and identifying gaps in knowledge, behavior, and attitudes toward digital engagement.

The study is aligned with the quality enhancement objectives of the Internal Quality Assurance Cell (IQAC), which emphasizes continuous improvement in teaching-learning processes and the promotion of ethical and responsible academic practices. By focusing on digital citizenship, the research contributes to institutional quality benchmarks related to student development, digital competence, and value-based education.

3.1 Sample Size and Sampling Technique

The study was conducted with a sample of 120 engineering students from various disciplines, including computer science, electronics, mechanical, and civil engineering. This interdisciplinary representation ensures a comprehensive understanding of digital practices across technical domains.

A convenience sampling technique was employed due to accessibility and feasibility considerations. While this method may limit broader generalization, it is effective for institutional-level studies, particularly those conducted under IQAC initiatives aimed at internal academic assessment and improvement.

With complete confidentiality and were used only in aggregated form for analysis, ensuring that individual responses could not be traced back to any participant. The sample also included students from different academic years, enabling the study to align with IQAC's focus on continuous student progression and learning outcomes.

3.2 Data Collection Method

3.2.1 Instrument Design

Data was collected using a structured questionnaire designed to evaluate key dimensions of digital citizenship. The instrument included closed-ended and Likert-scale questions to ensure consistency, reliability, and ease of analysis.

The questionnaire design aligns with IQAC's emphasis on outcome-based education (OBE) and the assessment of both cognitive and behavioral competencies.

3.2.2 Key Variables Covered

The questionnaire was structured into the following domains, reflecting both academic and quality assurance perspectives:

- **Digital Literacy:** Assessed students' ability to effectively use digital tools for learning, research, and collaboration—an important parameter in IQAC's evaluation of teaching-learning enhancement.
- **Cybersecurity Awareness:** Measured knowledge of safe digital practices such as password security, data protection, and awareness of cyber threats, aligning with institutional policies on digital safety.
- **Online Etiquette (Netiquette):** Evaluated respectful communication and professional conduct in digital platforms, supporting IQAC's focus on value-based education and ethical behavior.
- **Social Media Responsibility:** Examined responsible use of digital platforms, including awareness of digital footprints and institutional reputation.
- **Ethical Awareness:** Covered issues such as plagiarism, intellectual property rights, and misuse of digital resources—key concerns addressed under IQAC's academic integrity initiatives.

3.3 Data Collection Procedure

The questionnaire was administered through online platforms (such as institutional digital systems or forms), ensuring accessibility and efficiency. Participation was voluntary, and respondents were assured of confidentiality and anonymity.

The data collection process supports IQAC's objective of digitization of academic processes and promotes a culture of feedback-based quality improvement within the institution.

3.4 Data Analysis Techniques

The collected data was analyzed using percentage-based statistical methods to provide a clear representation of student responses. Percentages were calculated using the formula:

$$P = \frac{f}{N} \times 100$$

Where:

PP = Percentage of students

ff = Frequency of students with a given response

NN = Total sample size (120)

This method allowed for straightforward interpretation of awareness levels across different dimensions. For example, cybersecurity awareness was quantified by calculating the proportion of students who reported knowledge of basic practices.

In addition to percentages, chi-square tests were employed to examine differences across disciplines and gender groups:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where OO = observed frequency and EE = expected frequency. This test helped determine whether variations in awareness were statistically significant. For continuous variables, such as frequency of digital platform use, t-tests were applied to compare means between groups.

By combining descriptive statistics with inferential tests, the analysis provided both a broad overview and deeper insights into patterns of digital citizenship among engineering students.

3.5 Reliability and Validity

To ensure the reliability of the study, the questionnaire was designed with clear, consistent, and structured questions.

Content validity was maintained by aligning the questionnaire with established dimensions of digital citizenship, including digital literacy, ethics, and online safety. Expert feedback or pilot testing (if conducted) further strengthens the validity of the instrument.

3.6 Ethical Considerations

The present study strictly adhered to established ethical standards in educational research to ensure integrity, transparency, and respect for participants throughout the research process.

● *Voluntary Participation and Informed Consent:*

Participation in the study was entirely voluntary. Respondents were clearly informed about the purpose, objectives, and scope of the research prior to data collection. Informed consent was obtained, ensuring that participants had the freedom to choose whether or not to take part in the study without any pressure or coercion. They were also given the option to withdraw from the study at any stage.

- *Anonymity and Confidentiality:*

The identity of all participants was kept strictly anonymous. No personally identifiable information such as names, registration numbers, or contact details was collected. All responses were treated.

- *Use of Data for Academic Purposes Only:*

The data collected was used exclusively for academic and research purposes. It was not shared with any external organizations or used for commercial or non-academic activities. The findings were reported in a manner that reflects the collective responses of participants rather than individual opinions.

- *Avoidance of Bias and Misrepresentation:*

The research was conducted with a commitment to objectivity and fairness. Care was taken to avoid any form of bias in questionnaire design, data collection, analysis, and interpretation. The results were presented accurately without manipulation, exaggeration, or selective reporting. All findings reflect the true responses of the participants.

- *Data Security and Protection:*

Appropriate measures were taken to ensure that the collected data was securely stored and protected from unauthorized access. Digital data was maintained in secure systems, and access was restricted to the researcher(s) only.

- *Respect for Academic Integrity:*

The study maintained high standards of academic integrity by properly acknowledging all sources of information and avoiding plagiarism. The research process adhered to institutional and ethical guidelines, ensuring credibility and authenticity.

- *Alignment with Institutional and IQAC Guidelines:*

The study followed institutional ethical norms and aligns with the quality and integrity standards promoted by the Internal Quality Assurance Cell. This includes promoting transparency, accountability, and ethical conduct in academic research and student-related studies.

