Digital Citizenship Competencies for Responsible AI Use among University Students

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ABSTRACT

The increasing integration of Generative Artificial Intelligence (AI) in higher education has transformed teaching, learning, and knowledge creation while simultaneously raising concerns related to ethical use, academic integrity, information credibility, privacy, and digital well-being. These challenges highlight the need to strengthen university students' digital citizenship competencies for the responsible use of AI. The present study aimed to assess university students' digital citizenship competencies for responsible AI use and compare them with respect to gender, faculty, and level of study. A descriptive survey method was employed, and a sample of 320 Undergraduate and Postgraduate students from the Arts and Science faculties of selected government and private universities in Ahmedabad was selected using simple random sampling. As a novel contribution, the study developed the Responsible AI Digital Citizenship Framework (RADCF) through a systematic review of contemporary literature, component matrix analysis, and frequency analysis of internationally recognized frameworks. Based on the framework, the Responsible AI Digital Citizenship Scale (RADCS) was constructed and administered for data collection. The findings indicated that university students possessed a moderate to high level of digital citizenship competencies for responsible AI use across all five competency domains: AI Literacy and Digital Understanding, Information Evaluation and Critical Thinking, Ethical and Responsible AI Use, Privacy, Security and Digital Well-being, and Responsible AI-enabled Learning and Collaboration. Further, no statistically significant differences were observed in students' competencies with respect to gender, faculty, or level of study. The study contributes to the growing discourse on responsible AI in higher education by proposing an original conceptual framework and a validated assessment instrument. The findings provide valuable implications for AI literacy initiatives, digital citizenship education, curriculum development, and institutional policies promoting the ethical, responsible, and sustainable integration of Generative Artificial Intelligence in higher education.

Keywords: Responsible AI, Digital Citizenship, Generative Artificial Intelligence, Higher Education, University Students, AI Literacy.

INTRODUCTION

The rapid advancement of Generative Artificial Intelligence has significantly transformed the landscape of higher education by reshaping how students access information, generate knowledge, solve problems, and engage in academic learning. AI-powered tools such as Chat GPT, Gemini, Microsoft Copilot, and other large language models are increasingly being integrated into teaching–learning processes, enabling personalized learning experiences, enhanced productivity, and creative knowledge construction. While these technologies offer considerable educational opportunities, their widespread adoption has also raised concerns regarding academic integrity, misinformation, privacy, ethical decision-making, and students' overdependence on AI-generated content. Consequently, universities are increasingly recognizing that effective AI integration requires not only technological proficiency but also responsible and ethical digital behaviour.

In this context, digital citizenship has emerged as a fundamental competency for learners in AI-enabled educational environments. Digital citizenship extends beyond the technical use of digital technologies and encompasses the knowledge, skills, values, and behaviours required to participate safely, ethically, critically,

and responsibly in digital society. In the era of Generative AI, digital citizenship includes competencies such as understanding AI capabilities and limitations, critically evaluating AI-generated information, protecting privacy, maintaining academic integrity, ensuring ethical AI use, and collaborating responsibly through digital technologies. These competencies enable students to utilize AI as a supportive learning partner while preserving human judgment, critical thinking, and ethical responsibility.

The growing importance of responsible AI use is reflected in several national and international educational frameworks. The National Education Policy (NEP) 2020 advocates technology-enabled education that promotes critical thinking, ethical values, digital literacy, and twenty-first-century skills. Similarly, the UNESCO AI Competency Framework emphasizes AI literacy, human-centered AI, transparency, accountability, and ethical decision-making as essential competencies for learners. The European Digital Competence Framework (DigComp 2.2) highlights information literacy, digital safety, problem-solving, and the responsible use of emerging technologies, while the ISTE Digital Citizen Standards encourage ethical participation, responsible online behaviour, and critical evaluation of digital information. Collectively, these frameworks underscore the need to prepare university students for responsible participation in AI-driven learning environments.

Recent studies have examined AI literacy, digital competence, academic integrity, and students' adoption of Generative AI in higher education. However, limited empirical research has investigated digital citizenship competencies specifically for responsible AI use by integrating AI literacy, information evaluation, ethical AI practices, privacy and digital well-being, and responsible AI-enabled learning within a single conceptual framework. Furthermore, such evidence remains scarce in the Indian higher education context despite the increasing adoption of Generative AI by university students.

To address this gap, the present study proposes the Responsible AI Digital Citizenship Framework (RADCF) and develops the Responsible AI Digital Citizenship Scale (RADCS) to assess university students' digital citizenship competencies for responsible AI use. The study examines these competencies among undergraduate and postgraduate students from Arts and Science faculties of selected government and private universities in Ahmedabad and compares them with respect to gender, faculty, and level of study. The findings are expected to contribute to digital citizenship education, AI literacy initiatives, curriculum development, and institutional policies that promote the ethical, responsible, and sustainable integration of Generative Artificial Intelligence in higher education.

Review of Past Studies

Zawacki-Richter, Marín, Bond, and Gouverneur (2019), conducted a systematic review of Artificial Intelligence research in higher education. Their findings indicated that AI has been widely applied in intelligent tutoring systems, assessment, adaptive learning, and institutional management. The review also emphasized the growing need for research focusing on ethical issues, learner competencies, and responsible implementation of AI in educational settings, thereby providing an important foundation for contemporary studies on Generative AI and digital citizenship.

Chan and Hu (2023) investigated university students' perceptions of Generative Artificial Intelligence in higher education through a survey involving 399 undergraduate and postgraduate students in Hong Kong. The study found that students perceived Generative AI as a valuable toolfor enhancing learning, writing, research, and personalized academic support. However, they also expressed concerns regarding accuracy, privacy, ethical issues, and excessive dependence on AI-generated content. The authors emphasized the need for institutional guidelines and AI literacy to ensure the responsible integration of Generative AI in higher education.

