Article Identifier: https://identifier.visnav.in/1.0002/ijabs-25e-10002/

Transforming Research Communication Through Digital Platforms: A Study of Undergraduate Practices in a State University

Luijim S. Jose *, Amira Mae Serzo, Jessnim A. Palapal, Alhera A. Dela Cruz, John Marky A. Robles, Mary Joy B. Villacorta, Mark Joshua P. Ombania, Harrylou Jhean T. Gabriel, Rheanne Joyce A. Mempin, Emma Francesca Josephine P. Ramirez

Nueva Ecija University of Science and Technology, Gen. Tinio St. 3100 Cabanatuan City, Nueva Ecija, Philippines

* For correspondence: luijimjose@gmail.com

Received on: 10 May 2025

Published on: 31 May 2025

ABSTRACT

The rapid integration of digital collaboration tools has transformed research communication practices in higher education, offering new opportunities for real-time, asynchronous, and geographically unbounded academic collaboration. This study examines the influence of digital platforms—specifically Google Docs, Microsoft Teams, and Zoom—on research communication among undergraduate students at a Philippine state university. Employing a mixed-methods case study design, quantitative survey data (n = 115) and qualitative insights from two focus group discussions (n = 15) were triangulated to provide a comprehensive analysis. Findings reveal that digital tools significantly enhance clarity, timeliness, and inclusivity in research interactions, supporting collaborative learning and knowledge construction. However, challenges such as platform fatigue and persistent digital inequalities underscore the need for strategic management of digital ecosystems. Students' adaptive strategies, including platform standardization and proactive communication protocols, highlight the importance of agency and digital literacy in optimizing tool usage. The study concludes that while digital platforms offer substantial benefits for research communication, their effective integration necessitates deliberate pedagogical frameworks, inclusive access measures, and critical reflexivity. These insights contribute to the global discourse on technology-mediated learning and provide actionable recommendations for building resilient and equitable academic communities in the digital age.

Keywords: digital collaboration tools, research communication, higher education, digital literacy, state universities



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1. INTRODUCTION

The rapid evolution of digital technologies has transformed education, particularly in academic research communication. Integrating digital collaboration tools such as Google Workspace, Microsoft Teams, Zoom, and Slack has facilitated synchronous and asynchronous collaboration among students and researchers, reshaping how academic knowledge is constructed. shared, and disseminated. This transformation was significantly magnified by the COVID-19 pandemic, which compelled educational institutions worldwide to pivot to remote learning environments. As Al-Abdullatif and Gameil (2020) highlighted, digital collaboration tools have become essential for facilitating a seamless exchange of ideas and documents, allowing geographically dispersed teams to co-construct knowledge effectively. This accelerated shift to digital platforms has demonstrably altered the landscape of education and academic communication (Wei, Ding, & Gao, 2024).

Research communication, which entails the systematic exchange of ideas, data, and feedback among collaborators, is critical to the success of academic projects. The emergence and widespread adoption of digital collaboration platforms have profoundly influenced the dvnamics inherent in such communication. A study by Nagari, Sahid, and Hussin (2023) underscores that the quality of communication within research teams significantly impacts the efficiency of research processes and the innovation of outcomes. Several studies affirm that digital collaboration tools enhance accessibility, productivity, and effectiveness in academic settings (Busch et al., 2024; Murphy & Kelp, 2023). However, a notable gap persists in the literature regarding the micro-dynamics of research communication, particularly within resource-constrained environments such as many state universities in the Philippines.

In the context of Philippine higher education, state universities serve diverse and often underserved student populations. Integrating digital technologies into academic processes presents numerous challenges, including inadequate infrastructure, varying levels of digital literacy, and socio-economic disparities among students. Al-Abdullatif and Gameil (2020) emphasize the importance of understanding how digital literacy impacts communication behaviors in such contexts. Furthermore, empirical investigations examining how undergraduate students specifically utilize digital platforms for collaborative research remain limited, highlighting a critical area for further inquiry (Ibragimov et al., 2024). Addressing these issues is essential for developing strategies that leverage digital tools to promote academic excellence, particularly in institutions facing significant infrastructural and socioeconomic challenges.

