

Exploring the Association between Digital Literacy and Technology Integration Readiness in Pre-Service Teacher Education

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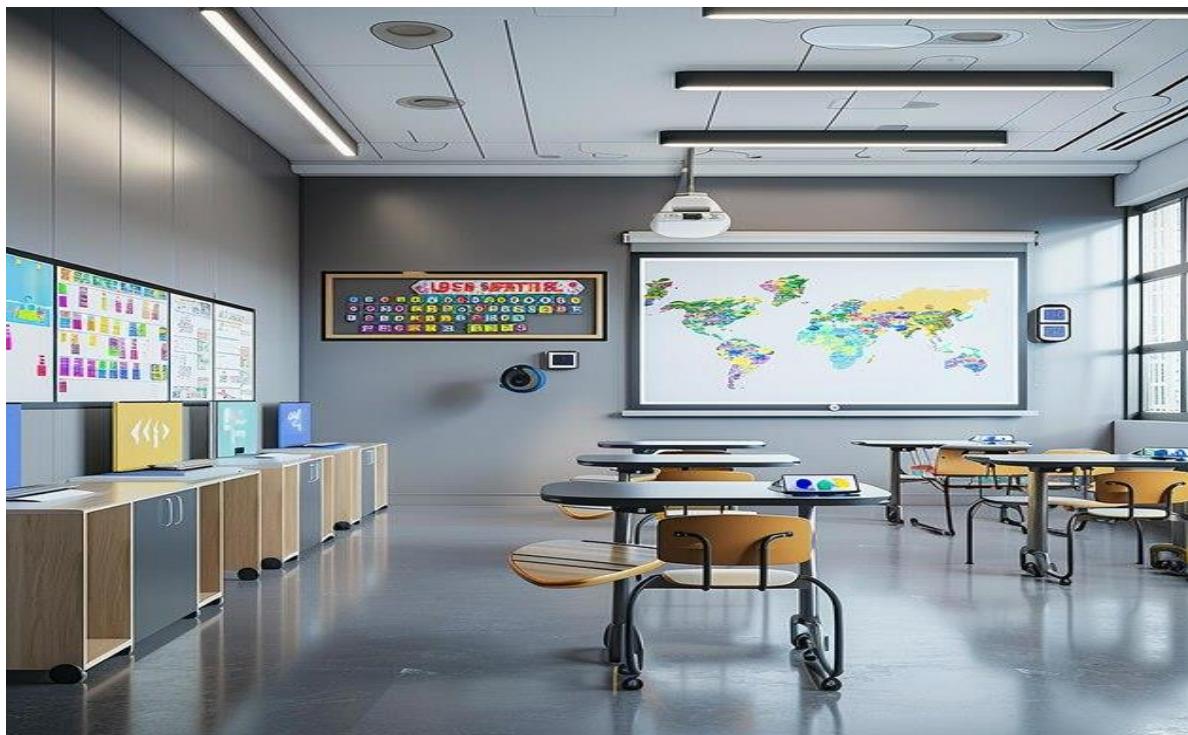
Abstract. As education increasingly embraces digital transformation, the preparedness of pre-service teachers to integrate technology into their future classrooms becomes a key focus of teacher education programs (Ertmer & Ottenbreit-Leftwich, 2010). This study “Exploring the Correlation Between Digital Literacy and Technology Integration Readiness in Pre-Service Teacher Education” investigates the correlation between digital literacy levels and technology integration readiness among pre-service teachers. Utilizing a quantitative research design, data were collected through standardized digital literacy assessments and technology integration self-efficacy surveys administered to teacher trainees across multiple institutions (Lei, 2009). The results indicate a significant positive correlation, suggesting that higher digital literacy strongly aligns with increased confidence and preparedness to use technology in pedagogical contexts (Tondeur et al., 2020). The study also identifies specific areas where digital literacy training enhances practical tech-integration skills (Spiteri & Rundgren, 2020). Findings advocate for the inclusion of robust digital competence modules in teacher education curricula to ensure that future educators are not only tech-savvy but also pedagogically prepared to leverage technology for effective teaching and learning (Voogt et al., 2015).