Chan (2023) developed a comprehensive AI policy education framework for higher education based on the perceptions of students, teachers, and institutional stakeholders. The study proposed an AI policy framework that emphasizes AI literacy, ethical use, academic integrity, privacy protection, institutional governance, and responsible implementation of Generative AI in teaching and learning. The findings highlight that effective AI integration requires clear institutional policies together with awareness and competency development among learners and educators.

UNESCO (2023), in its Guidance for Generative AI in Education and Research, emphasized that Generative AI should be implemented through a human-centred approach that promotes ethics, transparency, accountability, privacy protection, inclusion, and learner well-being. The guidance recommends strengthening AI literacy, critical thinking, digital responsibility, and institutional governance to ensure the safe and responsible use of Generative AI in education and research.

Wang, Dang, Wu, and Mac (2023) analyzed Generative AI policies and institutional guidelines adopted by leading universities in the United States. Their study revealed that most universities encourage the educational use of Generative AI while emphasizing academic integrity, ethical use, data privacy, transparency, and discipline-specific institutional policies. The study also recommended continuous faculty and student support for responsible AI adoption in higher education.

Crompton and Burke (2023) reviewed research on Artificial Intelligence applications in higher education and concluded that AI has significant potential to enhance teaching, learning, assessment, student support, and personalized education. At the same time, the review identified challenges related to ethics, privacy, transparency, and digital competence, highlighting the importance of developing responsible AI-related competencies among higher education stakeholders.

Sharma and Joshi (2024) examined the adoption and ethical perceptions of Generative AI among undergraduate and postgraduate students across Indian higher education institutions. Their survey revealed that while students frequently leverage conversational AI tools for ideation, writing assistance, and coding tasks, substantial gaps remain in students' awareness of data privacy, prompt transparency, and intellectual property constraints. The authors underlined the pressing necessity for Indian universities to institutionalize explicit AI ethics codes and curriculum-embedded digital citizenship modules aligned with NEP 2020 objectives.

Gupta and Narang (2024) investigated AI readiness and digital ethics among university students in North India. Their findings highlighted that although technical familiarity with large language models is relatively high across disciplines, students frequently struggle with verifying AI hallucinations and mitigating automated bias. They argued that higher education institutions must shift pedagogical focus from basic digital literacy to critical AI citizenship, fostering learners' capacities to interrogate machine-generated content and exercise autonomous academic integrity.

Al-Zahrani and Alasmari (2024) surveyed higher education learners regarding their ethical engagement with emerging AI systems, proposing that digital citizenship in the AI era requires an integrated triad of technical understanding, critical evaluation, and algorithmic accountability. Their empirical analysis showed that students with formal orientation in information literacy exhibited significantly higher discernment regarding source credibility and ethical citation compared to untrained peers.

Mishra, Sahoo, and Patel (2025) conducted an empirical inquiry into generative AI utilization patterns across public and private universities in western India. Their investigation documented that self-perceived competence often exceeds students' operational understanding of data retention policies and cyber safety risks associated with commercial AI platforms. The study concluded that structured institutional frameworks combining ethical guidelines with hands-on critical thinking tasks are vital for developing responsible digital citizens in academic environments.

Theoretical Foundation

The present study is grounded in internationally recognized educational and digital competency frameworks that emphasize the responsible, ethical, and effective use of digital technologies and Artificial Intelligence in higher education. The National Education Policy (NEP) 2020 advocates technology-enabled learning that promotes critical thinking, digital literacy, ethical values, and twenty-first-century skills. Similarly, the UNESCO AI Competency Framework, DigComp 2.2, and the ISTE Digital Citizen Standards collectively emphasize AI literacy, responsible digital participation, and critical evaluation of information, privacy and security, ethical decision-making, and responsible use of emerging technologies as essential competencies for learners in the

digital age.

Drawing upon these shared principles and the review of contemporary literature, the present study developed the Responsible AI Digital Citizenship Framework (RADCF) comprising five competency domains: AI Literacy and Digital Understanding, Information Evaluation and Critical Thinking, Ethical and Responsible AI Use, Privacy, Security and Digital Well-being, and Responsible AI-enabled Learning and Collaboration. The framework served as the conceptual foundation for the development of the Responsible AI Digital Citizenship Scale (RADCS) to assess university students' digital citizenship competencies for the responsible use of Generative Artificial Intelligence in higher education.

Research Gap

Existing studies have extensively examined Generative AI, AI literacy, digital competence, digital citizenship, and ethical AI use in higher education. However, limited empirical research has specifically investigated digital citizenship competencies for responsible AI use among university students. Furthermore, few studies have integrated AI literacy, critical evaluation, ethical AI use, digital safety, and responsible AI-enabled learning into a comprehensive competency framework and assessment tool, particularly in the Indian higher education context. Therefore, the present study addresses this gap by developing the Responsible AI Digital Citizenship Framework (RADCF) and the Responsible AI Digital Citizenship Scale (RADCS) to assess university students' digital citizenship competencies for responsible AI use.

Rationale of the Study

Responsible use of Generative AI has become an essential competency for university students. Assessing digital citizenship competencies is crucial for promoting ethical AI use, academic integrity, critical thinking, and digital safety. The present study is significant as it develops a comprehensive framework and assessment scale to evaluate these competencies. The findings are expected to support curriculum development, AI literacy initiatives, digital citizenship education, and institutional policies aligned with NEP 2020 and international AI competency frameworks.