This study explores the influence of digital collaboration tools on the research communication practices of undergraduate students within a selected Philippine state university. It seeks to answer key questions regarding the most commonly used platforms, their perceived impacts on communication clarity, timeliness, and inclusivity, as well as the specific challenges encountered. Understanding these dynamics is particularly relevant, given that students increasingly harness digital tools as integral components of their learning and research activities (Sarumaha, 2024). Thus, this study provides an empirical contribution to the growing field of technology-mediated communication in higher education (Murphy & Kelp, 2023).



Moreover, analyzing how undergraduate students interact within virtual environments may yield insights applicable beyond the academic sphere, influencing institutional policies and informing future curricular developments. Strengthening digital literacy among students is crucial, especially in contexts where digital tools are indispensable for fostering academic engagement and achievement (Nagari et al., 2023). The research findings are expected to guide the development of targeted educational strategies, including enhanced digital literacy training and more effective facilitation of research collaborations. By centering on the lived experiences of undergraduate researchers, this study aims to illuminate best practices for utilizing digital collaboration tools to foster inclusivity and collective academic success.

This research is significant to various stakeholders, including educational policymakers, university administrators, faculty members, and students. Insights generated from this study may lead to the development of targeted digital literacy programs, informed curricular reforms, and strengthened institutional support structures promoting effective communication in research contexts. Such outcomes align with global imperatives advocating for the meaningful integration of digital technologies to bridge communication gaps and improve research productivity (CS, Patil, & Gavimath, 2024).

The study focused on undergraduate students in research-intensive programs, specifically those engaged in collaborative capstone and thesis projects that necessitate effective communication. By narrowing the focus, the study aims to gain a deeper understanding of undergraduate experiences while excluding graduate students and faculty-led projects to maintain analytical consistency. Although the findings may not be universally generalizable, they are expected to provide critical insights applicable to similarly situated higher education institutions in the Philippines and other developing contexts (Eskew, Smythers, & Hutson, 2023).

Within this framework, digital collaboration tools are operationally defined as online platforms designed to facilitate user teamwork and communication, supporting real-time or asynchronous exchanges during the research process. Research communication systematically shares research-related ideas, data, and feedback among collaborators. Furthermore, a state university is any publicly funded institution in the Philippines that provides affordable access to tertiary education, serving a broad demographic of students with potentially diverse needs and experiences (Fajoye et al., 2023).

Exploring the role of digital collaboration tools in undergraduate research communication provides critical insights into the evolving dynamics of academic collaboration. By centering on students' lived experiences, this study contributes to the expanding literature on technology-mediated communication in higher education. It offers relevant implications for promoting inclusive and effective educational environments (Malykhin, O., Aristova, N., Dichek, N., & Dyka, N., 2021).

2. METHODOLOGY

2.1. Research Design

This study employed a mixed-methods case study design to comprehensively investigate the impact of digital collaboration tools on research communication practices among undergraduate students at a prominent public university in the Philippines. A mixed-methods approach was selected to allow the triangulation of



quantitative and qualitative data, enriching the depth of findings and addressing potential biases inherent in single-method studies (Creswell & Plano Clark, 2018). The case study strategy enabled an in-depth examination of the phenomenon within its real-life educational context, making it suitable for exploring the complex interactions between technology and communication practices in higher education.

2.2. Participants and Sampling

The participants of this study were undergraduate students who were undertaking research-intensive requirements, such as capstone projects and undergraduate theses. Students were purposively sampled from four academic programs: Bachelor of Science in Information Technology, Bachelor of Secondary Education, Bachelor of Science in Business Administration, and Bachelor of Science in Engineering. The academic diversity of the sample was intended to enhance the potential transferability of findings across various fields of study. Participants were eligible if they were engaged in group-based research, had regular experience using digital collaboration tools, and voluntarily consented to participate. 120 students were invited via course group chats, and 115 valid survey responses were retained after screening, yielding a response rate of 96%.

