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Preparing for the Future: A Quantitative Evaluation of Pre-Service Teacher Education for 21st-Century Classrooms

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Abstract

The dynamic landscape of 21st-century education demands that teachers possess a broad set of skills, including technological literacy, critical thinking, adaptability, and inclusive pedagogical practices. Pre-service teacher education programs play a critical role in equipping future educators with these competencies. However, the effectiveness of such programs in preparing teacher candidates for contemporary classroom challenges remains insufficiently evaluated. This study aims to quantitatively assess the effectiveness of pre-service teacher education programs in preparing future teachers to meet the demands of 21st-century classrooms. Specifically, it examines teacher candidates' self-reported preparedness across key domains such as technology integration, differentiated instruction, classroom management, and student-centered learning. A cross-sectional survey design was employed, to N = 400 final-year pre-service teachers from five accredited teacher education institutions. A structured questionnaire with Likert-scale items was used to collect data. The descriptive statistics ANOVA, regression analysis was conducted to examine the relationship between program components and perceived preparedness levels. The results of the study indicated a moderate to high levels, the model was statistically significant, $F(3, 396) = 111.62$, $p < .001$, explaining 46% of perceived preparedness among respondents, with the highest scores in content knowledge and classroom management. Though, lower scores were reported in areas such as technology integration and inclusive education. The significant differences were found between institutions, suggesting variability in program quality and emphasis. Regression analysis revealed that field experiences and faculty support were strong predictors of perceived preparedness. As the pre-service teacher education programs are generally effective in equipping future educators for the classroom, gaps remain in preparing them for the full spectrum of 21st-century teaching demands, particularly in technology and inclusion.

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Targeted improvements in curriculum design and practicum experiences are recommended to enhance program effectiveness.

Keywords: Pre-service teacher education, 21st-century skills, 21st-Century Classrooms teacher preparedness, quantitative analysis, educational effectiveness

Introduction

In the context of the 21st-century, teaching and learning environments have undergone significantly, the transition from the broad background to the specific problem could be slightly tightened as on transformations due to technological advancement, globalization, demographic shifts, and evolving educational paradigms. Classrooms today are increasingly diverse, digital, and collaborative, requiring educators to adopt new competencies beyond traditional content delivery (Voogt et al., 2013; Darling-Hammond, 2017). Teachers are expected not only to instruct but also to facilitate critical thinking, promote inclusivity, integrate technology, and foster socio-emotional learning (Trilling & Fadel, 2009; Fullan & Langworthy, 2014).

Pre-service teacher education programs play a pivotal role in preparing future teachers to navigate these demands effectively. These programs aim to equip teacher candidates with pedagogical knowledge, professional skills, and the capacity to adapt to evolving classroom dynamics (Zeichner, 2012). Yet, there is increasing concern regarding whether these programs sufficiently prepare graduates for the realities of 21st-century classrooms (Darling-Hammond et al., 2020; OECD, 2019).

Research highlights disparities in the quality and focus of teacher education programs, particularly in their capacity to foster digital literacy, inclusive teaching, and classroom innovation (Koehler & Mishra, 2009; UNESCO, 2018). Although many programs now incorporate modules on information and communication technology (ICT), inclusion, and student-centered approaches, the implementation and impact of these components vary widely (Ertmer & Ottenbreit-Leftwich, 2010). This necessitates an empirical evaluation of the effectiveness of such programs, especially from the perspective of pre-service teachers who are nearing graduation.

Despite continuous reform efforts in teacher education, many graduates report feeling underprepared to meet the challenges of today's classrooms (Cochran-Smith et al., 2016; Darling-Hammond et al., 2017). The persistent gap between theoretical preparation and practical application has raised concerns about the alignment between program curricula and actual teaching needs (Ball & Forzani, 2009; Zeichner, 2012). Challenges include insufficient training in classroom management, inadequate exposure to inclusive education practices, limited experience with differentiated instruction, and minimal guidance on the integration of technology into pedagogy (Gao et al., 2013; Mishra & Koehler, 2006).

Quantitative data assessing how effectively pre-service programs prepare teacher candidates for these challenges is scarce. Most existing evaluations rely on qualitative measures, anecdotal feedback, or program-level assessments without a systematic exploration of student perceptions across different teaching domains (Hammerness et al., 2005; OECD, 2019). There is, therefore, a pressing need for a data-driven inquiry into how pre-service teachers perceive their readiness and which elements of their training contribute most significantly to their confidence and competence.