Statement of the Problem

The increasing use of Generative Artificial Intelligence in higher education has created the need for students to use AI ethically, critically, and responsibly. Despite its widespread adoption, limited evidence exists regarding university students' digital citizenship competencies for responsible AI use, especially in the Indian context. Therefore, the present study investigates the digital citizenship competencies for responsible AI use among university students.

Objectives of the Study

The present study was undertaken with the following objectives:

1. To study the digital citizenship competencies for responsible AI use among university students.
2. To compare the digital citizenship competencies for responsible AI use among university students with respect to gender.
3. To compare the digital citizenship competencies for responsible AI use among university students with respect to faculty.
4. To compare the digital citizenship competencies for responsible AI use among university students with respect to level of study.

Null Hypotheses

The following null hypotheses were formulated for the study:

H_{01}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to gender.

H_{02}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to faculty.

H_{03}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to level of study.

Variables of the Study

Table 1: Variables of the Study

Sr. No.	Variable	Type of Variable	Levels
1	Digital Citizenship Competencies	Dependent Variable	—
2	Gender	Independent Variable	1. Male 2. Female
3	Faculty	Independent Variable	1. Arts 2. Science
4	Level of Study	Independent Variable	1. Undergraduate (UG) 2. Postgraduate (PG)

Operationalization of Terms

1. Digital Citizenship

Operational Definition: In the present study, *Digital Citizenship* refers to the knowledge, skills, values, and responsible behaviours demonstrated by university students while using digital technologies, particularly Generative Artificial Intelligence, in an ethical, safe, critical, and effective manner for academic and educational purposes.

2. Responsible Artificial Intelligence

Operational Definition: In the present study, *Responsible Artificial Intelligence* refers to the ethical, transparent, accountable, and appropriate use of Generative AI by university students while ensuring academic integrity, privacy, fairness, critical evaluation of AI-generated content, and responsible decision-making in educational contexts.

3. University Students

Operational Definition: In the present study, *University Students* refer to Undergraduate (UG) and Postgraduate

(PG) students studying in the Arts and Science faculties of the selected universities in Ahmedabad who constituted the sample of the study.

4. AI Ethics

Operational Definition: In the present study, *AI Ethics* refers to the ethical principles and responsible practices adopted by university students while using Generative AI, including honesty, transparency, fairness, accountability, privacy protection, respect for intellectual property, and adherence to academic integrity.

5. Digital Competencies

Operational Definition: In the present study, *Digital Competencies* refer to the knowledge, skills, attitudes, and abilities possessed by university students to use digital technologies and Generative AI effectively, critically, safely, and responsibly for information access, communication, collaboration, problem-solving, and academic learning. These competencies are measured through the Responsible AI Digital Citizenship Scale (RADCS) developed by the researcher.

METHODOLOGY

Research Method

The present study adopted a descriptive survey method to assess university students' digital citizenship competencies for responsible AI use.

Population

The population comprised all Undergraduate (UG) and Postgraduate (PG) students enrolled in the Arts and Science faculties of recognized government and private universities located in Ahmedabad, Gujarat.

Sample

A sample of 320 university students was selected for the study. The sample included students from both government and private universit**ies**, representing the Arts and Science faculties at the UG and PG levels.

Sampling Technique

Ahmedabad was divided into four geographical zones. From each zone**,** two universities were selected through simple random sampling, resulting in a total of eight universities. From every selected university, 10 students each were randomly selected from UG-Arts, UG-Science, PG-Arts, and PG-Science**,** yielding a total sample of 320 students.

Development of the Responsible AI Digital Citizenship Framework (RADCF)

To establish a conceptual foundation for assessing university students' digital citizenship competencies for responsible AI use, the Responsible AI Digital Citizenship Framework (RADCF) was developed through a systematic review of recent literature (2023–2026) and internationally recognized policy and competency frameworks. The review included NEP 2020, the UNESCO AI Competency Framework, DigComp 2.2, the ISTE Digital Citizen Standards, the OECD AI Principles, and contemporary empirical studies related to Artificial Intelligence, digital citizenship, AI literacy, AI ethics, and digital competence in higher education.

Identification of Competencies

Competencies repeatedly emphasized across the reviewed literature and international frameworks were

identified and organized into a component matrix (Table 1). Subsequently, the frequency of occurrence of each competency was calculated (Table 2) to determine the domains most consistently represented in the literature.

Table 2: Identification of Competencies from Literature

Sr. No.	Study / Framework	AI Literacy & Digital Understanding	Information Evaluation & Critical Thinking	Ethical & Responsible AI Use	Privacy, Security & Digital Well-being	Responsible AI-enabled Learning & Collaboration
1	Dig Comp 2.2 (2022)	✓	✓	✓	✓	✓
2	UNESCO AI Competency Framework (2024)	✓	✓	✓	✓	✓
3	ISTE Digital Citizen Standards	✓	✓	✓	✓	✓
4	OECD AI Principles	✓	✓	✓	✓	✓
5	Farias-Gaytan et al. (2023)	✓	✓		✓	✓
6	UNESCO (2023)	✓	✓	✓	✓	✓
7	Al-Zahrani & Alasmari (2024)	✓		✓	✓	✓
8	Arkorful et al. (2024)	✓	✓	✓	✓	✓
9	Mansoor et al. (2024)	✓	✓	✓		✓
10	Reicho et al. (2026)	✓	✓	✓	✓	✓
11	Jones (2026)	✓	✓	✓	✓	
12	Liu & Liu (2026)	✓	✓	✓	✓	✓
13	AI Ethics Literature		✓	✓	✓	✓
14	Responsible AI in Higher Education Studies	✓	✓	✓	✓	✓
15	Digital Citizenship Research in Higher Education	✓	✓	✓	✓	✓

