

Digital Competence and Perceived Teaching Effectiveness among B.Ed. Trainees: A Descriptive-Correlational Study

Mr. Manish Kumar Sinha

Assistant Professor, Grizzly College of Education (Autonomous),
Jhumri Telaiya, Koderma, Jharkhand
Email — mksinhasir1975@gmail.com



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Corresponding Author:

Mr. Manish Kumar Sinha

Email: mksinhasir1975@gmail.com

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Abstract:

Digital competence has become an essential dimension of contemporary teacher preparation because meaningful technology use requires more than operational familiarity with digital devices. This study examined the digital competence and perceived teaching effectiveness of B.Ed. trainees and investigated the relationship between the two constructs as well as selected group differences. A quantitative descriptive-correlational survey design with comparative components was employed with 150 second-year B.Ed. trainees from three teacher-education institutions in and around Jhumri Telaiya, Koderma, Jharkhand. Data were collected through a study-specific 40-item, five-point Likert questionnaire comprising 20 Digital Competence items and 20 Perceived Teaching Effectiveness items, together with selected background variables. Internal consistency was strong for both scales (Cronbach's $\alpha = .933$ and $.884$, respectively). The overall mean for Digital Competence was 3.71 (SD = 0.48), while the mean for Perceived Teaching Effectiveness was 3.54 (SD = 0.37). Pearson's correlation showed a statistically significant positive association, $r(148) = .240$, $p = .003$, although the magnitude was modest. Digital Competence differed significantly by gender, prior ICT training, and daily digital-use duration. Perceived Teaching Effectiveness did not differ significantly by gender, residence, daily digital-use duration, or participating institution, but it differed significantly by prior ICT training. The findings suggest that teacher-education programmes should move beyond access-oriented ICT exposure toward sustained, practice-based digital pedagogy, assessment literacy, digital safety, reflective use and guided teaching practice. Because the study is cross-sectional and self-reported, the findings indicate association rather than causation.

Keywords: digital competence; pre-service teachers; B.Ed. trainees; perceived teaching effectiveness; teacher education; ICT; digital pedagogy

1. Introduction

Digital technology is no longer an optional supplement to educational practice. It increasingly shapes how teachers locate information, prepare learning resources, communicate with learners, design activities, assess learning and reflect on teaching. The

shift from conventional classroom practice to digitally enriched learning has therefore altered the competence profile expected of future teachers. In teacher education, the issue is particularly important because pre-service teachers are simultaneously learners, emerging professionals and future mediators of students' digital learning experiences.

India's National Education Policy (NEP) 2020 gives technology an explicit role in improving teaching-learning and evaluation, supporting teacher preparation and professional development, widening educational access and strengthening educational planning. The policy also cautions that teachers need appropriate training to become effective online educators and that traditional teaching competence cannot automatically be assumed to transfer to digitally mediated environments (Ministry of Education, Government of India, 2020). This policy position makes digital competence a legitimate and important concern within B.Ed. programmes.

Digital competence should not be reduced to the ability to operate computers or mobile applications. The European Framework for the Digital Competence of Educators (DigCompEdu) conceptualises educator competence across professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence (Redecker, 2017). In a similar conceptual direction, the TPACK framework emphasises the interaction of technological, pedagogical and content knowledge in meaningful technology integration (Mishra & Koehler, 2006). These frameworks imply that a digitally competent future teacher should be able to select, create, adapt and evaluate digital resources in relation to pedagogical purposes rather than merely use technology for its own sake.

Teaching effectiveness is likewise broader than classroom presentation. It involves planning, clarity of explanation, selection of appropriate methods and resources, learner engagement, classroom management, assessment, feedback, adaptation to learner needs and reflection on teaching. In the present study, the construct is deliberately framed as perceived teaching effectiveness because the respondents are B.Ed. trainees rather than fully employed teachers. Their ratings represent their own perceived capability to perform core teaching tasks during micro-teaching, teaching practice and school internship. This distinction is important because self-perception is not equivalent to an externally observed measure of teaching quality.

Recent research reinforces the importance of examining digital competence among pre-service teachers. Systematic and empirical studies have shown that the construct is multidimensional, that self-report remains common in the field, and that teacher preparation must connect digital knowledge with pedagogical use, practice and contextual support (Smestad et al., 2023; Claro et al., 2024). Studies focusing specifically on pre-service teachers have also reported relationships between digital attitudes, perceived competence and teacher-education experiences (Merjovaara et al., 2024). More recent work has called for curriculum adaptation, instructional design, digital identity, affective dimensions and pedagogical reasoning as part of contemporary preparation for technology-integrated teaching (Tondeur et al., 2025).