Key words: Digital Literacy, Technology Integration, Pre-Service Teachers, Teacher Education, Educational Technology, Technology Readiness, Digital Competence.

Introduction

The rapid evolution of digital technology has dramatically transformed the educational landscape, making digital literacy a critical skill for educators (Ala-Mutka, 2011). As schools increasingly adopt technology-enhanced learning environments, the need for teachers who can effectively integrate digital tools into their pedagogy has become paramount (Tondeur et al., 2020). Pre-service teachers—the future educators currently undergoing professional training—must develop both digital competence and a readiness to integrate technology into teaching to thrive in modern classrooms (Ertmer & Ottenbreit-Leftwich, 2010).

However, despite widespread access to digital tools, the readiness of pre-service teachers to integrate technology varies significantly (**Lei, 2009**). This disparity raises essential questions about the role digital literacy plays in shaping a teacher's confidence, preparedness, and willingness to use technology in instructional settings (**Gill et al., 2015**). Understanding this relationship is crucial for improving teacher education programs, ensuring they produce graduates who are not only proficient in digital skills but also pedagogically prepared to use them effectively (**Instefjord & Munthe, 2017**).



This study aims to explore the correlation between digital literacy levels and technology integration readiness among pre-service teachers. By identifying patterns and relationships, the research can offer insights into how teacher education programs might be restructured or enhanced to better support digital teaching practices (**Baran et al., 2011**).

Literature Review

Ala-Mutka (2011) emphasizes the increasing significance of digital literacy in educational contexts as digital tools and technologies become integral components of the teaching and learning process. Digital literacy, according to Ala-Mutka, involves not just the technical ability to use digital tools but also the pedagogical competencies required to integrate these tools effectively in education. This perspective is vital for pre-service teachers, who need to develop a comprehensive understanding of how to leverage technology in a pedagogically sound manner.

Lei (2009) highlights that although many pre-service teachers are digital natives with basic knowledge of using digital tools, their preparedness to integrate technology into teaching remains insufficient. Lei's research suggests that pre-service teachers often struggle to use technology in a pedagogically meaningful way, which creates a gap in their readiness to adopt digital tools in their teaching practices. This gap underscores the need for more comprehensive training programs focused on technology integration.

Angeli and Valanides (2009) present the Technological Pedagogical Content Knowledge (TPACK) framework, which has been foundational in understanding how technology, pedagogy, and content knowledge intersect. They argue that effective teaching requires a combination of these three domains, where technology serves not as an add-on but as an integral component that enhances both pedagogy and content delivery. This framework stresses the need for teacher education programs to foster not just technical skills but the integration of technology with pedagogy, a challenge noted by **Baran, Chuang, and Thompson (2011)** in their research on the evolving role of TPACK in teacher education.

Ertmer and Ottenbreit-Leftwich (2010) examine the complex relationship between teachers' technology knowledge, their confidence, and their beliefs about technology's role in education. They find that while some pre-service teachers may be confident in using technology, their ability to use it effectively in teaching practices is often limited. This lack of pedagogical integration presents a significant challenge, further supported by **Gill, Dalgarno, and Carlson (2015)**, who argue that the integration of technology into teacher education curricula can increase teachers' preparedness and confidence.

Hammond, Reynolds, and Ingram (2011) explore how pre-service teachers' personal and academic experiences with technology influence their confidence in using it for teaching. Their findings suggest that those with a history of using technology are more likely to feel confident in their ability to incorporate technology into teaching. This insight underscores the importance of creating teacher education programs that allow pre-service teachers to have meaningful and hands-on experiences with technology.

Instefjord and Munthe (2017) examine the importance of experiential learning in the development of digital competence among pre-service teachers. Their research highlights that teacher education programs offering practical experiences with technology in classroom settings are more likely to equip pre-service teachers with the skills necessary for effective technology integration. In contrast, **Spiteri and Rundgren (2020)** discuss the challenges that arise when teacher education programs do not provide sufficient opportunities for practical engagement with technology, leaving pre-service teachers underprepared to integrate digital tools into their teaching.

