

A Multi-Dimensional Analysis of Digital Intelligence: Understanding the Core Digital Competencies Among Youth in the Digital Era

Sreelatha P^{1*}, C Karthik Deepa²

¹ Research scholar, Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women,
Coimbatore, India

² Assistant Professor, Department of Education, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, India

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Abstract

Digital intelligence has become a vital ability for young people negotiating the complexities of the digital age in an increasingly connected society. This study investigates the multidimensional nature of digital intelligence by assessing eight fundamental components among college students: Digital Identity, Digital Use, Digital Safety, Digital Security, Digital Emotional Intelligence, Digital Communication, Digital Literacy, and Digital Rights. Using a sample of 100 students selected through stratified random sampling, the study aims to understand the level of digital competency and the relationships among these dimensions. Data were collected using a standardized Digital Intelligence Scale and analyzed through descriptive statistics and Pearson correlation techniques. Results revealed that Digital Literacy (Mean = 4.10) and Digital Use (Mean = 3.98) recorded the highest mean scores, indicating strong technological proficiency among students. In contrast, Digital Emotional Intelligence and Digital Rights scored comparatively lower, highlighting areas requiring further development. Significant positive correlations were found among several dimensions, demonstrating the interconnected nature of digital competencies. The findings suggest that while youth are functionally adept at using technology, competencies related to emotional awareness, ethical responsibility, and understanding of digital rights remain less developed. The study emphasizes the importance of holistic digital education strategies that foster balanced digital citizens who are not only technologically proficient but also responsible, empathetic, and aware of their rights and responsibilities in digital environments. This analysis serves as a foundational step for educators, policymakers, and digital platforms seeking to cultivate a digitally intelligent generation capable of thriving in a dynamic digital society.

Keywords:- Digital Intelligence, Youth Competency, Digital Literacy, Digital Rights, Digital Communication.

I. INTRODUCTION

Digital intelligence is defined by eight key components: digital identity, digital use, digital safety, digital security, digital emotional intelligence, digital communication, digital literacy, and digital rights. These components provide a framework to evaluate an individual's readiness and resilience in the digital world. Recent studies indicate that while youth demonstrate proficiency in functional aspects such as device usage and internet

navigation, they often face challenges in critical areas including digital safety, misinformation recognition, online rights awareness, privacy management, and emotional regulation in digital interactions [1]. These findings highlight the need for a more comprehensive approach to digital competency development beyond technical skills.

Furthermore, the National Education Policy (NEP) 2020 emphasizes the integration of digital literacy and digital ethics into higher education curricula, underlining its importance for holistic student development. However, most institutions still focus on basic ICT training, leaving out nuanced aspects such as emotional, legal, and safety-related competencies. The lack of empirical data on students' digital intelligence, especially in the Indian higher education context, presents a critical gap.

By providing a multidimensional analysis of digital intelligence among college students, this study seeks to address that gap. The study examines students' levels of digital competency using a standardized framework encompassing all eight dimensions and identifies areas requiring targeted educational interventions. The findings are expected to support curriculum designers, educators, and policymakers in fostering digitally competent, ethically responsible, and emotionally intelligent citizens capable of navigating the complexities of contemporary digital environments [2].

II. REVIEW OF LITERATURE

Digital intelligence, as a multidimensional construct, encompasses the competencies required to navigate, manage, and engage responsibly in digital environments. With the growing ubiquity of digital technology in education, communication, and daily life, scholars have increasingly emphasized the need to move beyond basic digital literacy toward a holistic understanding of digital intelligence.

Recent research has expanded the concept of digital competence beyond technical proficiency to include cognitive, social, ethical, and emotional dimensions necessary for effective participation in digital environments [3]. Building on this perspective, the DQ framework identifies eight core competencies of digital intelligence: digital identity, digital use, digital safety, digital security, digital emotional intelligence, digital communication, digital literacy, and digital rights [4].

Studies have shown that although young people are highly engaged with digital technologies, their competencies vary considerably across different dimensions of digital intelligence. Darling found that higher education students often demonstrate strong digital skills but require further development in digital citizenship, ethical behavior, and responsible online engagement [5].

Similarly, Satapaniganone, Tachaphahapong, and Methakunavudhi (2024) reported that university students tend to perform well in digital use and literacy while showing lower competencies in areas such as digital safety, emotional intelligence, and awareness of digital rights. These findings support the need for comprehensive digital intelligence education in higher education settings.