2.3. Data Collection Procedures

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2.3.1. Quantitative Phase: Survey Administration
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An online survey was administered through Google Forms to collect quantitative data. The survey instrument comprised four sections covering demographic information, types and frequency of digital collaboration tool usage, perceived impacts on research communication (clarity, timeliness, and inclusivity), and common challenges encountered using these tools. A pilot test involving 20 students not included in the main study was conducted to ensure the clarity and relevance of the questions. Based on feedback from the pilot, minor revisions were made. The final survey instrument demonstrated strong internal consistency, with a Cronbach's alpha coefficient of 0.88. Students were allowed to complete the survey asynchronously over a two-week data collection period, ensuring flexibility.

2.3.2. Qualitative Phase: Focus Group Discussions

Following the survey, two focus group discussions (FGDs) were conducted to provide deeper insights into the students' experiences with digital collaboration tools. Fifteen volunteer participants, representing the four academic programs, were selected from the survey respondents. Each FGD comprised seven to eight students and lasted approximately 60 to 75 minutes. Sessions were held via Zoom to accommodate participant schedules and accessibility needs. A semistructured interview guide was developed to explore the participants' experiences, perceived benefits and limitations of digital collaboration, and the strategies they employed to address communication challenges. All discussions were audio-recorded with participants' consent and transcribed verbatim. Data saturation was reached after the second FGD, indicating that sufficient qualitative depth had been achieved.

2.4. Ethical Considerations

Ethical standards were strictly adhered to throughout the study. All participants were informed of the study's objectives, confidentiality procedures, voluntary participation, and their right to withdraw at any point without penalty. Informed consent was secured electronically before the commencement of both the survey and FGDs. Data were anonymized during the collection process, and access to digital records was



limited to the principal investigator and authorized research assistants. All files were stored in password-protected drives.

2.5. Data Analysis

2.5.1. Quantitative Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics, including frequencies, means, and standard deviations, were used to summarize demographic characteristics, digital tool usage patterns, and perceptions of communication impacts. Pearson's correlation analysis was employed to examine relationships between the frequency of digital tool usage and perceived improvements in research communication. Additionally, independent t-tests and one-way analysis of variance (ANOVA) were conducted to explore differences across demographic groups, with statistical significance set at p < .05.

2.5.2. Qualitative Data Analysis

Thematic analysis was utilized to analyze the qualitative data following the six-phase framework proposed by Braun and Clarke (2006). Transcripts were first read and re-read for familiarization, followed by the generation of initial codes. Codes were then organized into potential themes, reviewed, refined, and defined through collaborative discussions between two independent researchers. To enhance the credibility and trustworthiness of the findings, member checking was performed by presenting preliminary themes to selected participants for validation. An audit trail documenting coding decisions and thematic development was also maintained to ensure transparency and replicability of the research process.

By adopting a rigorous mixed-methods case study design, supported by ethical research practices and

systematic analytical procedures, this study provides robust and contextually grounded insights into how digital collaboration tools influence research communication among undergraduate students. Integrating quantitative and qualitative data ensures the validity and depth of findings, contributing meaningfully to the scholarship on educational technology and collaborative academic practices.

3. RESULTS AND DISCUSSIONS

This section presents the study's findings, organized into three major components: (1) participant demographics, (2) quantitative results derived from survey responses, and (3) qualitative insights obtained from focus group discussions (FGDs). The triangulation of data provides a comprehensive understanding of how collaboration digital tools influence research communication practices undergraduate among students in a Philippine state university.