Frequency Analysis of Identified Competencies

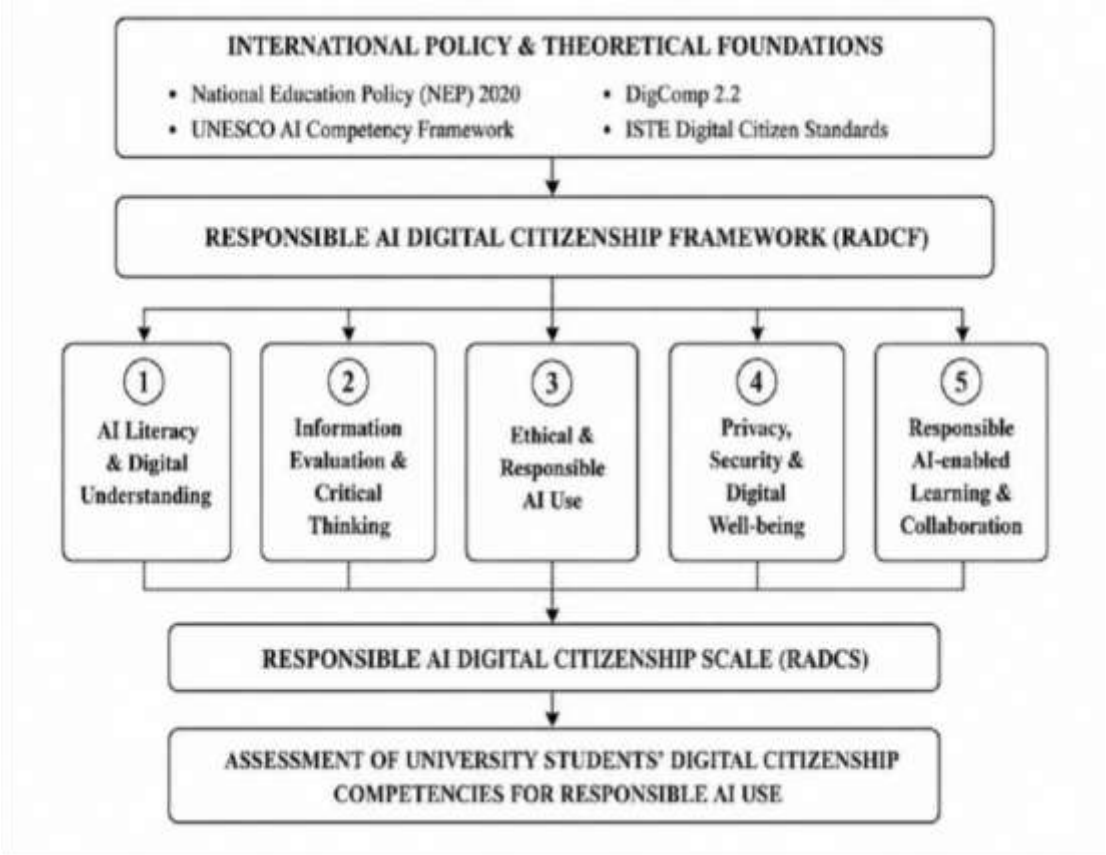
The frequency of occurrence of each competency was calculated to determine the competencies most consistently emphasized across the reviewed literature and international frameworks.

Table 3: Frequency Analysis of Identified Competencies

Sr. No.	Competency	Frequency	Rank
1	AI Literacy and Digital Understanding	14	I
2	Information Evaluation and Critical Thinking	14	I
3	Ethical and Responsible AI Use	15	I
4	Privacy, Security, and Digital Well-being	13	II
5	Responsible AI-enabled Learning and Collaboration	13	II

The frequency analysis indicated that five competency domains were consistently emphasized across the reviewed studies and frameworks. Based on their frequency of occurrence, conceptual relevance, and alignment with the objectives of the study, these competencies were integrated to develop the Responsible AI Digital Citizenship Framework (RADCF).

Responsible AI Digital Citizenship Framework (RADCF)



(Figure: 1) Responsible AI Digital Citizenship Framework (RADCF).

Source: Developed by the Researcher based on NEP (2020), UNESCO AI Competency Framework, DigComp 2.2, ISTE Digital Citizen Standards, and the review of related literature.

Justification of the Framework

The Responsible AI Digital Citizenship Framework (RADCF) synthesizes the competencies most consistently identified in contemporary literature and international frameworks into a unified conceptual model for higher education. The framework comprises five interrelated competency domains that collectively represent the knowledge, skills, values, and behaviours required for the responsible use of Generative Artificial Intelligence by university students. These domains also served as the conceptual basis for developing the Responsible AI Digital Citizenship Scale (RADCS).

Competency Domains

AI Literacy and Digital Understanding: Understanding the concepts, capabilities, limitations, and educational applications of Generative Artificial Intelligence.

Information Evaluation and Critical Thinking: Critically evaluating AI-generated information, verifying its credibility, and making informed academic decisions.

Ethical and Responsible AI Use: Using Artificial Intelligence ethically by maintaining academic integrity,

transparency, fairness, accountability, and respect for intellectual property.

Privacy, Security and Digital Well-being: Protecting personal information, maintaining digital security, safeguarding digital identity, and promoting responsible digital practices while using AI technologies.

Responsible AI-enabled Learning and Collaboration: Utilizing Artificial Intelligence to enhance learning, creativity, collaboration, communication, and problem-solving while preserving human judgment and active learner engagement.

The Responsible AI Digital Citizenship Framework (RADCF) provides the conceptual foundation for the Responsible AI Digital Citizenship Scale (RADCS) developed in the present study to assess university students' digital citizenship competencies for responsible AI use.