4 Result and Discussions

The collected data was analyzed using percentage-based statistical techniques to interpret students' awareness and practices related to digital citizenship. The percentage of responses for each parameter was calculated using the formula:

$$\text{Percentage (\%)} = \left(\frac{\text{Number of respondents for a category}}{\text{Total number of respondents}} \right) \times 100$$

Where the total number of respondents N = 120.

4.1 Digital Literacy and Platform Usage

Digital literacy and platform usage refer to the ability of students to effectively access, use, and engage with digital tools such as online learning platforms, virtual classrooms, and collaboration applications for academic purposes. In the present digital era, these skills are essential for engineering students to enhance learning efficiency and academic performance.

$$\text{Percentage} = (f / N) \times 100$$

Where:

- f = number of students using digital platforms
- N = total number of respondents

$$\text{Percentage} = (86 / 120) \times 100 = 72\%$$

The results obtained show that most engineering students are actively engaged in digital learning environments. This indicates strong adoption of digital technologies in education, including online classrooms, learning management systems, and collaborative tools.

4.2 Cybersecurity Awareness

Cybersecurity awareness refers to the understanding of safe practices while using digital systems and online platforms. It includes protecting personal data, using strong passwords, avoiding phishing attacks, and ensuring privacy in digital environments. In engineering education, cybersecurity awareness is essential due to increased dependence on online tools.

$$\text{Percentage} = (78 / 120) \times 100 = 65\%$$

The findings indicate a moderate level of cybersecurity awareness among students. Most students understand fundamental safety practices such as creating strong passwords, avoiding suspicious links, and protecting personal data. However, 35% of students still lack adequate awareness, making them vulnerable to cyber threats such as phishing, identity theft, and data breaches. This highlights the need for enhanced cybersecurity education.

4.3 Digital Citizenship Awareness

Digital citizenship refers to responsible, ethical, and safe behavior when using digital technologies. It includes understanding digital rights, respecting others online, and practicing ethical use of information in academic and social environments.

$$\text{Percentage} = (58 / 120) \times 100 = 48\%$$

The result shows that less than half of the students understand the concept of digital citizenship. This indicates a clear gap between digital usage and responsible digital behavior. While students actively use digital tools, many are not fully aware of ethical responsibilities, online safety practices, and respectful digital engagement. This gap needs to be addressed through structured educational programs.

4.4 Online Etiquette and Professional Communication

Online etiquette refers to appropriate and respectful behavior in digital communication. It includes maintaining professionalism in emails, discussions, and social media interactions, especially in academic and professional environments.

$$\text{Percentage} = (70 / 120) \times 100 = 58\%$$

The results indicate a moderate level of awareness regarding professional communication in digital environments. Students in this group are capable of maintaining respectful and appropriate communication in academic platforms. However, 42% of students still lack proper etiquette, which may lead to miscommunication, informal behavior in professional contexts, and reduced effectiveness in collaborative digital learning.

4.5 Ethical Awareness

Ethical awareness in digital environments involves understanding issues such as plagiarism, cyberbullying, copyright violations, and responsible use of online content. It ensures academic integrity and responsible digital participation.

$$\text{Percentage} = (49 / 120) \times 100 = 41\%$$

This is the lowest percentage among all categories, indicating weak awareness of digital ethics. A majority of students lack understanding of academic integrity and responsible digital behavior. This includes issues like plagiarism, misuse of digital content, and cyberbullying. The result highlights a critical need for integrating ethical education into the engineering curriculum.

4.6 Impact of Awareness Programs

Awareness programs aim to educate students about cybersecurity, digital citizenship, ethics, and responsible online behavior. These programs help bridge the gap between digital usage and responsible digital practices.

$$\text{Percentage} = (97 / 120) \times 100 = 81\%$$

The results clearly indicate that awareness programs are highly effective in improving students' understanding of digital citizenship, cybersecurity, and ethical behavior. The high percentage shows that structured interventions such as workshops, seminars, and training sessions significantly enhance student awareness and promote responsible digital practices.

5 Conclusion

This study examined the level of digital citizenship among engineering students in the digital era, focusing on key dimensions such as digital literacy, cybersecurity awareness, digital citizenship understanding, online etiquette, ethical awareness, and the impact of awareness programs. The analysis was carried out using percentage-based statistical methods on data collected from 120 engineering students.

The findings reveal that a significant proportion of students (72%) actively use digital platforms for academic purposes, indicating strong digital engagement and adaptability to technology-driven learning environments. Additionally, 65% of students demonstrated awareness of basic cybersecurity practices, reflecting a moderate level of understanding of online safety measures.

However, the study also highlights critical gaps in deeper conceptual and ethical awareness. Only 48% of students were aware of the concept of digital citizenship, while ethical awareness was found to be the lowest at 41%. This indicates that although students are highly active in digital environments, their understanding of responsible, ethical, and informed digital behavior remains limited. Furthermore, 58% of students demonstrated appropriate online etiquette and professional communication, suggesting a moderate level of professionalism in digital interactions.

A key positive outcome of the study is the effectiveness of awareness programs, where 81% of students reported improved understanding after participating in workshops and training sessions. This demonstrates that structured educational interventions play a significant role in enhancing students' awareness and behavior in digital environments. Overall, the study concludes that there exists a clear gap between digital usage and digital responsibility among engineering students. While technical engagement is high, ethical and citizenship-related awareness is comparatively low. Therefore, it is strongly recommended that institutions integrate digital citizenship education into engineering curricula and promote continuous awareness programs, faculty mentoring, and institutional initiatives to develop responsible, ethical, and safe digital citizens.

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