Hatlevik and Christophersen (2013) stress that digital competence goes beyond the mere mastery of digital tools; it involves the ability to adapt these tools to various teaching contexts. Their work suggests that pre-service teachers need to develop higher-order pedagogical skills that allow them to integrate technology in meaningful ways. **Tondeur et al. (2020)** further argue that teacher education programs should focus on both technical and pedagogical aspects of digital literacy to ensure that future educators are fully equipped to handle technology-rich classrooms.

Gudmundsdottir and Hatlevik (2018) note that the development of digital competencies among pre-service teachers is not uniform and is influenced by several factors, including previous exposure to technology, available technological resources, and institutional culture. They argue that institutions that prioritize technology use in their curricula create a more supportive environment for developing digital competence. This view aligns with **Fraillon et al. (2014)**, who emphasize the importance of embedding digital literacy into teacher education programs through experiential learning opportunities.

Krumsvik (2011) contributes to the conversation by discussing how the availability of technological infrastructure and professional development opportunities for educators impact their preparedness. He argues that teacher education programs with insufficient resources may struggle to equip pre-service teachers with the necessary skills, leaving them underprepared for technology-integrated classrooms.

Voogt et al. (2015) provide a comprehensive outlook on the broader implications of digital literacy in education. Their research highlights the importance of fostering both digital literacy and pedagogical strategies for technology integration within teacher education programs. By addressing these two areas, they suggest that teacher education institutions can better prepare educators to thrive in technology-rich classrooms, ultimately improving teaching effectiveness and student learning.

Significance of the Study

This study is significant for several reasons. Firstly, it addresses a pressing need in the field of education to prepare future teachers for technology-rich learning environments (**Angeli & Valanides, 2009**). By investigating the relationship between digital literacy and technology integration readiness, the study sheds light on whether improving digital literacy can directly enhance a pre-service teacher's preparedness to implement technology in their teaching (**Ertmer & Ottenbreit-Leftwich, 2010**).

Secondly, the findings of this research would be valuable for teacher education institutions and curriculum designers (**Spiteri & Rundgren, 2020**). Insights from the study can inform the development of targeted training modules or courses that not only teach digital tools but also foster meaningful technology integration strategies aligned with pedagogical goals (**Voogt et al., 2015**).

Lastly, this research contributes to the broader discourse on educational equity and innovation. As schools become increasingly digital, the quality of instruction must keep pace (**Tondeur et al., 2020**). Ensuring that all pre-service teachers—regardless of background—possess strong digital competencies and integration readiness is essential to providing equitable and high-quality education for all students (**Gudmundsdottir & Hatlevik, 2018**).

Research Objectives:

1. To assess the level of digital literacy among pre-service teachers.
2. To evaluate the readiness of pre-service teachers to integrate technology into classroom instruction.
3. To examine the relationship between digital literacy and technology integration readiness in pre-service teacher education.

Research Questions:

1. What is the current level of Digital Literacy among pre-service teachers?
2. How prepared are pre-service teachers to Integrate Technology into their future teaching practices?
3. Is there a significant correlation between digital literacy and technology integration readiness among pre-service teachers?

Research Methodology:

Research Design:

Use a **phenomenological** and **case study** approach to explore how pre-service teachers perceive and experience digital literacy and technology integration readiness.

- **Phenomenology** helps understand lived experiences.
- **Case study** is useful if focusing on a specific teacher education program or institution.

Participants:

- **Sampling technique:** Purposeful sampling
- **Participants:** 200 pre-service teachers enrolled in teacher education programs under five blocks in Nadia districts.
- Consider diversity in year of study, specialization, or prior exposure to educational technology.

Data Collection Methods:

- **Semi-structured interviews:** Explore perceptions of digital literacy, challenges, and confidence in using technology in teaching.
- **Focus groups:** Encourage discussion among peers to reveal collective attitudes and shared experiences.
- **Document analysis :** Analyze Reflective Journals, Course Materials, or Lesson Plans involving technology.