3.1. Participant Demographics

A total of 115 undergraduate students participated in the study, representing four academic programs. Table 1 summarizes the demographic characteristics of the participants. The sample showed a slight predominance of female students (54.8%) and a strong representation from the Bachelor of Science in Information Technology (BSIT) program. A substantial majority (78.3%) reported owning a personal laptop or desktop computer, while 73.0% indicated having stable internet access at home, an important factor in digital collaboration effectiveness.

- 3.2. Quantitative Results
 - 3.2.1. Platform Usage Patterns



Table 1.	Participant Demographics	5
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Demographic Variable	Category	Frequency	Percentage (%)
Gender	Female	63	54.8%
	Male	52	45.2%
Academic Program	BS Information Technology	39	33.9%
	Bachelor of Secondary Education	31	27.0%
	BS Business Administration	25	21.7%
	BS Engineering	20	17.4%
Primary Device Used	Laptop/Desktop	90	78.3%
	Smartphone Only	25	21.7%
Internet Access Quality	Stable	84	73.0%
	Unstable	31	27.0%

(n = 115)

Note. Participants could select multiple applicable categories.

Table 2. Frequency of Digital Collaboration Tool Usage

Digital Tool	Frequency of Users	Percentage (%)
Google Docs	109	94.8%
Microsoft Teams	78	67.8%
Zoom	75	65.2%
Slack	28	24.3%
Trello	22	19.1%
Discord	18	15.7%
(n = 115)		

Note. Respondents could select multiple platforms

Analysis of survey data revealed that students widely adopted digital collaboration tools in their research workflows. Google Docs was the most commonly utilized platform (94.8%), followed by Microsoft Teams (67.8%) and Zoom (65.2%). Additionally, 71.3% of respondents reported using two or more platforms simultaneously, highlighting the multi-platform nature of contemporary academic collaboration.

3.2.2. Perceived Impacts of Digital Collaboration Tools

Students rated the impact of digital collaboration tools on research communication using a 5-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Results showed strong positive perceptions, with high mean scores for improvements in clarity (M = 4.38, SD = 0.52),

timeliness (M = 4.26, SD = 0.64), and inclusivity (M = 4.18, SD = 0.69).

A Pearson correlation analysis assessed the relationship between the frequency of digital tool usage and perceived improvements in communication quality. A moderate, statistically significant positive correlation was observed (r = .47, p < .001, 95% CI [.34, .59]), indicating that a higher frequency of digital tool use was associated with greater perceived enhancements in research communication.

3.2.3. Perceived Advantages and Challenges

The open-ended survey responses provided further insight into the perceived benefits and challenges of digital collaboration tools. Table 4 summarizes these findings.



Table 3. Correlation Between Frequency of Tool Usage and Research Communication ()ualit	v
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Variable	r	95% Confidence Interval	p-value
Frequency of Tool Usage × Communication Quality	0.47	[0.34, 0.59]	< 0.001
(n = 115)			

Table 4. Summary of Perceived Advantages and Challenges of Digital Collaboration Tools

Theme	Frequency of Mentions (%)	Description
Real-time Editing and Feedback	88.7%	Ability to collaboratively edit documents and provide immediate feedback
Increased Meeting Flexibility	79.1%	Capacity to conduct meetings without physical presence
Enhanced Inclusivity	65.2%	Opportunity for broader participation through asynchronous engagement
Platform Fatigue	23.5%	Confusion and inefficiency from using multiple communication tools
Digital Divide Issues	18.3%	Internet instability and device inadequacies limiting participation

Among the reported advantages, real-time editing and immediate feedback were the most frequently cited (88.7%), followed by increased meeting flexibility (79.1%) and enhanced inclusivity (65.2%). Challenges identified included platform fatigue (23.5%)—referring to the confusion and cognitive overload caused by managing multiple platforms—and digital divide issues (18.3%) related to unstable internet connections and inadequate devices.

3.3. Qualitative Results

3.3.1. Emerging Themes from Focus Group Discussions

The two focus group discussions, involving 15 participants, provided richer narratives contextualizing the survey findings. Thematic analysis revealed three major themes: (1) Enhanced Efficiency and Flexibility in Research Communication, (2) Challenges of Platform Overload and Technological Inequality, and (3) Strategies for Managing Digital Collaboration.