Kunkhong, Yongsorn, and Ponathong (2024) validated a multidimensional model of digital intelligence among higher education students and confirmed that digital intelligence consists of several interrelated competencies that collectively influence students' readiness for participation in digital societies.

Furthermore, Prinsloo, Khalil, and Slade (2024) emphasized the importance of digital wellbeing, emotional regulation, and ethical technology use in contemporary higher education environments, particularly as artificial intelligence and digital platforms become increasingly integrated into learning processes. Their findings suggest that digital intelligence should encompass not only technical capabilities but also responsible and emotionally aware engagement with digital technologies.

In the Indian context, rapid digitalization, online learning initiatives, and the implementation of the National Education Policy (NEP) 2020 have increased the importance of digital intelligence among college students. However, empirical research examining all eight dimensions of digital intelligence and their interrelationships among Indian higher education students remains limited.

Collectively, recent literature supports a multidimensional approach to evaluating digital intelligence among youth. However, there remains a gap in empirical research specifically assessing the interrelationships among all eight DQ components within diverse academic populations, especially in the Indian context, underscoring the relevance and necessity of the present study.

III. OBJECTIVES

- To assess the level of digital intelligence across its eight core components among college students.
- To analyze the relationship between different components of digital intelligence to identify areas of strength and gaps.

IV. OPERATIONAL DEFINITION

A. Digital Intelligence:

In this study, digital intelligence refers to the measurable set of cognitive, technical, emotional, and ethical competencies that enable students to effectively and responsibly use digital technologies. Digital identity, use, safety, security, emotional intelligence, communication, literacy, and rights make up eight components here [6].

B. Youth:

Youth in this study refers to students aged between 18 to 24 years, currently enrolled in undergraduate arts and science programs, who represent the emerging generation of digital users [7].

C. Digital Comparison:

In this study, digital competencies refer to the essential set of knowledge, skills, attitudes, and values required to navigate, evaluate, create, and communicate effectively in digital environments. These competencies encompass information and media literacy, critical thinking, digital content creation, problem-solving, collaboration, and ethical use of technology [8].

D. Digital Era:

In this study, the digital era refers to the contemporary period marked by the widespread integration of digital technologies into everyday life, education, and communication. It is characterized by rapid technological advancements, increased connectivity, the prevalence of smart devices, and the growing dependence on digital platforms for personal, academic, and professional activities [9].

V. METHODOLOGY

A. Research Design

The present study adopted a descriptive and correlational research design to explore and analyze the level and interrelationship of digital intelligence components among college students. The descriptive design helped in identifying the distribution and mean levels of each digital competency, while the correlational design allowed the researcher to assess how these competencies are interrelated within the digital behavior patterns of youth [10].

B. Population and Sample

The study's target demographic consisted of arts and science college enrolled undergraduate students. A sample of 100 students was selected to represent the population adequately. The sample consisted of individuals aged between 18 and 24 years, with an equal representation of gender (50 males and 50 females) and course stream (50 from Arts and 50 from Science backgrounds). This balanced demographic distribution was ensured to capture diverse perspectives on digital intelligence among youth.

C. Sampling Technique

The study used a stratified random sampling method. This approach was selected to keep proportional representation over the strata of gender and academic stream. Stratification ensured that subgroups were equally considered during participant selection, thereby enhancing the reliability and validity of the findings by minimizing sampling bias.

D. Variables of the Study

The study concentrated on evaluating as variables eight elements of digital intelligence. Among these factors defining the main variables of interest were digital identity, digital use, digital safety, digital security, digital emotional intelligence, digital communication, digital literacy, digital rights. As this is a correlational study, no independent or manipulated variables were involved; rather, each digital intelligence domain was evaluated to examine its level and interrelation with other components [11].

E. Tools Used for Data Collection

Data were collected using the Digital Intelligence (DQ) Assessment Scale, developed based on the Digital Intelligence (DQ) Framework proposed by the DQ Institute (2019). The instrument comprised structured items representing each of the eight components of digital intelligence, namely Digital Identity, Digital Use, Digital Safety, Digital Security, Digital Emotional Intelligence, Digital Communication, Digital Literacy, and Digital Rights. The scale was designed on a 5-point Likert format ranging from 'Strongly Disagree' to 'Strongly Agree', with each component represented by five to seven items.