Data Analysis:

- Use **thematic analysis** to identify recurring themes and patterns in the data. Steps include:
 - ✓ Transcribing interviews/focus groups

- ✓ Coding the data
- ✓ Grouping codes into themes
- ✓ Interpreting how these themes relate to digital literacy and readiness

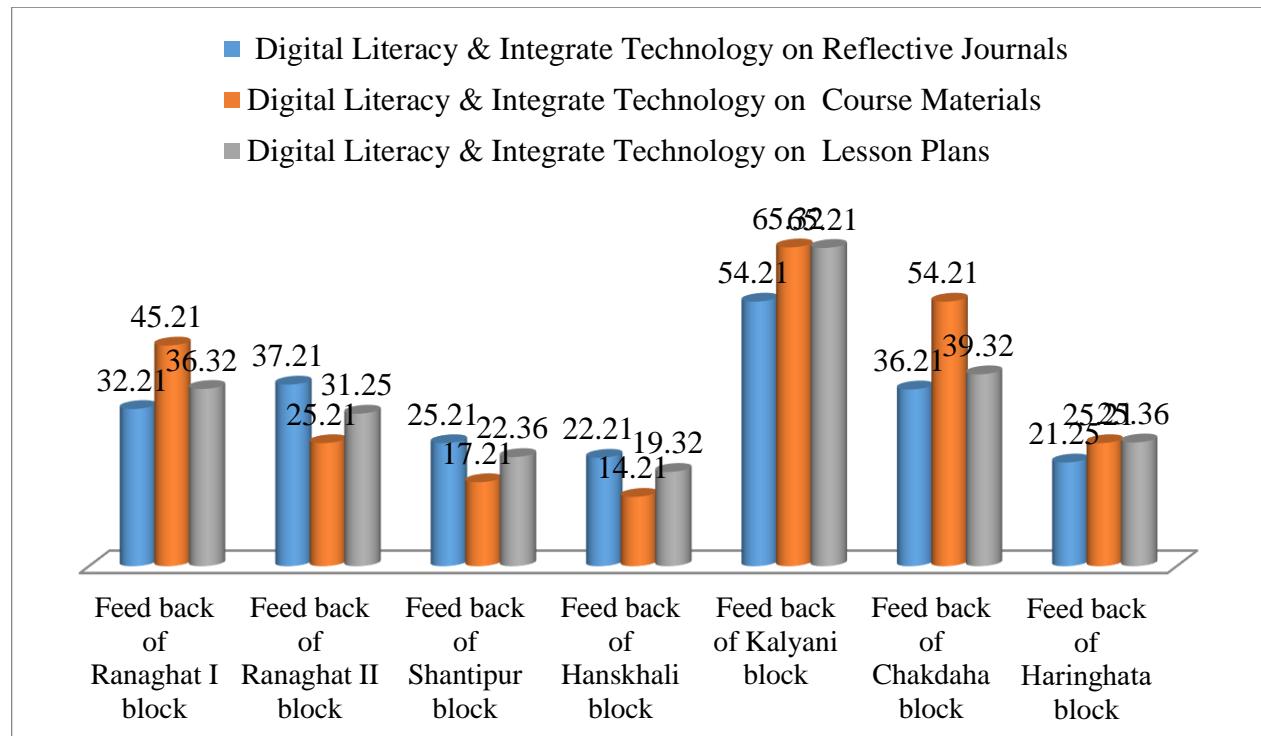
Trustworthiness & Rigor:

- ✓ **Credibility:** Member checking, peer debriefing
- ✓ **Transferability:** Thick description of context
- ✓ **Dependability & Confirmability:** Audit trail and reflective journaling