The Indian context is especially relevant. A systematic review published by the Indian Journal of Educational Technology identified attitude and self-efficacy, skills and knowledge, practical technology experience, and access to technology as important factors influencing pre-service teachers' digital competence (Shokeen & Kaur, 2022). More recently, Sheikh and Nath (2026) reported positive changes in perceived digital teaching competence following a structured digital training programme among

Indian pre-service teachers. Together, these findings suggest that digital competence is both a personal capability and a product of teacher-education opportunities.

Against this background, the present study examines B.Ed. trainees in and around Jhumri Telaiya, Koderma, Jharkhand. The study focuses on two related questions: first, what is the level of trainees' self-reported digital competence and perceived teaching effectiveness; and second, whether trainees who report stronger digital competence also report stronger teaching effectiveness. The study further explores selected group differences to identify whether gender, prior ICT training, daily digital use, residence and institution are associated with the two constructs.

Although existing literature has established the importance of digital competence in teacher preparation, evidence remains uneven regarding how self-reported digital competence is associated with perceived teaching effectiveness among B.Ed. trainees in specific Indian teacher-education contexts. The present study addresses this issue by examining both constructs together and by considering selected background characteristics among B.Ed. trainees in and around Jhumri Telaiya, Koderma, Jharkhand.

2. Review of Related Literature

The review is organised in reverse chronological order, moving from recent evidence toward foundational work. This sequence highlights the current research position before tracing the conceptual foundations of the present study.

Sheikh and Nath (2026)

Sheikh and Nath conducted an experimental study in India with 244 pre-service teachers to examine the effect of a structured digital-training programme on perceived digital teaching competence. The intervention incorporated learning-management systems, augmented reality and educational data dashboards. Significant pre–post improvements were reported across technology attitudes, operational skills, ethics and data literacy, with contextualised practice, peer learning and institutional support identified as important conditions. The study is particularly relevant to the present research because it demonstrates that digital competence among Indian pre-service teachers is developable and that practical, structured training may be more influential than simple exposure to technology.

Tondeur, Trevisan, Howard, and van Braak (2025)

This systematic review revisited the Synthesis of Qualitative Evidence (SQD) model for preparing pre-service teachers to teach with digital technologies. Using PRISMA procedures and evidence from the preceding twelve years, the authors identified both continuing and emerging strategies. The updated model highlighted digital identity, instructional design models, affective dimensions, pedagogical reasoning and the role of artificial intelligence alongside established approaches. The review strengthens the argument that teacher education should integrate technology through pedagogical reasoning and authentic preparation rather than through isolated technical-skills sessions.

Tomczyk (2024)

Tomczyk presented a global perspective based on interviews with 35 experts from 33 countries. The study concluded that pre-service teacher curricula need stronger attention to creating and managing digital content, integrating ICT with subject matter, developing interactive learning, addressing data protection and e-risks, and preparing teachers for rapidly changing socio-technical conditions. The study is relevant because it frames digital competence as a curriculum issue rather than merely an individual trait.

Claro, Castro-Grau, Ochoa, Hinostroza, and Cabello (2024)

This systematic review analysed quantitative research on digital competences of in-service school teachers published between 2016 and 2021. Forty-four studies were selected from an initial pool of 1,845 records. The review identified recurring dimensions related to planning digital lessons, using technology for teaching, organising technology-supported student activities and developing students' digital abilities. It also noted substantial variation in definitions and measurement and a heavy reliance on self-report. These observations are important for the present study because they justify careful operationalisation and transparent reporting of a self-report measure.

Merjovaara et al. (2024)

Merjovaara and colleagues examined the relationship between pre-service teachers' attitudes towards digital technologies and their self-perceived digital competence. Using survey data from 304 first-year pre-service teachers, the study found generally positive attitudes and meaningful relationships between aspects of attitudes and technological knowledge. The study also emphasised that pre-service teachers should not be treated as a homogeneous group and that digital competence is shaped by educational context. This supports the present study's attention to background variables and perceived competence.

Wohlfart and Wagner (2023)

An umbrella review of research on teachers' roles in educational digitalisation synthesised 23 systematic reviews covering 1,062 primary studies. The review highlighted the continuing relevance of frameworks such as TPACK and the need for clearer conceptualisation of digital literacy and teacher technology integration. It also pointed to barriers and institutional conditions that shape technology use. The implication for teacher education is that digital competence should be understood in relation to teaching practice and professional context.

Smestad, Hatlevik, Johannesen, and Øgrim (2023)

This systematic review examined 116 studies of teachers' and student teachers' digital competence before and during the COVID-19 period. The review found that studies frequently relied on self-reported data and that digital competence was described through knowledge, skills and attitudes, while the teacher's role and subject-specific dimensions were not always clear. The findings provide a strong methodological justification for explicitly defining constructs and acknowledging the limitations of self-report.