The internal consistency reliability of the overall scale was established using Cronbach's Alpha, yielding a coefficient of $\alpha = 0.87$, indicating good reliability. In addition to the overall reliability, Cronbach's Alpha was computed for each component to enhance transparency and internal consistency reporting: Digital Identity ($\alpha = 0.82$), Digital Use ($\alpha = 0.79$), Digital Safety ($\alpha = 0.84$), Digital Security ($\alpha = 0.85$), Digital Emotional Intelligence ($\alpha = 0.81$), Digital Communication ($\alpha = 0.80$), Digital Literacy ($\alpha = 0.83$), and Digital Rights ($\alpha = 0.78$). These values indicate acceptable to good internal consistency across all dimensions. Content validity of the instrument was established through expert review by specialists in digital education and social science research, along with pilot testing to ensure clarity, relevance, and appropriateness for the target population [12].

F. Procedure for Data Collection

Prior to data collection, formal permission was obtained from the concerned academic institutions, and ethical clearance was ensured. Participants were informed about the purpose of the study, and their voluntary consent was sought. The survey was administered either in printed format or through a secure digital platform, depending on the convenience of the participants. Responses were collected within a stipulated period and compiled systematically for further analysis. All identifying information was kept confidential to maintain the anonymity of participants.

G. Statistical Techniques Used

Descriptive and inferential statistical approaches were used to examine the data. The distribution of scores among every digital intelligence component was compiled using descriptive statistics like mean, standard deviation, frequency, and percentage. Using Pearson's correlation coefficient, the researcher was able to find noteworthy correlations between components and hence investigate their interactions. Should it be necessary, other methods such Principal Component Analysis (PCA) could be taken under consideration for the identification of dominating data clusters.

H. Ethical Considerations

The study followed accepted moral research standards. Before they entered the study, every participant signed informed permission. Participants' identities were anonymised during data analysis and reporting; they were guaranteed of the confidentiality of their responses. The research process was conducted with integrity, ensuring transparency, voluntary participation, and respect for the rights of all individuals involved.

I. Scope and Limitations

This study is limited in scope to analyzing the levels and relationships among digital intelligence components among college students aged 18 to 24 years. It does not extend to other variables such as mental health, socioeconomic status, or institutional digital policies. While the findings offer valuable insights into digital competencies among youth, the limited sample size ($N = 100$) and regional focus may affect the generalizability of the results. Nonetheless, the study provides a foundational understanding of digital intelligence as a multi-dimensional construct within the student population [13].

VI. RESULTS AND INTERPRETATION

The results section presents the analysis of data collected from 100 students on eight components of digital intelligence. It includes descriptive statistics, correlation patterns among variables, and demographic insights. Visualizations such as bar graphs and heatmaps illustrate the levels and interrelationships of digital competencies across the sample group. (Naseer et al., 2025)

Table 1. Demographic Profile of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Age	18–20	47	47.00%
	21–22	33	33.00%
	23–24	20	20.00%
Gender	Male	50	50.00%
	Female	50	50.00%
Course Stream	Arts	50	50.00%
	Science	50	50.00%
Year of Study	First Year	30	30.00%
	Second Year	37	37.00%
	Third Year	33	33.00%
Internet Usage	<2 hours	8	8.00%
	2–4 hours	33	33.00%
	4–6 hours	42	42.00%
	>6 hours	17	17.00%

The demographic profile was based on responses from 100 undergraduate students aged between 18 and 24 years. The age distribution revealed that 47% of participants were in the 18–20 age group, followed by 33% aged 21–22, and 20% aged 23–24, indicating that nearly half the respondents were in the early phase of their academic journey. Gender representation was perfectly balanced, with 50 males and 50 females, ensuring equitable insights into digital intelligence irrespective of gender.

Participants were equally split across academic streams, with 50 students each from Arts and Science, providing an opportunity to compare digital behaviors across different disciplines. With regard to the year of study, 37% of respondents were in their second year, 33% in third year, and 30% in first year, offering a well-distributed academic exposure and developmental diversity.

In terms of daily internet usage, 42% of students reported spending 4–6 hours online, while 33% used the internet for 2–4 hours. A smaller proportion, 17%, used it for more than 6 hours daily, and only 8% reported less than 2 hours of usage. These usage patterns confirm that the majority of the sample is actively engaged in the digital environment, making them well-suited for evaluating aspects of digital intelligence [22].