3.3.2. Theme 1: Enhanced Efficiency and Flexibility

Participants highlighted that digital collaboration tools significantly enhanced the efficiency and flexibility of their research communications. Features such as realversion control, asynchronous time editing. commenting, and virtual meetings allowed for rapid project progression without the need for frequent physical meetups. These capabilities also promoted better work-life balance, enabling students to fulfill academic obligations alongside personal responsibilities.

3.3.3. Theme 2: Platform Overload and Technological Inequality

Despite these benefits, students encountered challenges managing multiple communication platforms without centralized agreements. Participants noted that scattered updates across Messenger, Google Drive, and email sometimes resulted in miscommunication or document versioning problems. Furthermore, students



Table 5. Emerging Themes from Focus Group Discussions		
Theme	Description	
Enhanced Efficiency and Flexibility	Real-time collaboration, faster feedback cycles, and improved time	
	management	
Platform Overload and Technological	Confusion due to multiple platforms; disparities in internet and device	
Inequality	access	
Strategies for Managing Digital	Adoption of standardized platforms, regular virtual meetings, informal	
Collaboration	check-ins	

from remote areas, or those reliant solely on smartphones, faced technological disadvantages, reinforcing issues of digital inequality highlighted in the survey.

3.3.4. Theme 3: Strategies for Managing Digital Collaboration

To address these challenges, students developed proactive collaboration strategies. Teams standardized their tools—typically using one platform for document management and one for messaging—to minimize confusion. Regular weekly meetings, clear agendas, and informal check-ins were identified as essential practices to maintain coordination and accountability throughout the research process.

3.3.5. Triangulation of Quantitative and Qualitative Findings

The qualitative data supported and enriched the quantitative findings. Survey trends indicating high tool usage, perceived improvements in communication, and reported challenges were directly echoed in the focus group discussions. For example, the phenomenon of platform fatigue observed in open-ended survey responses was vividly illustrated by participants' narratives about confusion across multiple channels. Similarly, strategies for digital collaboration management discussed during FGDs reflected practical adaptations to challenges identified quantitatively. This triangulation strengthens the validity of the study's conclusions regarding both the opportunities and complexities of digital collaboration in academic research communication.

The findings demonstrate that digital collaboration tools positively influence research communication among undergraduate students, primarily by enhancing clarity, responsiveness, and inclusivity. However, the benefits depend on deliberate management strategies, adequate technological infrastructure, and digital literacy support. Without these, digital platforms may inadvertently create confusion and widen existing inequalities. The results highlight the urgent need for structured institutional interventions and policy innovations to maximize the transformative potential of digital collaboration tools in higher education contexts.

4. **DISCUSSION**

The evolving landscape of research communication practices in higher education institutions, particularly within a Philippine state university, reveals substantial shifts brought about by integrating digital collaboration tools. The pervasive usage of platforms such as Google Docs, Microsoft Teams, and Zoom affirms the centrality of technology in enhancing academic collaboration. This observation parallels global trends identified by Quraishi, Ulusi, Muhid, Hakimi, and Olusi (2024), who emphasize the growing necessity of digital literacy in higher education curricula, particularly regarding technology's transformative role in extending



educational interactions beyond traditional constraints of time and space. Furthermore, Suryadi, Muslim, and Setyono (2024) highlight that digital literacy significantly improves institutional performance, underscoring the correlation between effective technology implementation and enhanced educational outcomes.

Findings from this study reveal a significant positive correlation between the frequency of digital tool usage and improvements in research communication quality. This result is consistent with Menshikova et al. (2023), who observed that well-integrated digital competencies enhanced information facilitate exchange and collaborative knowledge construction among academic communities. The students' engagement in both synchronous and asynchronous collaborations, enabled through real-time editing and immediate feedback, exemplifies the principles of collaborative learning theory (Dillenbourg, 1999), where technology serves as a conduit for deeper educational interaction. Similarly, Arissaputra, Sobandi, Sentika, Sultan, and Wijaya (2023) argue that digital literacy initiatives can substantially enrich students' collaborative when capacities embedded in learning processes.