The significance of this research lies in its potential to contribute evidence-based insights into the current state of teacher preparation. As school systems aim to meet national and international benchmarks such as the Sustainable Development Goals (UNESCO, 2016) and 21st-century skills frameworks (P21, 2015), the effectiveness of teacher education becomes paramount.

Findings from this study can inform policy decisions, guide curriculum redesign, and support institutions in strengthening areas that currently fall short. Moreover, it will contribute to the scholarly literature by providing a comprehensive quantitative analysis of teacher readiness, a relatively underexplored dimension in the field (Grossman et al., 2009; Tatto et al., 2012). Educational institutions, teacher educators, accreditation bodies, and policymakers will benefit from the results, using them to enhance teacher training quality and graduate outcomes.

This study is delimited to final-year pre-service teachers enrolled in accredited teacher education programs in selected universities. The study adopts a quantitative research design, utilizing self-reported survey instruments to collect data on

perceived preparedness. It does not include in-service teachers, program administrators, or direct classroom observation.

While the study focuses on perceived rather than objectively measured competence, it offers valuable insights into how future teachers assess their own readiness. This perception-based approach is particularly relevant, as teacher confidence has been linked to actual classroom performance (Tschannen-Moran & Woolfolk Hoy, 2001).

- **Definition of Terms**

a) Pre-service teacher: An individual enrolled in a teacher education program who has not yet assumed full-time teaching responsibilities.
b) 21st-century skills: A broad set of knowledge, skills, work habits, and character traits deemed necessary to succeed in modern educational and workplace environments. These include critical thinking, collaboration, digital literacy, and cultural awareness (Trilling & Fadel, 2009).
c) Perceived preparedness: The self-reported level of confidence and readiness that a pre-service teacher feels regarding their ability to perform teaching duties effectively.

Review of the Literature

The existing research on pre-service teacher's education (PSTE) and its readiness to prepare teachers for 21st-century classrooms has grownup rapidly over the last two decades. The literature focusses on whether PSTE cultivates the teachers' digital competency, higher-order pedagogical skills, collaborative and problem-solving dispositions, and capacities for inclusive, learner-centered instruction. The literature shows numerous repeated themes like curriculum alignment, technology integration, practicum quality, assessment and leadership for outcomes but also significant contradictions and insistent methodological weaknesses that limit clear conclusions about "effectiveness."

A demanding evaluation that (a) follows B.Ed. (Hons) graduates from final year into early teaching years, (b) uses triangulated measures (classroom observation, validated performance rubrics, student learning indicators), and (c) explicitly examines contextual mediators (the school resources, mentor support, policy environment) would address several of the gaps above. Doing this in Pakistan or a similarly under-represented context adds needed empirical specificity and progresses the field's external validity.

The literature founds a clear schema on competency alignment, authentic practicum, and importance of ICT integration, but falls short on strong causal data and contextually valid measurement. To the strengthening the empirical designs (longitudinal, mixed methods, validated instruments) and centering low-resource contexts will move the field from hopeful curriculum descriptions to defensible claims about what prepares teachers for 21st-century classrooms.

Theoretical Framework

This study is anchored in Shulman's Pedagogical Content Knowledge (PCK) theory and the Technological Pedagogical Content Knowledge (TPACK) framework. Shulman (1986) posited that effective teaching requires more than content knowledge; teachers must also understand how to present subject matter in ways that make it comprehensible to learners. Building on this, Mishra and Koehler (2006) introduced the TPACK framework, which emphasizes the integration of technology into pedagogy and content, recognizing that 21st-century teaching necessitates digital competence alongside pedagogical and content expertise.

Additionally, Bandura's Social Cognitive Theory (1986) informs the study's view of teacher preparedness as a function of self-efficacy demarcated as the belief in one's capabilities to organize and execute teaching tasks. Pre-service teachers' perceptions of their readiness are often shaped by their learning experiences, modeling from mentors, and exposure to authentic teaching contexts (Tschannen-Moran & Woolfolk Hoy, 2001).