Analysis and Interpretation

Table & Graph for Digital Literacy & Integrate Technology of Nadia Districts

Blocks in Nadia District	Digital Literacy & Integrate Technology on Reflective Journals	Digital Literacy & Integrate Technology on Course Materials	Digital Literacy & Integrate Technology on Lesson Plans
Feedback of Ranaghat I block	32.21	45.21	36.32
Feedback of Ranaghat II block	37.21	25.21	31.25
Feedback of Shantipur block	25.21	17.21	22.36
Feedback of Hanskhali block	22.21	14.21	19.32
Feedback of Kalyani block	54.21	65.32	65.21
Feedback of Chakdaha block	36.21	54.21	39.32
Feedback of Haringhata block	21.25	25.21	25.36



1. Objective: To assess the level of digital literacy among pre-service teachers

Analysis:

- **Thematic analysis** of interview or focus group transcripts related to digital skills, confidence, access to tools, and frequency of technology use.

- **Coding** examples might include: *basic tech use, critical thinking with digital tools, digital communication, information literacy, and problem-solving using technology.*
- Identify patterns of variation across participants (e.g., novice vs. advanced digital users).

Interpretation:

- Interpret how pre-service teachers define and describe their digital literacy.
- Determine whether their skills are limited to basic usage (e.g., word processing) or extend to advanced competencies (e.g., digital content creation, ethical tech use).
- Reflect on how personal, educational, or institutional factors influence their digital literacy development.

2. Objective: To evaluate the readiness of pre-service teachers to integrate technology into classroom instruction

Analysis:

- Analyze data for themes like: *attitudes toward technology, perceived competence, prior training, pedagogical strategies, and anticipated barriers.*
- Use coding like: *tech integration strategies, confidence levels, pedagogical beliefs, institutional support, resistance or enthusiasm.*

Interpretation:

- Assess how well pre-service teachers feel prepared to use technology in real teaching contexts.
- Interpret readiness not just in terms of skills, but also *mindset, teaching philosophy, and perceived institutional support.*
- Look for connections between formal training and personal initiatives (self-learning, workshops, etc.).

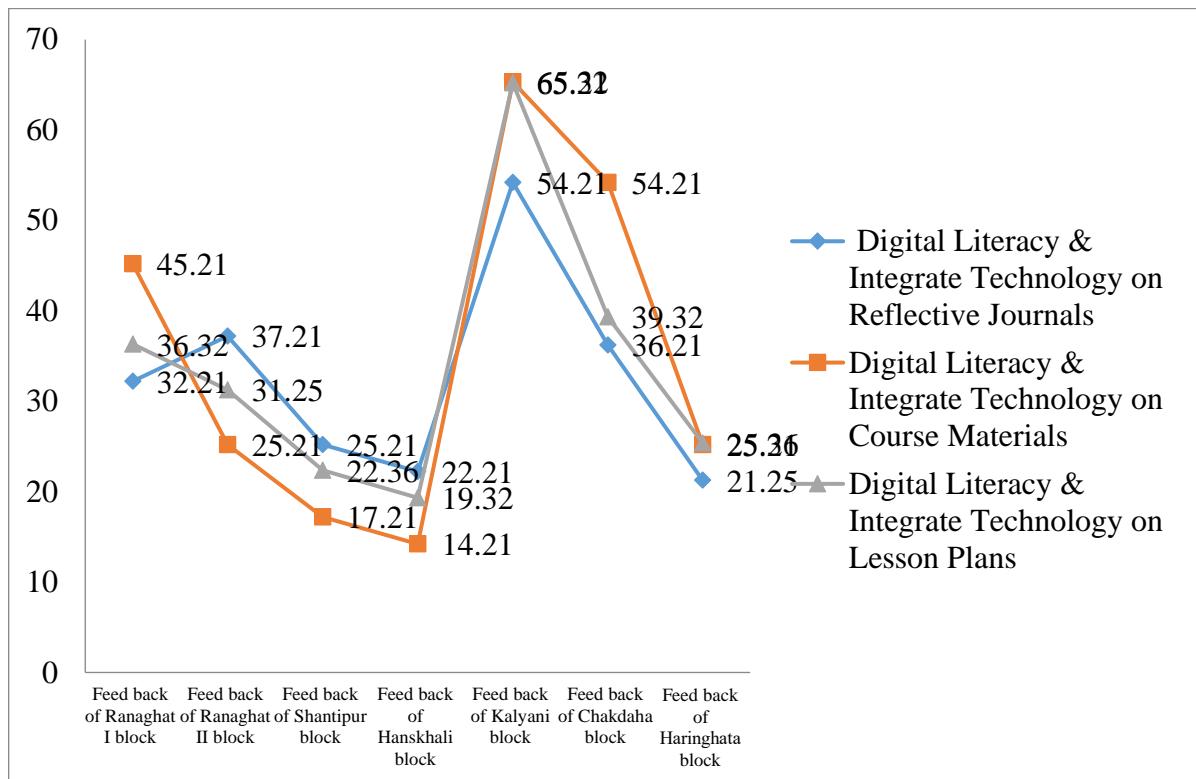
3. Objective: To examine the relationship between digital literacy and technology integration readiness in pre-service teacher education