Despite these positive outcomes, the research also uncovers complexities associated with digital collaboration, notably the phenomenon of platform fatigue. Students reported experiencing cognitive and logistical burdens from managing multiple communication channels simultaneously. This challenge aligns with Almahasees et al. (2021) and Marisa and Djulia (2022), who articulate concerns about digital overload, warning that fragmented digital ecosystems can lead to miscommunication, redundancy, and confusion. Hence, while digital tools augment academic collaboration, coherent strategies to streamline communication across platforms are necessary to optimize efficiency and reduce cognitive strain.

Moreover, the findings reveal the persistent presence of the digital divide, disproportionately affecting students from rural and disadvantaged backgrounds. Although digital collaboration tools are widely accessible, disparities in internet connectivity, device quality, and digital literacy continue to impede equitable participation in research activities. This observation echoes the concerns raised by the World Bank (2022) and further elaborated by Klochko and Prokopenko (2023),who emphasize that technological advancements, if not accompanied by inclusivity measures, risk exacerbating existing educational inequities. Consequently, higher education institutions must simultaneously promote innovation and prioritize digital inclusion by ensuring access to resources and support systems that enable full participation for all students.

Students' adaptive strategies, such as standardizing and establishing clear communication platforms within teams, highlight protocols significant metacognitive regulation and agency among undergraduate researchers. These grassroots solutions resonate with Cohen, Pérez, and Murray's (2018) findings, who advocate for recognizing student-driven initiatives enhancing digital collaboration in frameworks. Supporting and institutionalizing such bottom-up strategies could lead to more sustainable improvements in research communication practices.

The study also points out that successful digital collaboration transcends mere technological efficiency. It involves socio-technical dynamics where shared norms, mutual accountability, and a culture of inclusivity are just as crucial as technical skills. This



expands the definition of digital literacy beyond operational competencies to include collaborative, interpersonal, and ethical dimensions, aligning with perspectives proposed by Ala-Mutka (2011) and echoed by Repanovici, Borcoman, Mihoc, and Babii (2024).

Theoretically, this study invites a critical re-examination of media richness theory (Daft & Lengel, 1986). While traditionally, high-richness media such as video conferencing are associated with superior communication outcomes for complex tasks, this research indicates that the proliferation of digital platforms can introduce cognitive load that undermines even these advantages when not adequately managed. Thus, the relationship between media richness, platform and communication effectiveness management, demands a more nuanced understanding of modern academic environments.

This study reinforces the understanding that embedding digital collaboration tools into research communication frameworks is not a straightforward technological advancement. Instead, it involves navigating infrastructural limitations, cognitive challenges, and socio-cultural negotiations. To fully harness the potential of digital tools for enhancing academic collaboration, higher education institutions must adopt a comprehensive approach that combines technological innovation with active frameworks for inclusivity and equity. By recognizing these multifaceted realities, universities can build more resilient and effective academic communities, ensuring that research inclusive, and communication remains dynamic, responsive in the digital era.

5. CONCLUSION

This study critically examined the influence of digital collaboration tools on research communication

practices among undergraduate students in a Philippine state university, offering important insights into the socio-technical dynamics of academic collaboration in higher The contemporary education. findings demonstrate that digital platforms such as Google Docs, Microsoft Teams, and Zoom have become integral components of students' research workflows, substantially enhancing communication processes' clarity, timeliness, and inclusivity. These tools, by enabling real-time document co-editing, asynchronous feedback mechanisms, and flexible virtual interactions, have redefined the traditional paradigms of research communication, aligning them more closely with the demands of an increasingly interconnected and digitized academic world.