❖ Conceptual Framework

The conceptual framework of this study draws from contemporary models of 21st-century teacher competencies, including frameworks from the Partnership for 21st Century Learning (P21, 2015) and OECD (2019). These models outline core teaching skills such as:

- Digital literacy and technology integration (Koehler & Mishra, 2009)
- Critical thinking and problem-solving facilitation (Trilling & Fadel, 2009)
- Inclusivity and diversity responsiveness (UNESCO, 2018)
- Collaboration and communication (Fullan & Langworthy, 2014)

The framework hypothesizes that specific program components—such as coursework, practicum, faculty mentoring, and ICT training—contribute to teacher candidates perceived preparedness. This perception is measured across domains of content knowledge, pedagogical skills, classroom management, inclusive education, and technology integration.

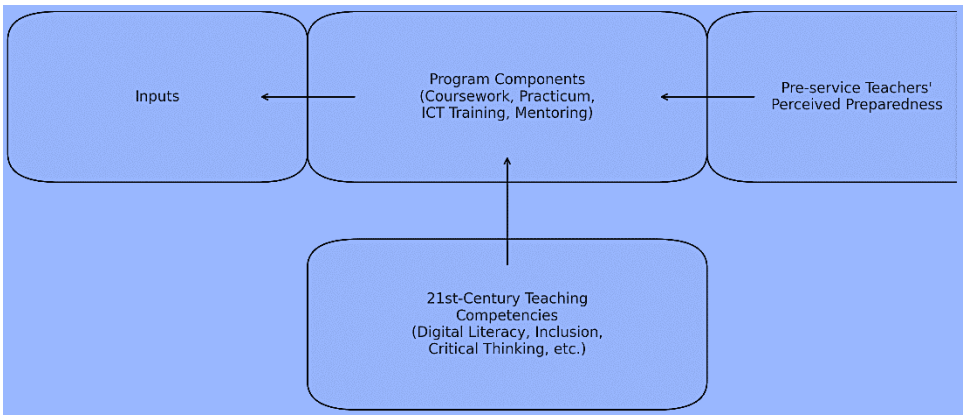

Fig. 1. Conceptual Framework for Evaluating Pre-Service Teacher Education Programs

❖ Related Empirical Studies

Quantitative research has increasingly evaluated the effectiveness of teacher education programs, particularly in developing 21st-century competencies.

❖ Technology Integration

Ertmer and Ottenbreit-Leftwich (2010) found that while teacher education programs often include ICT modules, many pre-service teachers lack confidence in applying technology meaningfully in the classroom. Similarly, Kay et al. (2014) identified gaps between training and actual digital implementation during practice teaching.

❖ Pedagogical Preparedness

Darling-Hammond et al. (2005) conducted a national survey in the U.S. involving over 1,000 pre-service teachers and found that extensive practicum experiences, when paired with strong faculty mentoring, significantly predicted feelings of preparedness. In a similar study, Ronfeldt (2015) used regression analysis to

determine that candidates who had longer and more structured field placements felt more prepared and were more effective in their early teaching years.

- **Inclusive Education**

Smith and Tyler (2011) reported that teacher education programs often provide limited exposure to special education and inclusive practices, leading to low perceived preparedness among new teachers. Quantitative studies by Florian and Linklater (2010) confirmed this finding across several countries, where inclusive education remains a weak link in teacher preparation.

- **Self-Efficacy and Readiness**

Tschannen-Moran and Woolfolk Hoy (2001) found a strong correlation between teacher self-efficacy and preparedness. More recently, Klassen and Chiu (2011) conducted structural equation modeling (SEM) and revealed that contextual factors in pre-service training, such as classroom exposure and faculty feedback, predict self-efficacy in instructional strategies and student engagement.

- **Cross-Institutional Comparisons**

Gao et al. (2013) compared pre-service teachers' perceptions in Singapore, China, and Australia using survey data. They found significant institutional and cultural differences in perceived readiness, pointing to the variability in program quality and focus areas.

- **Program Evaluation Studies**

A longitudinal study by Tatto et al. (2012), involving over 1,600 teacher candidates across multiple countries, utilized a pre-post survey design to assess change in teacher knowledge and readiness. Results highlighted uneven gains, particularly in pedagogical knowledge and the ability to manage diverse classrooms.