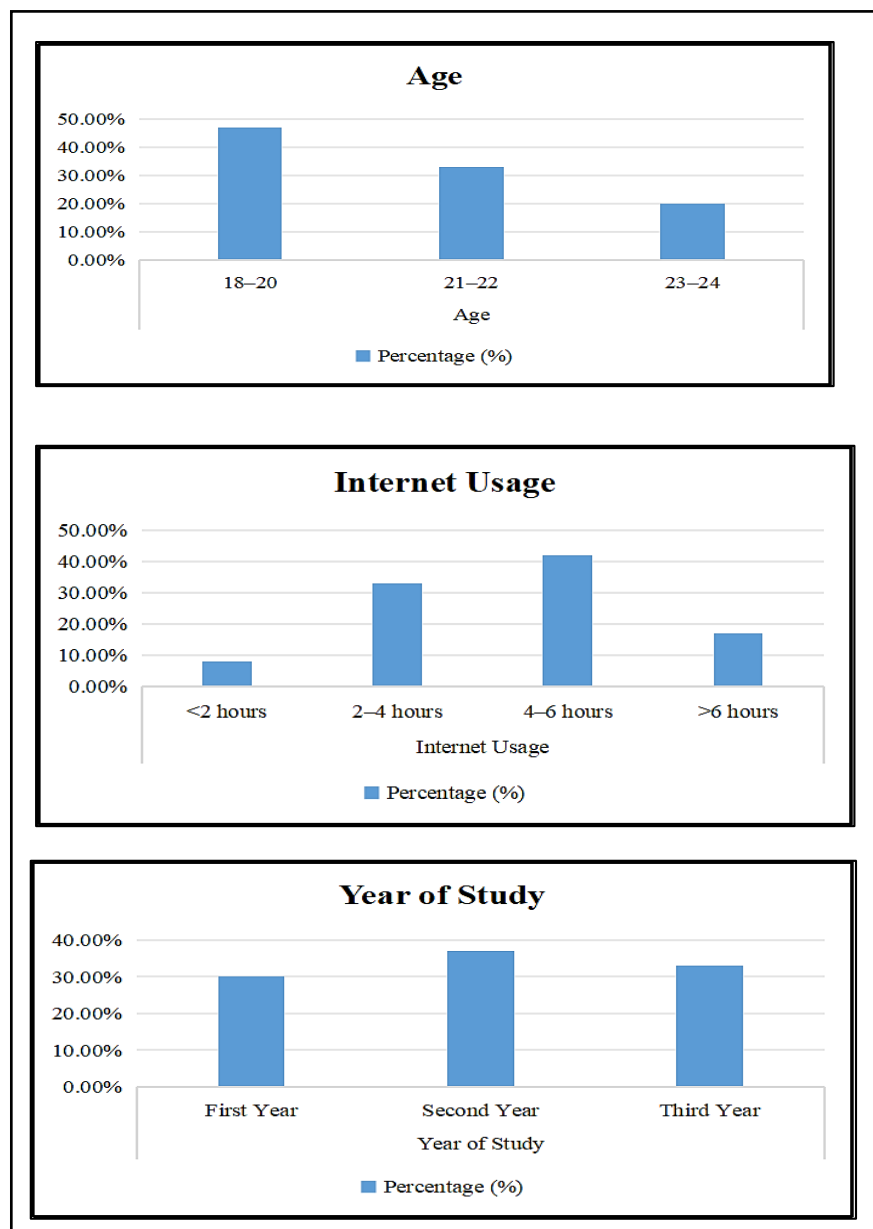


Fig 1: Demographic summary

A. Assessment of Core Digital Intelligence Dimension

The descriptive analysis of the eight core components of digital intelligence provides valuable insights into the competency levels of students. The mean scores range from 3.65 to 4.10 on a 5-point Likert scale, indicating a generally moderate to high level of digital intelligence among participants.

Digital Literacy recorded the highest mean score of 4.10, with a relatively low standard deviation ($SD = 0.42$), suggesting that most students are proficient in identifying credible digital content, evaluating online information, and using digital tools effectively. This aligns with the increasing emphasis on digital academic resources in higher education.

Digital Use followed closely with a mean of 4.02 ($SD = 0.45$), reflecting that students are confident in their routine engagement with digital devices for learning, communication, and entertainment. The low variability here implies consistent usage patterns among the respondents.

Digital Security (Mean = 3.91) and Digital Communication (Mean = 3.88) also scored well, indicating students' awareness of protective online behaviors (e.g., password safety and privacy settings) and their ability to communicate respectfully in digital spaces.

Digital Identity (Mean = 3.85) showed a stable yet slightly lower score compared to others. This suggests that while students are moderately aware of how their online presence affects their digital reputation, this area may still require structured digital citizenship training.