However, the benefits of digital collaboration tools are neither automatic nor evenly distributed. The emergence of platform fatigue, communication fragmentation, and persistent digital inequalities underscores the complexity inherent in technologymediated academic interactions. Without intentional management, the proliferation of digital platforms can paradoxically erode the efficiencies they are meant to deliver. At the same time, inequities in access can reinforce existing socio-economic disparities within educational institutions.

Moreover, the findings illuminate the vital role of user agency in optimizing digital collaboration. Students who developed and adhered to standardized communication protocols, engaged in regular virtual meetings with clear objectives, and proactively addressed connectivity challenges were better able to leverage digital tools to support effective research collaboration. These behaviors suggest that technological proficiency must be complemented by strategic organizational skills and



collaborative competencies to maximize digital platform benefits.

Thus, the study concludes that digital collaboration tools are promising to enhance research communication in higher education; their effective integration requires a deliberate, inclusive, and pedagogically informed approach. The implications extend beyond tool adoption to encompass broader questions of digital literacy, equity, and institutional support structures. Strategic investments in technological infrastructure and human capacity development are essential for state universities seeking to build resilient, inclusive, and future-ready academic communities.

6. **RECOMMENDATION**

In light of the findings and conclusions drawn, several actionable recommendations are proposed to guide higher education institutions, particularly state universities, in optimizing the use of digital collaboration tools for research communication:

1. Institutionalize Comprehensive Digital Literacy Programs.

Universities should design and implement structured digital literacy initiatives beyond technical tool usage. Training should encompass best practices in digital collaboration, platform standardization, online etiquette, information management, cybersecurity, and critical platform evaluation. These programs should be mandatory components of research methods courses across disciplines.

2. Establish Clear Institutional Guidelines for Research Collaboration.

Institutions should provide standardized protocols for digital collaboration in research projects. These may

include recommendations on preferred platforms, file management practices (e.g., version control guidelines), communication norms (e.g., response times, meeting etiquette), and data privacy standards. Clear frameworks can reduce the cognitive load on student teams and promote consistency in communication practices.

3. Bridge the Digital Divide Through Targeted Support Measures.

Recognizing that equitable access remains a challenge, universities should develop interventions such as device loan programs, subsidized internet packages, and expanded on-campus Wi-Fi coverage. Partnerships with technology providers can be explored to offer students affordable, high-quality devices. These measures would directly address barriers that impede full participation in digital academic activities.

4. Promote Faculty Mentorship on Digital Collaboration Management.

Research advisers and faculty members should receive capacity-building training to mentor students in research design and methodology and manage digital collaboration. Faculty guidance on project planning, task delegation, digital meeting facilitation, and conflict resolution in online environments can significantly enhance research team dynamics.

5. Integrate Platform Management Skills into Research Curricula.

Curricular revisions should incorporate modules that focus explicitly on project management and platform navigation in digital contexts. Exposure to tools such as Trello for task tracking, Slack for structured



communication, and Mendeley for collaborative referencing could be embedded within existing research writing or thesis preparation courses.

6. Conduct Continuous Research on Digital Collaboration Practices.

Higher education institutions should encourage ongoing empirical studies to monitor digital collaboration trends, challenges, and innovations. Longitudinal studies assessing how students' communication patterns evolve with technological advances would provide valuable insights for iterative policy development.

7. Foster a Culture of Reflexive Digital Use.

Beyond technical proficiency, universities should encourage a critical mindset among students regarding their digital practices. Reflexivity entails continually evaluating their digital communication behaviors' effectiveness, inclusivity, and ethical dimensions, promoting a more conscious and sustainable engagement with technology.

By implementing these recommendations, state universities can move beyond reactive digital adoption toward proactive digital empowerment, fostering academic environments where technology is a true enabler of effective, equitable, and innovative research communication

7. ACKNOWLEDGEMENT

NA

8. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

9. SOURCE/S OF FUNDING

NA

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