Development and Psychometric Properties of the Responsible AI Digital Citizenship Scale (RADCS)

Based on the conceptual domains established in the Responsible AI Digital Citizenship Framework (RADCF), the Responsible AI Digital Citizenship Scale (RADCS) was developed to assess university students' digital citizenship competencies for responsible AI use.

Content and Face Validity:

Initially, a pool of 40 potential items across the five theoretical domains was drafted following an extensive review of international frameworks (DigComp 2.2, UNESCO AI Competency Framework, ISTE Standards) and contemporary literature. Content validity was established through evaluation by an expert panel of seven specialists in Education, Educational Technology, and Psychometrics. Experts reviewed each item for clarity, domain relevance, and contextual appropriateness on a 4-point rating scale. Items yielding a Content Validity Index (Item-CVI / I-CVI) > 0.83 and an overall Scale Content Validity Index (S-CVI/Ave) of 0.91 were retained. Based on qualitative expert feedback, items were reworded for clarity, resulting in a refined 30-item scale (with 6 items per domain, including 15 positively keyed and 15 negatively keyed statements to mitigate acquiescence response bias). Responses are recorded on a 5-point Likert scale: *Strongly Agree (5)*, *Agree (4)*, *Neutral (3)*, *Disagree (2)*, and *Strongly Disagree (1)*; scoring is reversed for negative items, yielding total possible scores ranging from 30 to 150.

Reliability and Pilot Testing:

A pilot study was conducted on a representative sample of 60 university students (excluded from the final sample) to evaluate item comprehensibility and internal consistency. In the final study sample (N = 320), the overall internal consistency of the 30-item RADCS was established using Cronbach's Alpha, demonstrating high overall reliability at $\alpha = 0.91$. Domain-wise reliability coefficients demonstrated strong internal consistency across all five dimensions:

- **Domain 1:** AI Literacy and Digital Understanding (6 items) — $\alpha = 0.83$
- **Domain 2:** Information Evaluation and Critical Thinking (6 items) — $\alpha = 0.85$
- **Domain 3:** Ethical and Responsible AI Use (6 items) — $\alpha = 0.84$
- **Domain 4:** Privacy, Security, and Digital Well-being (6 items) — $\alpha = 0.81$
- **Domain 5:** Responsible AI-enabled Learning and Collaboration (6 items) — $\alpha = 0.82$

Construct Validity and Factor Structure:

The theoretical dimensionality of the five-domain framework was guided a priori by the component matrix and frequency analysis of established international frameworks. In the present study, preliminary construct suitability

was confirmed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.88) and Bartlett's Test of Sphericity (χ^2= 3418.62, df = 435, p

< 0.001), supporting the factorability of the correlation matrix. While the exploratory and confirmatory factor structures demonstrate alignment with the proposed five-factor model, formal structural equation modeling and multi-group confirmatory factor analysis (CFA) across diverse national institutions represent an important avenue for subsequent psychometric validation studies.

Data Collection Procedure

After obtaining permission from the selected universities, the finalized Responsible AI Digital Citizenship Scale (RADCS) was administered to the sampled university students. The responses were collected, screened for completeness, and prepared for statistical analysis.

Statistical Techniques

The collected data were analyzed using descriptive and inferential statistics. Mean and Standard Deviation (SD) were calculated to assess the overall level of digital citizenship competencies for responsible AI use. Prior to conducting inferential analyses, preliminary assumption tests were performed to verify the suitability of parametric procedures. Data normality was assessed through skewness and kurtosis indices (all falling within the acceptable range of 1.0) and confirmed by the Shapiro-Wilk test ($p > 0.05$). Homogeneity of variance across comparative groups was evaluated and satisfied using Levene's test for equality of variances ($p > 0.05$). To test the formulated null hypotheses, Independent Samples t-tests were conducted with degrees of freedom (df), exact two-tailed p-values, 95% Confidence Intervals (CI), and effect sizes measured by Cohen's d (0.2 = small, 0.5 = medium, 0.8 = large) reported to evaluate differences across gender, faculty (Arts and Science), and level of study (UG and PG).

Data Analysis and Interpretation Component 1: AI Literacy and Digital Understanding

Table 4: University Students' Responses toward AI Literacy and Digital Understanding

Sr. No.	Statement	SA		A		N		D		SD	
		n	%	n	%	n	%	n	%	n	%
1.	I understand the basic concepts and functions of Generative AI tools used in education.	132	41.25	118	36.88	42	13.12	18	5.63	10	3.12
2.	I can identify appropriate academic tasks where Generative AI can be used effectively.	125	39.06	122	38.13	40	12.50	21	6.56	12	3.75
3.	I am aware that AI-generated responses should be interpreted considering their capabilities and limitations.	138	43.13	116	36.25	36	11.25	18	5.63	12	3.75
4.	I find it difficult to understand how Generative AI works in educational settings.	14	4.38	22	6.87	38	11.88	120	37.50	126	39.37
5.	I believe Generative AI can provide accurate answers without any limitations.	12	3.75	26	8.13	40	12.50	114	35.62	128	40.00
6.	I use AI tools without trying to understand how they generate information.	10	3.13	24	7.50	46	14.37	118	36.88	122	38.12

It reveals that university students possess a high level of AI Literacy and Digital Understanding. The majority of respondents demonstrated a sound understanding of the concepts, functions, applications, capabilities, and

limitations of Generative AI in educational contexts. They also rejected misconceptions regarding the unquestioned accuracy of AI-generated information and the use of AI without understanding its functioning. These findings indicate that university students have adequate foundational AI literacy, enabling them to use Generative AI responsibly and effectively for academic purposes.