Digital Safety (Mean = 3.74) and Digital Rights (Mean = 3.70) reflect moderate awareness levels. Students appear to understand basic safe practices but may lack in-depth knowledge of their digital rights and responsibilities, possibly due to limited exposure to digital law or policy education.

Digital Emotional Intelligence received the lowest mean score of 3.65 with a standard deviation of 0.54. This indicates that while students interact confidently online, they may lack the ability to empathize, regulate emotions, or respond constructively during digital conflicts. The relatively higher SD also suggests variability in emotional regulation skills among respondents [15].

Table 2. Descriptive Analysis of the Eight Core Components

Component	Mean	SD
Digital Identity	3.85	0.48
Digital Use	4.02	0.45
Digital Safety	3.74	0.52
Digital Security	3.91	0.47
Digital Emotional Intelligence	3.65	0.54
Digital Communication	3.88	0.49
Digital Literacy	4.10	0.42
Digital Rights	3.70	0.51

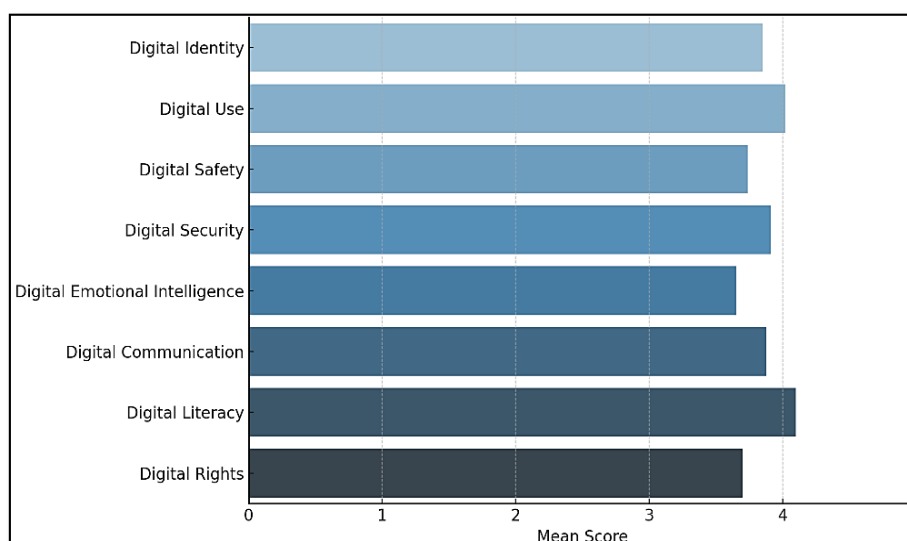


Fig 2: Mean Scores of Digital Intelligence Components

The correlation heatmap illustrates the strength and direction of the relationships among the eight core components of digital intelligence. All correlations are positive, indicating that improvements in one competency are generally associated with enhancements in others. This supports the understanding that digital intelligence is a multi-dimensional, interlinked construct.

The strongest positive correlation was observed between Digital Use and Digital Literacy ($r = 0.62$), suggesting that students who are adept at accessing and using digital tools also possess strong skills in evaluating and applying digital information effectively. Similarly, Digital Communication showed high correlation values with Digital Use ($r = 0.54$) and Digital Identity ($r = 0.51$), indicating that students who communicate well online tend to have better control over their digital presence and are more active digital users.

A significant relationship also exists between Digital Safety and Digital Security ($r = 0.48$), which reflects the natural overlap between safe online behavior and secure digital practices like password management and privacy control. These correlations emphasize the practical connection between awareness and implementation of protective digital habits.

Moderate correlations were found between Digital Emotional Intelligence and other components such as Digital Communication ($r = 0.41$) and Digital Safety ($r = 0.36$), implying that students who are emotionally aware in digital interactions also tend to be more cautious and respectful online. However, Digital Emotional Intelligence and Digital Rights showed the lowest inter-correlations, suggesting that these competencies may develop more independently and could benefit from targeted training.

The overall pattern of correlations reinforces the idea that digital intelligence is not compartmentalized, but rather a system of competencies that reinforce and influence each other. This justifies the need for an integrated digital education framework that simultaneously nurtures technical, ethical, emotional, and cognitive dimensions of digital behaviour [16].