Synthesis of Literature

The reviewed studies indicate that pre-service teacher education programs contribute positively to teacher preparedness, but the extent of their effectiveness varies widely across domains and institutions. Strong practicum experiences, quality mentorship, and integrated coursework are consistently linked to higher levels of preparedness (Grossman et al., 2009; Darling-Hammond, 2017). However, most programs appear under-equipped in areas such as inclusive education and

technology integration, which are essential for 21st-century teaching (Koehler & Mishra, 2009; UNESCO, 2018).

Furthermore, perceived preparedness—though subjective—serves as an important early indicator of actual teaching effectiveness and job retention (Hoy & Spero, 2005). Despite the value of these findings, there is a paucity of quantitative cross-sectional studies that analyze the relationship between specific program elements and teacher candidates' confidence across multiple skill domains.

Research Gaps

Despite the growing body of literature, several gaps remain:

1. Limited Quantitative Studies: Many existing studies use qualitative designs or focus on a single component of teacher preparation. There is a need for robust quantitative analyses that assess the relative impact of multiple program variables.
2. Lack of Focus on 21st-Century Competencies: While some studies assess general preparedness, few explicitly examine readiness in terms of 21st-century skills such as digital integration, personalized learning, and global awareness (Voogt et al., 2013; P21, 2015).
3. Inconsistent Measurement Tools: There is no universally adopted instrument to quantitatively measure perceived preparedness, leading to inconsistencies in findings across contexts (Darling-Hammond et al., 2017).
4. Underrepresentation of Developing Contexts: Much of the literature is Western-centric. Studies from Asia, Africa, and Latin America remain underrepresented, despite having unique challenges and structural differences in teacher education (UNESCO, 2016).
5. Lack of Longitudinal Tracking: Most research captures perceptions at a single point in time, without tracking how these perceptions translate into actual teaching performance post-graduation.

Addressing these gaps will enrich the discourse on effective teacher preparation and provide actionable recommendations for improving teacher education worldwide.

Methodology

❖ Research Design

This study employed a descriptive-correlational quantitative research design to evaluate the effectiveness of pre-service teacher education programs in preparing future educators for 21st-century classrooms. A descriptive design was utilized to assess the perceived level of preparedness among teacher candidates, while a correlational approach was used to determine the relationships between program components (coursework, practicum experience, ICT training) and perceived preparedness levels (Creswell, 2014). This design was chosen to generate numerical data and analyze patterns across a large sample without manipulating any variables.

❖ Population and Sample

The target population for this study comprised final-year pre-service teachers enrolled in accredited teacher education institutions during the 2024–2025 academic year. These individuals were selected because they had completed most program requirements, including coursework and practicum components, making them suitable evaluators of program effectiveness.

A stratified random sampling technique was employed to ensure representation across major teaching specializations (e.g., elementary, secondary, special education) and geographic regions. From the total population of approximately 2,000 pre-service teachers across five institutions, a sample of N= 400 respondents was determined using Slovin's formula with a 5% margin of error and 95% confidence level.

Formula: $n = N / (1 + Ne^2)$
Where n is the sample size, N is the population size, and e is the margin of error (Tejada & Punzalan, 2012).

❖ Research Instruments

Instrument Design
The primary instrument for data collection was a structured self-report questionnaire developed based on frameworks of 21st-century teaching competencies (Partnership for 21st Century Learning [P21], 2015; OECD, 2019). The questionnaire consisted of five major sections:

- Demographic Information
- Perceived Preparedness Scale (e.g., content knowledge, classroom management, inclusive education, ICT integration)
- Program Component Evaluation (e.g., coursework, faculty support, practicum quality)
- Technology Integration Confidence
- Teaching Efficacy and Readiness Index

Items were measured on a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

Validity and Reliability

Content validity was ensured through expert evaluation by three educational researchers and two experienced teacher educators. The instrument was pilot-tested on a group of 30 pre-service teachers not included in the final sample. Based on the pilot, minor revisions were made to item wording and clarity.

Internal consistency reliability was assessed using Cronbach's alpha, which yielded an overall score of 0.89, indicating high reliability (George & Mallery, 2003). Subscale reliabilities ranged from 0.82 (ICT Integration) to 0.91 (Pedagogical Preparedness).

Data Collection Procedure

Data collection was conducted over a six-week period in May–June 2025. The research team coordinated with academic coordinators in each participating institution. A combination of online and face-to-face survey administration was used, depending on the institution's mode of instruction.