Component 2: Information Evaluation and Critical Thinking

Table 5: University Students' Responses toward Information Evaluation and Critical Thinking

Sr. No.	Statement	SA		A		N		D		SD	
		n	%	n	%	n	%	n	%	n	%
1.	I verify AI-generated information using reliable academic sources before using it.	126	39.38	120	37.50	40	12.50	22	6.87	12	3.75
2.	I critically evaluate AI-generated responses before accepting them as accurate.	132	41.25	116	36.25	38	11.88	22	6.87	12	3.75
3.	I compare information generated by AI with multiple trustworthy sources when necessary.	128	40.00	118	36.88	42	13.12	20	6.25	12	3.75
4.	I usually accept AI-generated information without checking its accuracy.	12	3.75	22	6.87	42	13.13	118	36.87	126	39.38
5.	I rarely question the credibility of information produced by AI tools.	10	3.13	24	7.50	44	13.75	120	37.50	122	38.12
6.	I believe fact-checking AI-generated content is unnecessary.	8	2.50	18	5.63	38	11.87	124	38.75	132	41.25

It indicates that university students possess strong Information Evaluation and Critical Thinking competencies while using Generative AI. The respondents demonstrated responsible practices by verifying AI-generated information through reliable academic sources, critically evaluating AI-generated content, and comparing it with trustworthy references before academic use. They also rejected practices associated with the uncritical acceptance of AI-generated information. These findings suggest that university students exhibit sound critical thinking and information evaluation skills, enabling them to use Generative AI responsibly and make informed academic decisions.

Component 3: Ethical and Responsible AI Use

Table 6: University Students' Responses toward Ethical and Responsible AI Use

Sr. No.	Statement	SA		A		N		D		SD	
		n	%	n	%	n	%	n	%	n	%
1.	I acknowledge AI-generated content appropriately whenever required in academic work.	130	40.63	118	36.87	40	12.50	20	6.25	12	3.75
2.	I use Generative AI in ways that maintain academic honesty and integrity.	136	42.50	116	36.25	38	11.88	18	5.62	12	3.75
3.	I understand the ethical responsibilities associated with using AI in education.	134	41.88	118	36.87	36	11.25	20	6.25	12	3.75
4.	It is acceptable to submit AI-generated work as my own without acknowledgment.	8	2.50	18	5.63	36	11.25	126	39.37	132	41.25
5.	Ethical guidelines are unnecessary while using Generative AI for academic purposes.	10	3.13	20	6.25	38	11.87	122	38.13	130	40.62
6.	I believe plagiarism is acceptable if AI generates the content.	6	1.87	16	5.00	34	10.63	124	38.75	140	43.75

It indicates that university students demonstrate strong Ethical and Responsible AI Use competencies. The respondents reported responsible practices such as acknowledging AI-generated content appropriately, maintaining academic honesty and integrity, and understanding the ethical responsibilities associated with the educational use of Generative AI. They also rejected behaviours related to submitting AI-generated work without acknowledgment, disregarding ethical guidelines, and accepting AI-assisted plagiarism. These findings suggest that university students possess a high level of ethical awareness and responsible behaviour, enabling them to use Generative AI in an ethical, transparent, and academically responsible manner.

Component 4: Privacy, Security, and Digital Well-being

Table 7: University Students' Responses toward Privacy, Security, and Digital Well-being

Sr. No.	Statement	SA		A		N		D		SD	
		n	%	n	%	n	%	n	%	n	%
1.	I avoid sharing personal or confidential information while using AI tools.	138	43.13	116	36.25	34	10.62	20	6.25	12	3.75
2.	I consider privacy and data security before using online AI platforms.	134	41.88	118	36.87	38	11.88	18	5.62	12	3.75
3.	I use AI tools in ways that support healthy and balanced digital habits.	126	39.38	120	37.50	42	13.12	20	6.25	12	3.75
4.	I freely share sensitive personal information with AI applications.	10	3.13	18	5.62	36	11.25	122	38.13	134	41.87
5.	I pay little attention to privacy policies while using AI tools.	12	3.75	20	6.25	40	12.50	120	37.50	128	40.00
6.	I use AI for prolonged periods even when it negatively affects my well-being.	14	4.37	22	6.88	42	13.12	118	36.88	124	38.75

It indicates that university students demonstrate strong Privacy, Security, and Digital Well-being competencies while using Generative AI. The respondents reported responsible practices such as protecting personal information, considering privacy and data security, and maintaining healthy digital habits during AI use. They also rejected behaviours associated with careless information sharing, neglect of privacy policies, and excessive dependence on AI. These findings suggest that university students possess a high level of awareness regarding digital privacy, cyber security, and responsible digital behavior, supporting the safe and ethical use of Generative AI in academic settings.

Component 5: Responsible AI-enabled Learning and Collaboration

Table 8: University Students' Responses toward Responsible AI-enabled Learning and Collaboration

Sr. No.	Statement	SA		A		N		D		SD	
		n	%	n	%	n	%	n	%	n	%
1.	I use Generative AI to enhance my learning rather than replace my own thinking.	136	42.50	114	35.63	40	12.50	18	5.62	12	3.75
2.	AI helps me collaborate more effectively with classmates on academic tasks.	124	38.75	122	38.13	42	13.12	20	6.25	12	3.75
3.	I use AI to generate ideas that improve my creativity and problem-solving.	132	41.25	118	36.88	38	11.87	20	6.25	12	3.75
4.	I depend entirely on AI instead of making my own academic efforts.	10	3.13	18	5.62	40	12.50	124	38.75	128	40.00
5.	Using AI reduces the need for collaboration with teachers and classmates.	12	3.75	20	6.25	38	11.88	122	38.12	128	40.00
6.	I believe AI should replace human judgment in most academic activities.	8	2.50	16	5.00	34	10.63	126	39.37	136	42.50

It indicates that university students demonstrate strong Responsible AI-enabled Learning and Collaboration competencies. The respondents reported using Generative AI to enhance learning, support collaboration with peers, and foster creativity and problem-solving while maintaining their own critical thinking and academic efforts. They also rejected excessive dependence on AI, the replacement of human judgment, and reduced collaboration with teachers and classmates. These findings suggest that university students perceive Generative AI as a supportive educational tool that complements learning, collaboration, and responsible academic engagement rather than replacing human interaction and decision-making.