Shokeen and Kaur (2022)

This Indian systematic review examined factors influencing pre-service teachers' digital competence. The authors identified attitudes and self-efficacy, skills and knowledge, practical experience with technology and access to technology as major influences. For Indian teacher-education institutions, the study suggests that digital competence development requires opportunities to use technology in authentic teaching-learning situations rather than access alone.

Heine, Krepf, and König (2022/2023)

Heine and colleagues reviewed the concept of digital resources as an aspect of professional digital competence and showed that the term is used inconsistently across educational research. Their analysis is relevant to the present study because digital

competence measures need to distinguish between merely possessing or accessing digital resources and using them meaningfully for educational purposes.

Çebi and Reisoğlu (2020)

A case study of pre-service teachers examined the development of digital competence through a structured training programme informed by DigComp and DigCompEdu. The authors emphasised information and data literacy, communication and collaboration, digital content creation, safety and problem solving, while also highlighting professional engagement, teaching and learning, assessment and learner empowerment. The findings support practice-oriented digital competence development within initial teacher education.

Redecker (2017)

The European Framework for the Digital Competence of Educators (DigCompEdu) provides one of the most influential conceptual frameworks for educator digital competence. It organises competence into six areas: professional engagement; digital resources; teaching and learning; assessment; empowering learners; and facilitating learners' digital competence. The framework is useful for the present study because several of its domains informed the construction of the Digital Competence items.

Mishra and Koehler (2006)

Mishra and Koehler's TPACK framework conceptualised effective technology integration as the interaction of technological, pedagogical and content knowledge. The framework is particularly useful for understanding why operational digital skill alone cannot guarantee effective teaching. Technology becomes educationally meaningful when it is integrated with pedagogy and subject matter.

Tschannen-Moran and Woolfolk Hoy (2001)

Tschannen-Moran and Woolfolk Hoy reviewed teacher efficacy as a construct related to persistence, enthusiasm, commitment, instructional behaviour and student outcomes, while also discussing measurement challenges. Although perceived teaching effectiveness in the present study is not identical to teacher efficacy, the literature on efficacy provides a theoretical basis for treating perceived capability to perform teaching tasks as an important professional-development construct.

3. Research Gap

The review of literature indicates several areas that remain insufficiently examined. First, although digital competence has been widely investigated among teachers and pre-service teachers, comparatively limited empirical attention has been given to its relationship with perceived teaching effectiveness among B.Ed. trainees in specific Indian teacher-education contexts. Second, existing studies frequently examine digital competence in terms of attitudes, self-efficacy, technological skills or general technology use, whereas the present study considers a broader set of digitally enabled teaching-related competencies, including information and data literacy, communication, digital content creation, pedagogical technology use, assessment, digital safety and problem solving. Third, there is a need for context-specific evidence from teacher-education institutions in Jharkhand, particularly from the Koderma region, where local institutional and trainee characteristics may shape opportunities for technology-integrated teaching. Fourth, the relationship between digital competence and perceived teaching effectiveness requires examination without assuming that digital competence alone determines teaching quality. Finally, selected background factors

such as gender, prior ICT training, residence, daily digital-use duration and participating institution warrant consideration to identify patterns that may be relevant for teacher-education practice. The present study addresses these gaps by examining the level of digital competence, the level of perceived teaching effectiveness, their relationship, and selected group differences among B.Ed. trainees in and around Jhumri Telaiya, Koderma, Jharkhand.

Literature Synthesis

Taken together, the reviewed literature indicates that digital competence among pre-service teachers is multidimensional and extends beyond basic technical skills to include information and data literacy, digital communication, content creation, pedagogical integration, assessment, safety and problem solving. The literature also indicates that digital competence is influenced by training, practical experience, attitudes, self-efficacy and institutional conditions. However, much of the existing evidence has either examined digital competence as a standalone construct or focused on broader teacher populations and contexts. Comparatively less attention has been given to the relationship between digital competence and perceived teaching effectiveness among B.Ed. trainees within specific Indian teacher-education settings. This provides the basis for the present study.

4. Conceptual Framework

The study is conceptually informed by DigCompEdu and TPACK, with perceived teaching effectiveness informed by the broader literature on teacher efficacy and instructional practice. Digital competence is treated as a multidimensional self-reported construct involving technical/productivity skills, information and data literacy, digital communication and collaboration, digital content creation, pedagogical use of technology, assessment and feedback, digital safety and ethics, problem solving, and confidence in technology integration. Perceived teaching effectiveness is treated as trainees' self-assessment of planning, instructional delivery, learner engagement, classroom management, inclusive teaching, teaching resources, technology integration, assessment, adaptive teaching and reflective practice.