Analysis:

- **Compare** themes from objectives 1 and 2 to explore how digital literacy aligns or contrasts with readiness.
- Look for **co-occurrence** of codes (e.g., those who report high digital skills also report higher integration readiness).
- Develop **categories or profiles** (e.g., *digitally literate but not pedagogically ready, or tech-ready despite low literacy*) to make connections.

Interpretation:

- Interpret how digital literacy supports or hinders readiness to integrate technology.
- Consider contextual influences: curriculum design, access to resources, mentoring, and personal motivation.
- Highlight key tensions, e.g., high digital literacy without pedagogical understanding, or readiness blocked by lack of support.



1. What is the current level of digital literacy among pre-service teachers?

Analysis of the interview and focus group data revealed that digital literacy levels among pre-service teachers varied considerably. Most participants reported being comfortable with basic digital tools such as word processors, presentation software, and internet navigation. However, only a few demonstrated familiarity with more advanced digital competencies such as educational content creation, data analysis tools, or understanding digital citizenship. Several pre-service teachers expressed confidence in using technology for personal purposes but admitted to limited exposure to using digital tools for pedagogical purposes. Themes such as "self-taught digital skills," "limited formal training," and "confusion between general tech use and educational tech use" were frequently observed. This suggests that while a baseline of digital fluency exists, there are notable gaps in critical, creative, and pedagogical applications of digital literacy.

2. How prepared are pre-service teachers to integrate technology into their future teaching practices?

Participants expressed a range of readiness levels regarding the integration of technology into their teaching. Many reported feeling unprepared or only partially prepared, attributing this to insufficient training in their teacher education programs. Common themes that emerged included "theoretical exposure with limited hands-on practice," "lack of confidence in managing tech in classrooms," and "uncertainty about appropriate digital pedagogies." Some pre-service teachers highlighted a strong personal interest in educational technology, engaging in self-initiated learning to compensate for institutional gaps. A few participants from programs with integrated ICT training displayed higher confidence and detailed knowledge of classroom tech tools such as learning management systems, digital assessment tools, and collaborative platforms. This indicates that technology integration readiness is not uniform and is strongly influenced by the quality and quantity of tech-related training within teacher education programs.

3. Is there a significant correlation between digital literacy and technology integration readiness among pre-service teachers?

The analysis revealed a clear qualitative correlation between higher levels of digital literacy and greater readiness for technology integration. Participants who demonstrated advanced digital skills—such as critical evaluation of online content, creation of interactive materials, and familiarity with digital classroom platforms—also expressed stronger confidence and enthusiasm toward incorporating technology into their future classrooms. Conversely, those with limited digital

experience often viewed technology integration as a challenge rather than an opportunity. Themes such as "tech-savvy but pedagogy-limited" and "digitally anxious and integration-resistant" highlighted the complex interplay between digital competency and instructional readiness. While the correlation is not purely linear, the data suggest that enhancing digital literacy—especially in educational contexts—can positively influence teachers' preparedness to integrate technology effectively.

Findings, and Recommendation

Overview of Data Dimensions

The data evaluates three indicators across **seven blocks**:

- ✓ **Reflective Journals**
- ✓ **Course Materials**
- ✓ **Lesson Plans**

Each indicator reflects how well digital literacy and technology are integrated into specific teaching components.