Hypothesis Testing

H_{01}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to gender.

Table 9: Comparison of Digital Citizenship Competencies with respect to Gender

Variable	Group	N	Mean	SD	df	t-value	p-value	95% CI of Difference	Cohen's d	Result
Gender	Male	158	114.05	12.83	318	0.48	0.632	[-3.42, 2.12]	0.05	Not Significant
	Female	162	114.70	12.46						

Interpretation:

As shown in Table 9, the mean score of male students (M = 114.05, SD = 12.83) and female students (M = 114.70, SD = 12.46) showed no substantial variation. The independent samples t-test yielded t(318) = 0.48, p = 0.632, with a 95% CI of [-3.42, 2.12] and a negligible effect size (Cohen's d = 0.05). Because the exact p-value exceeds the 0.05 threshold of significance, the null hypothesis (H_{01}) is not rejected. This indicates that gender does not significantly influence university students' digital citizenship competencies for responsible AI use.

H_{02}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to faculty (Arts and Science*).*

Table 10: Comparison of Digital Citizenship Competencies with respect to Faculty

Variable	Group	N	Mean	SD	df	t-value	p-value	95% CI of Difference	Cohen's d	Result
Faculty	Arts	160	113.96	12.71	318	0.71	0.478	[-3.63, 1.95]	0.07	Not Significant
	Science	160	114.80	12.58						

Interpretation:

Table 10 presents the comparative results across academic faculties. The mean score for Arts students was 113.96 (SD = 12.71), whereas Science students scored a mean of 114.80 (SD = 12.58). The statistical comparison yielded t(318) = 0.71, p = 0.478, 95% CI [-3.63, 1.95], with a negligible effect size (Cohen's d = 0.07). Since p > 0.05, the null hypothesis (H_{02}) is not rejected, demonstrating that students from both Arts and Science faculties exhibit comparable levels of digital citizenship competencies for responsible AI use.

H_{03}: There is no significant difference in the digital citizenship competencies for responsible AI use among university students with respect to level of study (Undergraduate and Postgraduate).

Table 11: Comparison of Digital Citizenship Competencies with respect to Level of Study

Variable	Group	N	Mean	SD	df	t-value	p-value	95% CI of Difference	Cohen's d	Result
Level of Study	UG	160	114.12	12.76	318	0.39	0.697	[- 3 . 3 0 , 2.26]	0.04	Not Significant
	PG	160	114.64	12.53						

Interpretation:

Table 11 illustrates the comparison between Undergraduate (UG) and Postgraduate (PG) students. The mean score for UG students was 114.12 (SD = 12.76), while PG students obtained a mean score of 114.64 (SD = 12.53). The analysis revealed t(318) = 0.39, p = 0.697, 95% CI [-3.30, 2.26], and an effect size of Cohen's d = 0.04. Because p > 0.05, the null hypothesis ($H_{1\beta}$) is not rejected, indicating that academic level (UG vs. PG) does not produce a statistically significant difference in students' responsible AI digital citizenship competencies.

Overall Competency Levels of University Students for Responsible AI Use

To classify university students into Low, Moderate, and High competency categories, empirical sample quartiles and distribution-based cut-off scores were calculated from the total scores on the Responsible AI Digital Citizenship Scale (RADCS) (Mean = 114.38, SD = 12.63, theoretical range = 30–150).

The cut-off thresholds were derived using the empirical first quartile ($Q_1 = 104.0$) and third quartile ($Q_3 = 122.0$) of the sample distribution:

- **Low Competency:** Scores strictly below the lower quartile (< 104, or < Q_1)
- **Moderate Competency:** Scores spanning the interquartile range (104 to 122, or $Q_1 \leq X \leq Q_3$)
- **High Competency:** Scores exceeding the upper quartile (> 122, or > Q_3)

Table 12: Classification of University Students According to their Digital Citizenship Competencies

Competency Level	Cut-off Score / Range	Criterion	Frequency (n)	Percentage (%)
High	Above 122	> Q_3 (Upper Quartile)	114	35.63
Moderate	104–122	Q_1 to Q_3 (Interquartile Range)	152	47.50
Low	Below 104	< Q_1 (Lower Quartile)	54	16.87
Total	—	—	**320**	**100.00**

Interpretation:

As displayed in Table 12, the largest proportion of university students (47.50%, n = 152) fell within the moderate competency range, followed by 35.63% (n = 114) demonstrating high competency. Only 16.87% (n = 54) of respondents scored within the low competency bracket. Cumulatively, 83.13% of students demonstrated moderate to high levels of digital citizenship competencies for responsible AI use. This distribution highlights that while the majority of students possess an adequate foundation and awareness regarding responsible AI usage, institutional interventions are necessary to elevate learners from moderate procedural awareness to high-level mastery and ethical autonomy.

Findings of the Study

The major findings of the present study are as follows:

- The study found that university students possessed a moderate to high level of AI literacy and digital understanding, indicating that they were familiar with the concepts, capabilities, limitations, and educational applications of Generative AI.

- The study revealed that university students demonstrated high information evaluation and critical thinking competencies, as they critically evaluated AI-generated information and verified its credibility before academic use.

- The findings indicated that university students exhibited a high level of ethical and responsible AI use, reflecting their commitment to academic integrity, transparency, fairness, and responsible use of Generative AI.