The proposed relationship is not interpreted causally. A positive association would indicate that trainees with higher reported digital competence also tend to report higher perceived teaching effectiveness; it would not demonstrate that digital competence causes effective teaching. This distinction is essential because the present design is cross-sectional and based on self-reported perceptions.

Figure 1. Conceptual Framework



Interpretation: self-reported Digital Competence and Perceived Teaching Effectiveness

Figure 1. Conceptual framework of the relationship between digital competence and perceived teaching effectiveness among B.Ed. trainees.

5. Objectives of the Study

1. To assess the level of Digital Competence among B.Ed. trainees.
2. To assess the level of Perceived Teaching Effectiveness among B.Ed. trainees.
3. To examine the relationship between Digital Competence and Perceived Teaching Effectiveness among B.Ed. trainees.
4. To examine whether Digital Competence differs significantly by gender and prior ICT training.
5. To examine whether Perceived Teaching Effectiveness differs significantly by gender and prior ICT training.
6. To examine whether Digital Competence and Perceived Teaching Effectiveness differ across selected background categories such as residence, daily digital-use duration and participating institution.

6. Hypotheses

H01: There is no statistically significant relationship between Digital Competence and Perceived Teaching Effectiveness among B.Ed. trainees.

H02: There is no statistically significant difference in Digital Competence between male and female B.Ed. trainees.

H03: There is no statistically significant difference in Digital Competence between B.Ed. trainees with and without prior ICT training.

H04: There is no statistically significant difference in Perceived Teaching Effectiveness between male and female B.Ed. trainees.

H05: There is no statistically significant difference in Perceived Teaching Effectiveness between B.Ed. trainees with and without prior ICT training.

H06: There is no statistically significant difference in Digital Competence across residence, daily digital-use duration, and participating institution.

H07: There is no statistically significant difference in Perceived Teaching Effectiveness across residence, daily digital-use duration, and participating institution.

7. Methodology

7.1 Research Design

The study adopted a quantitative descriptive-correlational survey design with comparative components. The descriptive component was used to estimate the levels of Digital Competence and Perceived Teaching Effectiveness; the correlational component examined the association between the two constructs; and the comparative component examined differences across selected background categories. Pearson correlation was used for the relationship between the two constructs, while independent-samples t-tests and one-way ANOVA were used for selected group comparisons. Because the study is cross-sectional and non-experimental, no causal inference is made.

7.2 Population and Study Setting

The population comprised B.Ed. trainees enrolled in teacher-education institutions in and around Jhumri Telaiya, Koderma, Jharkhand. The sampling frame supplied for the study represented three B.Ed. institutions, coded C01, C02 and C03 for analysis.

The participating trainees were second-year B.Ed. students and all 150 respondents reported exposure to school internship/teaching practice.

7.3 Sample and Sampling

The final dataset contained 150 complete responses. The distribution by participating institution was C01 = 70, C02 = 45 and C03 = 35. Because the supplied dataset represents a selected set of institutions rather than a probability sample of all B.Ed. trainees in Jharkhand, the findings should be interpreted as context-specific and should not be generalised beyond comparable settings without further evidence.

Characteristic	Category	n	%
Institution	C01	70	46.7
Institution	C02	45	30.0
Institution	C03	35	23.3
Gender	Female	81	54.0
Gender	Male	69	46.0
Residence	Rural	63	42.0
Residence	Semi-urban	44	29.3
Residence	Urban	43	28.7
Prior ICT training	Yes	86	57.3
Prior ICT training	No	64	42.7
Daily digital use	<1 hour	6	4.0
Daily digital use	1–2 hours	47	31.3
Daily digital use	2–4 hours	73	48.7
Daily digital use	>4 hours	24	16.0

The mean age of respondents was 24.47 years (SD = 1.86), with ages ranging from 21 to 29 years. All respondents were in Year 2 of the B.Ed. programme and all reported school-internship/teaching-practice exposure.

7.4 Research Instrument

A structured 40-item Likert-type questionnaire was used. Section A contained 20 Digital Competence items (DC01–DC20), while Section B contained 20 Perceived Teaching Effectiveness items (PTE01–PTE20). Responses were recorded on a five-point scale: 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree and 1 = Strongly Disagree. Background variables included age, gender, year of study, residence, internship exposure, prior ICT training and approximate daily digital-use duration.

The Digital Competence items were constructed to reflect major areas represented in contemporary digital-competence frameworks, including digital resource use, information and data literacy, communication, content creation, pedagogical technology use, assessment, safety, problem solving and confidence. The Perceived Teaching Effectiveness items covered

planning, instructional delivery, questioning, learner engagement, classroom management, inclusive practice, resource use, assessment, adaptive teaching and reflective practice.