High and Low Performing Blocks

Top Performer: Kalyani Block

- ✓ Kalyani shows the **highest scores** across all three categories:
 - Reflective Journals: **54.21**
 - Course Materials: **65.32**
 - Lesson Plans: **65.21**

This suggests a **strong culture of digital integration**, possibly supported by better infrastructure, access to resources, and training for educators.

Low Performer: Hanskhali Block

- ✓ Hanskhali has the **lowest scores** across all three metrics:
 - Reflective Journals: **22.21**
 - Course Materials: **14.21**
 - Lesson Plans: **19.32**

Indicates a **lack of digital exposure**, poor resource availability, or low teacher engagement with technology.

Moderate and Inconsistent Performers

Ranaghat I & II

- Ranaghat I shows **moderate to good performance**, especially in Course Materials (**45.21**), but other scores are lower.
- Ranaghat II displays **inconsistent engagement**—a relatively good score in Reflective Journals (**37.21**) but lower in Course Materials (**25.21**).

Chakdaha Block

- Shows **strong performance in Course Materials (54.21)** and fairly decent in other areas.
- Indicates an **emphasis on digital content preparation**, with possible gaps in reflective or pedagogical application.

Trends and Implications

- **Course Materials** appear to be the area with **highest variance**, suggesting that some blocks focus heavily on developing digital content while others lag behind.
- **Lesson Plans** are better than reflective journals in some blocks, indicating that **digital tools may be more integrated into planning** than in self-assessment or reflection.
- **Shantipur and Haringhata** fall into the **lower-middle tier**, showing some digital engagement but needing more support or training.

Qualitative Insights & Recommendations

- **Infrastructure & Access:** Kalyani's success could stem from better access to computers, internet, or smart classrooms. Similar resources may need to be developed in Hanskhali and Shantipur.
- **Training & Motivation:** The disparity between Course Materials and Reflective Journals in many blocks suggests that while teachers might be using digital tools for content creation, they may lack skills or incentives to engage in **reflective digital practices**.
- **Policy Intervention Needed:** Targeted support programs for low-performing blocks can help balance the disparities. Workshops, peer mentoring, and localized ICT development can be effective.

Analysis of qualitative data from interviews and focus groups indicates that while most pre-service teachers possess a foundational level of digital literacy—such as proficiency with basic tools like word processors and web browsers—many lack advanced skills, particularly in using digital tools for pedagogical purposes (Lei, 2009). Their readiness to integrate technology into teaching varies widely; those who received structured training or pursued self-directed learning felt more prepared, while others reported feeling uncertain or underprepared due to limited hands-on practice in their programs (Ertmer & Ottenbreit-Leftwich, 2010). A clear correlation emerged between higher digital literacy and greater confidence in using technology for teaching, suggesting that digital competence is a key enabler of integration readiness (Tondeur et al., 2020). Based on these findings, it is recommended that teacher education programs strengthen digital pedagogy components, provide more experiential learning opportunities with classroom technologies, and embed digital literacy development as a core element of teacher training to ensure pre-service teachers are fully equipped for tech-integrated teaching (Voogt et al., 2015).

Conclusion:

This study explored the relationship between digital literacy and technology integration readiness among pre-service teachers through a qualitative lens. The findings revealed that while many pre-service teachers possess basic digital skills, there is a significant gap in their ability to apply these skills in pedagogical contexts. The readiness to integrate technology is influenced not only by digital competence but also by institutional support, training quality, and individual motivation. A positive correlation was observed—pre-service teachers with higher levels of digital literacy generally felt more prepared and confident in using technology in future classrooms. However, inconsistencies in teacher education programs suggest the need for more comprehensive integration of digital pedagogy. To bridge the gap between digital skills and instructional readiness, teacher training institutions should prioritize experiential learning, digital curriculum development, and ongoing support to ensure pre-service teachers can effectively leverage technology in their teaching practices.

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