- The study found that university students possessed high privacy, security, and digital well-being competencies, demonstrating awareness of data privacy, cybersecurity, digital identity, and responsible digital behaviour while using AI technologies.

- The findings revealed that university students demonstrated a high level of responsible AI-enabled learning and collaboration, effectively utilizing Generative AI to support learning,creativity, collaboration, and problem-solving while recognizing the importance of human judgment.

- The overall competency analysis showed that 35.63% of the respondents possessed high, 47.50% possessed moderate, and 16.87% possessed low digital citizenship competencies for responsible AI use. Thus, 83.13% of the university students demonstrated moderate to high competency levels.

- The study found no significant difference in digital citizenship competencies for responsible AI use among university students with respect to gender, faculty (Arts and Science), and level of study (UG and PG), indicating that these competencies were comparable across all groups.

- Overall, the findings suggest that university students are well prepared to use Generative AI responsibly for academic purposes and possess the knowledge, skills, and ethical awareness required for effective participation in AI-enabled higher education.

Educational Implications of the Study

The Educational Implications of the present study are as follows:

- Higher education institutions should integrate digital citizenship education into university curricula to promote responsible and ethical use of Generative AI.

- Universities should strengthen AI literacy and critical evaluation skills through structured learning experiences, enabling students to use AI tools effectively and responsibly.

- Institutional policies should emphasize academic integrity, ethical AI practices, and transparency in the use of Generative AI for academic work.

- Awareness programmes should be organized to enhance students' understanding of privacy, cyber security, digital well-being, and responsible digital behaviour while using AI technologies.

- The findings support the implementation of NEP 2020 by promoting technology-enabled, ethical, and learner-centered education in higher education institutions.

- The Responsible AI Digital Citizenship Framework (RADCF) and the Responsible AI Digital Citizenship Scale (RADCS) developed in the present study may serve as useful resources for researchers, teacher educators, and policymakers in assessing and promoting responsible AI use among university students.

- The study highlights the need to foster a balanced partnership between human intelligence and Artificial Intelligence, ensuring that AI enhances learning while preserving critical thinking, ethical reasoning, and informed decision-making.

Limitations of the Study

While the present study provides valuable empirical insights into university students' digital citizenship competencies for responsible AI use and introduces an original framework (RADCF) and scale (RADCS), several methodological limitations must be acknowledged:

Reliance on Self-Reported Measures and Social Desirability Bias:

The data were collected entirely via self-reported survey responses. In investigations assessing academic integrity, ethics, and responsible technological habits, self-report instruments are inherently vulnerable to social desirability bias, where participants may report perceived ideal behaviors rather than their actual daily digital practices.

Geographical and Institutional Scope:

The sample was drawn exclusively from eight selected universities within the metropolitan area of Ahmedabad, Gujarat, comprising 10 students per cell across specific disciplines. Although stratified random sampling was utilized across zones, faculties, and study levels, this localized geographical boundary may constrain the direct generalizability of the findings to rural institutions, other Indian states, or varied regional higher education systems.

Absence of Performance-Based Behavioral Metrics:

The study measured self-perceived competencies and attitudes rather than demonstrated operational skills. Future empirical investigations should complement self-report rating scales with objective performance-based tasks, situational judgment assessments, algorithmic prompt-testing exercises, or real-time behavioral simulations to measure authentic AI evaluation and ethical problem-solving competencies.

Cross-Sectional Design:

The descriptive survey design captured students' perceptions at a single point in time. Given the rapid evolution of generative AI tools and emerging institutional guidelines, longitudinal investigations are needed to track how digital citizenship competencies evolve throughout academic degree programs.

Recommendations of the Study

Based on the findings of the study, the following recommendations are proposed:

- Universities should incorporate digital citizenship and responsible AI use into undergraduate and postgraduate curricula.
- Regular workshops and awareness programmes should be organized to strengthen students' AI literacy, ethical AI use, and critical evaluation skills.
- Higher education institutions should formulate clear guidelines for the ethical, safe, and responsible use of Generative AI in academic activities.
- Researchers may validate and apply the Responsible AI Digital Citizenship Framework (RADCF) and the Responsible AI Digital Citizenship Scale (RADCS) in different educational contexts and geographical regions.

- Future studies may be conducted using larger samples, diverse educational settings, and mixed-method or longitudinal research designs to further investigate digital citizenship competencies for responsible AI use.

CONCLUSION

The present study examined university students' digital citizenship competencies for responsible Artificial Intelligence use in higher education. The findings revealed that students demonstrated a moderate to high level of competency across the five domains of the Responsible AI Digital Citizenship Framework (RADCF), namely AI Literacy and Digital Understanding, Information Evaluation and Critical Thinking, Ethical and Responsible AI Use, Privacy, Security and Digital Well-being, and Responsible AI-enabled Learning and Collaboration. Furthermore, no statistically significant differences were observed in students' competencies with respect to gender, faculty, or level of study, indicating that responsible AI-related digital citizenship competencies were consistently demonstrated across the selected groups.

A significant contribution of the study is the development of the Responsible AI Digital Citizenship Framework (RADCF) and the corresponding Responsible AI Digital Citizenship Scale (RADCS), which provide a structured conceptual and measurement framework for assessing responsible AI use among university students. These contributions extend the existing literature by integrating AI literacy, ethical AI practices, information evaluation, privacy, digital well-being, and AI-enabled learning within a unified framework.

The findings underscore the importance of embedding responsible AI use and digital citizenship into higher education curricula, institutional policies, and AI literacy initiatives. The proposed framework and scale may serve as useful resources for educators, researchers, and policymakers in promoting the ethical, responsible, and sustainable integration of Generative Artificial Intelligence in higher education.

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