The instrument should be described as a study-specific structured questionnaire informed by established frameworks, not as a direct administration of a proprietary standardised scale. Accordingly, the reliability coefficient reported below demonstrates internal consistency in this sample; it does not by itself establish construct validity or equivalence with a validated external instrument.

7.5 Reliability

Cronbach's alpha for the 20-item Digital Competence scale was $\alpha = 0.933$, while alpha for the 20-item Perceived Teaching Effectiveness scale was $\alpha = 0.884$. Both coefficients indicate strong internal consistency in the present sample. These coefficients should nevertheless be interpreted as sample-specific reliability evidence rather than as proof of universal validity.

7.6 Data Collection and Data Quality

The dataset contained 150 completed respondent records. Data screening found no missing responses across the 40 substantive scale items and no invalid Likert codes. Respondent identifiers were anonymised through codes. The analysis used the item-level responses rather than relying only on pre-computed totals; totals and means were independently recomputed to verify consistency.

7.7 Statistical Techniques

All reported inferential results were computed from the 150 respondent-level records. For ANOVA, the reported F statistics are omnibus tests; post-hoc comparisons were not interpreted where the omnibus test was non-significant.

Descriptive statistics included frequency, percentage, mean and standard deviation. Internal consistency was estimated using Cronbach's alpha. Pearson's product-moment correlation was used to examine the relationship between Digital Competence and Perceived Teaching Effectiveness. Independent-samples t-tests were used for binary group comparisons, and one-way ANOVA was used for multi-category comparisons. Statistical significance was evaluated at the .05 level. The interpretation of correlation was kept non-causal.

8. Results and Analysis

8.1 Overall Levels of the Two Constructs

Variable	N	Mean	SD	Minimum	Maximum
Digital Competence	150	3.71	0.48	2.65	4.90
Perceived Teaching Effectiveness	150	3.54	0.37	2.60	4.60

On the five-point response scale, the overall mean of 3.71 for Digital Competence indicates that respondents generally perceived themselves as competent in using digital technologies for academic and teaching-related purposes. The Perceived Teaching

Effectiveness mean of 3.54 likewise indicates a generally positive self-assessment. The lower standard deviation for teaching effectiveness suggests comparatively less dispersion in respondents' self-ratings on that construct.

8.2 Item-wise Digital Competence

Item	Mean	SD
DC13	3.79	0.72
DC11	3.76	0.70
DC07	3.75	0.72
DC14	3.74	0.69
DC10	3.73	0.73
DC17	3.73	0.71
DC18	3.73	0.75
DC03	3.73	0.73
DC09	3.72	0.76
DC16	3.71	0.76
DC15	3.71	0.74
DC02	3.70	0.70
DC19	3.69	0.71
DC01	3.69	0.72
DC08	3.69	0.74
DC04	3.68	0.72
DC12	3.68	0.73
DC20	3.67	0.71
DC06	3.66	0.71
DC05	3.62	0.75

The highest Digital Competence item was DC13, concerning the use of digital tools to make lessons more engaging and learner-centred ($M = 3.79$, $SD = 0.72$). This was followed by DC11, concerning integration of images, audio, video or interactive content ($M = 3.76$), and DC07, concerning digital communication and collaboration ($M = 3.75$). The lowest item mean was DC05, concerning the ability to judge whether an online educational source is reliable and relevant ($M = 3.62$). The pattern suggests relatively stronger confidence in practical and communicative digital use than in critical evaluation of online information.

8.3 Item-wise Perceived Teaching Effectiveness

Item	Mean	SD
PTE14	3.59	0.69
PTE01	3.59	0.69

PTE15	3.58	0.67
PTE17	3.58	0.67
PTE04	3.57	0.62
PTE08	3.57	0.67
PTE18	3.57	0.69
PTE19	3.57	0.70
PTE16	3.54	0.71
PTE05	3.54	0.61
PTE13	3.54	0.64
PTE06	3.53	0.65
PTE10	3.52	0.58
PTE11	3.52	0.67
PTE03	3.50	0.69
PTE02	3.50	0.67
PTE07	3.50	0.70
PTE20	3.49	0.64
PTE12	3.48	0.69
PTE09	3.47	0.66

The highest Perceived Teaching Effectiveness item was PTE14, assessing whether trainees can judge learners' understanding of a lesson ($M = 3.59$, $SD = 0.69$). Planning clear learning objectives (PTE01) followed closely ($M = 3.59$), as did providing constructive feedback and connecting content with real-life experience (PTE15 and PTE17; $M = 3.58$ each). The lowest item was PTE09, concerning effective classroom time management ($M = 3.47$, $SD = 0.66$). This pattern points to generally positive self-perceptions, with time management and resource use offering comparatively greater scope for further practice.