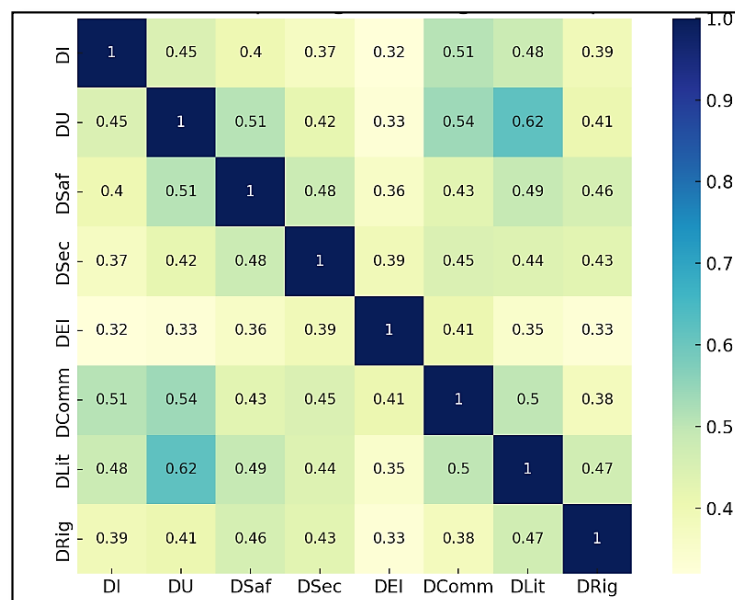


Fig 3: Correlation Heat Map

VII. DISCUSSION

The present study aimed to assess the levels and interrelationships of eight core components of digital intelligence among college students. The findings align with and extend previous research in several key areas [17]:

A. High Proficiency in Digital Literacy and Digital Use

Participants demonstrated the highest mean scores in Digital Literacy (Mean = 4.10) and Digital Use (Mean = 4.02), indicating strong competencies in accessing, evaluating, and utilizing digital information and tools. This is consistent with the findings of a systematic review by Eshet-Alkalai (2012), which highlighted the increasing digital literacy among youth due to their constant engagement with digital technologies. The study emphasized that digital literacy is not merely about technical skills but also involves cognitive and socio-emotional aspects, which our findings support.

B. Moderate Awareness in Digital Safety and Security

The study revealed moderate mean scores in Digital Safety (Mean = 3.74) and Digital Security (Mean = 3.91), suggesting that while students are somewhat aware of online risks and protective measures, there is room for improvement. This finding aligns with the research by Livingstone et al. (2011), which found that although young people are frequent internet users, they often lack comprehensive understanding of online safety and privacy issues.

C. Lower Competence in Digital Emotional Intelligence and Digital Rights

The lowest mean scores were observed in Digital Emotional Intelligence (Mean = 3.65) and Digital Rights (Mean = 3.70), indicating a need for enhanced education in these areas. This pattern may be attributed to the limited emphasis on socio-emotional learning and digital citizenship components within traditional higher education curricula, particularly in the Indian context where technical skill development is often prioritized over affective and ethical dimensions of digital engagement. This finding is in line with the study by Park and Lee (2020), which emphasized that while technical digital skills are often prioritized, emotional intelligence and understanding of digital rights are frequently neglected in digital education curricula.

In addition, despite increasing digital exposure among Indian students, structured training on empathy, responsible online behavior, and awareness of digital rights remains relatively underrepresented in formal academic programs. As a result, students may develop operational proficiency with technology without a corresponding depth in emotional regulation and rights-based digital awareness.

D. Interrelationships Among Digital Intelligence Components

The correlation analysis in our study showed significant positive relationships among various digital intelligence components, notably between Digital Use and Digital Literacy ($r = 0.62$), and between Digital Communication and Digital Identity ($r = 0.51$). These findings support the DQ framework proposed by the DQ Institute, which posits that digital competencies are interconnected and collectively contribute to an individual's overall digital intelligence[18].

From a policy perspective, these findings align with the goals of the National Education Policy (NEP) 2020, which emphasizes the integration of digital literacy, critical thinking, and holistic skill development in higher education. The results of this study underscore the need for institutions to move beyond technical skill training and incorporate structured digital citizenship, emotional intelligence, and rights awareness modules into undergraduate curricula to ensure balanced digital competence development.

VIII. CONCLUSION

The study's findings corroborate existing literature, highlighting that while college students exhibit strong digital literacy and usage skills, there is a pressing need to address gaps in digital emotional intelligence and awareness of digital rights. The interrelated nature of digital intelligence components underscores the importance of a holistic approach to digital education that encompasses technical skills, emotional understanding, and rights awareness. Future research could adopt longitudinal designs to examine how digital intelligence evolves over time as students progress through higher education. Additionally, cross-regional or cross-cultural comparative studies would help identify contextual differences in digital intelligence development and inform more targeted educational interventions.

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