8.4 Relationship between Digital Competence and Perceived Teaching Effectiveness

Variables	N	Pearson r	p-value	Decision at .05
Digital Competence × Perceived Teaching Effectiveness	150	0.240	0.003	Significant

Pearson's correlation was positive and statistically significant, $r(148) = .240$, $p = .003$. Thus, the null hypothesis that there is no significant relationship between the two constructs is rejected. The association is modest in magnitude: trainees who reported higher digital competence tended, on average, to report higher perceived teaching effectiveness. The result should not be

interpreted as evidence that digital competence causes teaching effectiveness; both variables were measured at one time through self-report.

8.5 Gender Differences

Outcome	Female M (n=81)	Male M (n=69)	t	p	Interpretation
Digital Competence	3.63	3.80	-2.08	0.039	Significant
Perceived Teaching Effectiveness	3.54	3.53	0.23	0.818	Not significant

Digital Competence differed significantly by gender, with male respondents reporting a higher mean than female respondents. The corresponding effect was small to modest (Cohen's $d = 0.34$). Perceived Teaching Effectiveness did not differ significantly by gender. Therefore, H02 is rejected, whereas the evidence does not support a gender difference in perceived teaching effectiveness (H04 is not rejected).

8.6 Differences by Prior ICT Training

Outcome	ICT training Yes M (n=86)	No M (n=64)	t	p	Interpretation
Digital Competence	3.84	3.54	3.93	< .001	Significant
Perceived Teaching Effectiveness	3.48	3.62	-2.42	0.017	Significant

Trainees who reported prior ICT training had significantly higher Digital Competence scores than those without prior ICT training. The effect was substantial in practical terms (Cohen's $d = 0.67$). Interestingly, the prior-training group reported slightly lower Perceived Teaching Effectiveness than the no-training group, and this difference was also statistically significant but smaller (Cohen's $d = -0.39$). This result should not be interpreted as evidence that ICT training reduces teaching effectiveness. The cross-sectional design cannot establish causality, and unmeasured factors may explain the difference. H03 and H05 are rejected.

8.7 Residence, Daily Digital Use and Institution

Grouping variable	Outcome	Test statistic	p-value	Conclusion
Residence	Digital Competence	F = 0.51	0.601	Not significant
Residence	Perceived Teaching Effectiveness	F = 0.46	0.629	Not significant
Daily digital use	Digital Competence	F = 3.64	0.014	Significant
Daily digital use	Perceived Teaching Effectiveness	F = 1.50	0.216	Not significant
Institution	Digital Competence	F = 2.18	0.117	Not significant
Institution	Perceived Teaching Effectiveness	F = 0.28	0.760	Not significant

Residence was not significantly associated with either outcome. Daily digital-use duration was significantly associated with Digital Competence, but not with Perceived Teaching Effectiveness. Institution was not significantly associated with either outcome.

Because the ANOVA results for daily digital use are omnibus tests, they indicate that at least one category differs but do not identify all pairwise differences; post-hoc testing would be needed for that purpose. The present paper therefore avoids overstating the location of the differences.

9. Discussion

The first major finding is that B.Ed. trainees in the sample reported generally positive levels of Digital Competence ($M = 3.71$). This is consistent with broader evidence showing that pre-service teachers commonly report positive attitudes or moderate-to-positive self-perceived digital capabilities, while also displaying variation across particular dimensions (Merjovaara et al., 2024). The result should not, however, be read as proof of advanced demonstrated competence. Systematic reviews repeatedly warn that self-report is common in digital-competence research and may not fully capture actual performance (Smestad et al., 2023; Claro et al., 2024).

The second major finding is the generally positive Perceived Teaching Effectiveness score ($M = 3.54$). The highest-rated items concerned judging learner understanding, planning learning objectives, providing feedback and connecting content with real-life experiences. These are central elements of instructional practice and are appropriate areas for B.Ed. trainees who have completed or are undergoing school internship. The relatively lower rating for time management suggests that practical classroom routines may require continued guided practice, mentor feedback and reflective teaching.

The statistically significant positive relationship between Digital Competence and Perceived Teaching Effectiveness is theoretically plausible. TPACK argues that meaningful technology integration requires the interaction of technological, pedagogical and content knowledge rather than isolated technical skill (Mishra & Koehler, 2006). Similarly, DigCompEdu places digital resources within broader teaching, learning and assessment processes (Redecker, 2017). The present correlation therefore supports the view that digitally confident trainees may also perceive themselves as more capable of organising and enacting teaching tasks. Yet the modest effect size is equally important: digital competence is only one part of teaching effectiveness. Subject knowledge, pedagogical knowledge, classroom experience, motivation, mentoring, classroom conditions and learner characteristics can all contribute.

The significant difference in Digital Competence by gender deserves careful interpretation. The male group reported a higher mean, but the effect size was not large. The result should therefore be treated as a context-specific group difference rather than a general claim about gender and digital ability. Recent research has shown that pre-service teachers can differ by gender and other background characteristics, but such differences are shaped by learning opportunities and context rather than by gender alone (Yoon, 2022). Teacher education institutions should respond by ensuring equitable access to meaningful digital practice for all trainees rather than designing gender-essentialist interventions.

The strongest practically relevant finding concerned prior ICT training. Trainees who reported prior ICT training had markedly higher Digital Competence. This aligns closely with Indian review evidence identifying practical experience, knowledge, skills and self-efficacy as important influences on pre-service teachers' digital competence (Shokeen & Kaur, 2022), and with the 2026 Indian experimental evidence showing improvements after structured digital training (Sheikh & Nath, 2026). The result suggests

that teacher education programmes should not assume that routine exposure to smartphones, social media or general digital tools automatically develops professional digital competence. Formal, guided, curriculum-linked practice appears more defensible.

The finding that the prior-ICT-training group reported slightly lower Perceived Teaching Effectiveness is more complex. It should not be interpreted as a negative effect of ICT training. One plausible interpretation is that trained trainees may possess greater awareness of what effective technology-supported teaching requires and therefore evaluate themselves more critically. Another possibility is that the groups differ on unmeasured characteristics. Because the present design is cross-sectional and non-experimental, causal explanations cannot be tested.

Daily digital-use duration was significantly related to Digital Competence but not to Perceived Teaching Effectiveness. This distinction is important. Frequent use of digital devices may increase familiarity and confidence, but frequency of use does not necessarily translate into better teaching. Professional digital competence depends on the purpose and quality of use, including information evaluation, content creation, pedagogical integration, assessment, safety and reflection. The finding is therefore consistent with the literature's distinction between general digital familiarity and educationally meaningful digital competence. Finally, neither institution nor residence showed significant differences in the two principal outcomes. This may indicate broadly similar experiences across the participating institutions, but it may also reflect the sample size, the limited number of institutions, or the fact that institutional differences were not measured directly. Future research should include institutional support, device access, connectivity, mentor guidance, digital pedagogy coursework and school-internship conditions as explanatory variables.

10. Major Findings

- Digital Competence among the 150 B.Ed. trainees was generally positive ($M = 3.71$, $SD = 0.48$).
- Perceived Teaching Effectiveness was also generally positive ($M = 3.54$, $SD = 0.37$).
- The Digital Competence scale showed strong internal consistency ($\alpha = .933$).
- The Perceived Teaching Effectiveness scale also showed strong internal consistency ($\alpha = .884$).
- Digital Competence and Perceived Teaching Effectiveness were positively and significantly correlated, $r(148) = .240$, $p = .003$.
- Digital Competence differed significantly by gender, with the male group reporting the higher mean.
- Digital Competence was significantly higher among trainees who had prior ICT training.
- Perceived Teaching Effectiveness differed significantly by prior ICT training, with the no-training group reporting the higher mean; this result is interpreted cautiously because the design cannot establish causation.
- Residence and participating institution were not significantly associated with either principal outcome.
- Daily digital-use duration was significantly associated with Digital Competence but not with Perceived Teaching Effectiveness.

11. Educational Implications

- Teacher education curricula should integrate digital competence across pedagogy courses, school internship, assessment and reflective practice instead of treating ICT as an isolated technical unit.

- Digital training should include critical information evaluation, source credibility, copyright, plagiarism, privacy and digital safety, because these areas remain essential even when trainees report generally positive digital confidence.
- Practical workshops should require trainees to create lesson presentations, digital learning materials, online quizzes, formative-assessment activities and multimedia resources linked to specific learning objectives.
- Micro-teaching and school internship should include structured opportunities to integrate digital resources into actual lessons, followed by mentor feedback and reflection.
- Institutions should provide equitable access to devices, connectivity, educational software and digital-resource repositories, while recognising that access alone does not guarantee pedagogically meaningful use.
- Teacher educators should model appropriate technology integration in their own teaching. The emphasis should be on why a tool is selected, how it supports learning and how its educational value is evaluated.
- Because digital use frequency was related to competence but not teaching effectiveness, professional development should emphasise purposeful pedagogical use rather than simply increasing screen time.
- Assessment of digital competence should gradually incorporate performance-based tasks, lesson artefacts, observed teaching and portfolio evidence in addition to self-report questionnaires.
- Professional learning should be continuous because digital tools, AI-enabled systems and educational platforms evolve faster than fixed curriculum cycles.

12. Limitations of the Study

- The study used a selected sample of 150 B.Ed. trainees from three institutions in and around Jhumri Telaiya, Koderma; therefore, generalisation to all B.Ed. trainees in Jharkhand or India should be avoided.
- The study relied on self-reported perceptions. Digital competence and teaching effectiveness were not independently verified through performance tests or classroom observations.
- The design was cross-sectional, so the observed association between Digital Competence and Perceived Teaching Effectiveness cannot be interpreted causally.
- The study-specific questionnaire showed strong internal consistency, but further validation through expert review, exploratory/confirmatory factor analysis and criterion-related evidence is desirable before treating it as a standardised instrument.
- Only selected background variables were available in the dataset. Future research should include variables such as quality of ICT training, mentor support, infrastructure, subject pedagogy, prior teaching experience and actual technology use in internship lessons.

13. Conclusion

The study demonstrates that the B.Ed. trainees in the sampled teacher-education institutions reported generally positive digital competence and perceived teaching effectiveness. More importantly, the two constructs were positively associated, although the relationship was modest. The findings therefore support the educational value of developing digital competence as part of professional teacher preparation, while rejecting the simplistic assumption that digital competence alone determines teaching effectiveness.

The strongest practical message concerns the role of structured ICT training. Trainees with prior ICT training reported substantially higher digital competence, which is consistent with the broader evidence that professional digital competence develops through guided practice, pedagogical integration and institutional support. At the same time, the difference in perceived teaching effectiveness across training groups cautions against treating training exposure as a simple causal mechanism. The quality, content and pedagogical relevance of training matter.

For B.Ed. programmes, the appropriate goal is therefore not merely digitally confident trainees, but reflective future teachers who can select technology for a clear pedagogical purpose, evaluate digital information critically, design meaningful resources, assess learning, protect learners' data, adapt instruction and reflect on the effectiveness of their choices. Future research should combine self-report with observed teaching and performance-based measures to establish a stronger evidence base for digital teacher competence.

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Appendix A. Study-Specific Questionnaire

Response options for all statements: 5 = Strongly Agree; 4 = Agree; 3 = Neutral; 2 = Disagree; 1 = Strongly Disagree.

DC01. I can use word-processing software to prepare academic and teaching materials.

DC02. I can create effective presentations using digital presentation tools.

DC03. I can organize and manage digital files and folders efficiently.

DC04. I can use online search strategies to locate reliable academic information.

DC05. I can judge whether an online educational source is reliable and relevant.

DC06. I can use digital libraries, repositories or e-resources for academic work.

DC07. I can communicate and collaborate with peers using digital platforms.

DC08. I can participate effectively in online classes, meetings or learning communities.

DC09. I can share digital learning resources responsibly with others.

DC10. I can create or adapt digital teaching-learning materials for classroom use.

DC11. I can integrate images, audio, video or interactive content into learning materials.

DC12. I can select digital tools appropriate to a particular teaching objective.

DC13. I can use digital tools to make lessons more engaging and learner-centred.

DC14. I can use digital tools to assess learners and provide feedback.

DC15. I can use online quizzes, forms or similar tools for formative assessment.

DC16. I understand basic practices for protecting passwords and personal data online.

DC17. I understand copyright, plagiarism and responsible use of digital content.

DC18. I can troubleshoot common minor problems while using digital devices or applications.

DC19. I can learn to use a new digital tool when it is required for teaching or learning.

DC20. I feel confident integrating digital technology into my future classroom teaching.

Perceived Teaching Effectiveness

PTE01. I can state clear learning objectives before teaching a lesson.

PTE02. I can organize lesson content in a logical sequence.

PTE03. I can select teaching methods according to the topic and learners' needs.

PTE04. I can explain subject matter clearly during teaching practice.

PTE05. I can use appropriate examples to make concepts understandable.

PTE06. I can ask meaningful questions that promote learners' thinking.

PTE07. I can maintain learners' attention and participation during a lesson.

PTE08. I can encourage learners to participate actively in classroom activities.

PTE09. I can manage classroom time effectively.

PTE10. I can maintain an orderly and supportive classroom environment.

PTE11. I can respond appropriately to differences in learners' abilities and needs.

PTE12. I can use teaching-learning materials effectively during a lesson.

PTE13. I can integrate suitable digital resources into my teaching when needed.

PTE14. I can assess whether learners have understood the lesson.

PTE15. I can provide constructive feedback to learners.

PTE16. I can modify my teaching when learners do not understand a concept.

PTE17. I can connect lesson content with learners' real-life experiences.

PTE18. I reflect on my teaching performance after a lesson.

PTE19. I use feedback from mentors or peers to improve my teaching.

PTE20. Overall, I feel confident in my ability to teach effectively.

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