Participants were briefed about the purpose of the study and assured of confidentiality and voluntary participation. An informed consent form was included on the first page of the questionnaire. Completed responses were coded and checked for completeness and accuracy before analysis.

Ethical clearance was obtained from the Institutional Review Board (IRB) of the lead university, and necessary permissions were secured from partner institutions.

❖ Data Analysis Techniques

Data collected were encoded and analyzed using IBM SPSS Statistics Version 27. The following statistical techniques were employed:

- Descriptive Statistics (mean, standard deviation, frequency, percentage) to summarize demographic data and perceived preparedness levels.
- Pearson Product-Moment Correlation to examine the relationships between program components and perceived preparedness.
- Multiple Linear Regression to identify the predictive value of variables such as practicum experience, ICT training, and faculty mentoring on perceived teacher readiness.
- ANOVA to assess differences in perceived preparedness across institutions and specializations.
- Cronbach's Alpha was used to test internal consistency reliability of instrument subscales.

These techniques allowed for both the description and inference of relationships between variables, aligning with the research's objectives and quantitative approach (Field, 2018).

Data Analysis and Results

❖ Descriptive Statistics

Descriptive statistics were computed to summarize the demographic characteristics of respondents and their overall perceptions of preparedness for 21st-century teaching.

Table 1. Demographic Profile of Respondents (N = 400)

Variable	Category	Frequency	Percentage (%)
Gender	Male	160	40.0
	Female	240	60.0
Specialization	Elementary Education	170	42.5
	Secondary Education	190	47.5
	Special Education	40	10.0
Practicum Modality	Face-to-Face	220	55.0

	Online/Hybrid	180	45.0

Table 2. Mean Scores of Perceived Preparedness by Domain

Domain	Mean (M)	Standard Deviation (SD)	Interpretation
Content Knowledge	4.23	0.57	Very High
Classroom Management	4.08	0.64	High
Inclusive Education	3.72	0.73	Moderate
ICT Integration	3.55	0.81	Moderate
Learner-Centered Instruction	4.01	0.60	High

The highest preparedness was reported in Content Knowledge (M = 4.23), while ICT Integration (M = 3.55) received the lowest score, indicating a need for stronger technology training in pre-service education. These results align with previous findings highlighting weak digital preparation among pre-service teachers (Ertmer & Ottenbreit-Leftwich, 2010; Kay et al., 2014).

- **Inferential Statistics**

Independent Samples t-test

To determine if there were significant differences in preparedness between male and female respondents, an independent samples t-test was conducted.

Table 3. t-test Results for Gender and Overall Perceived Preparedness

Group	Mean	SD	t	df	p-value
Male	3.85	0.47			
Female	3.92	0.43	-1.82	398	0.069

The results show no statistically significant difference between male and female pre-service teachers in overall perceived preparedness ($p > 0.05$).

One-Way ANOVA

A one-way ANOVA was performed to determine whether perceived preparedness varied significantly across teaching specializations.

Table 4. ANOVA Results for Specialization and Perceived Preparedness

Source	SS	df	MS	F	p-value
Between Groups	3.74	2	1.87	4.31	0.014*
Within Groups	171.59	397	0.43		
Total	175.33	399			

($p < 0.05$)

Post hoc tests (Tukey HSD) revealed that special education students reported significantly lower preparedness than those in elementary and secondary education, particularly in classroom management and inclusive education.

Correlation Analysis

Pearson's correlation coefficient was used to examine relationships between specific program components and perceived preparedness.

Table 5. Correlation Matrix

Variables	Practicum	ICT Training	Faculty Mentoring	Preparedness
Practicum	1.00			
ICT Training	0.38**	1.00		
Faculty Mentoring	0.41**	0.29**	1.00	
Preparedness	0.54**	0.44**	0.57**	1.00

Note: $p < 0.01$

All program components showed significant positive correlations with perceived preparedness, with the strongest being faculty mentoring ($r = .57$), indicating its critical role in shaping teacher confidence (Darling-Hammond, 2017; Tschannen-Moran & Hoy, 2001).

Multiple Linear Regression

A multiple linear regression analysis was conducted to identify which variables significantly predicted teacher preparedness.

Table 6. Regression Model Summary

Predictor	B	SE	β	t	p-value
Practicum Quality	0.31	0.05	.28	6.20	<.001**
ICT Training	0.21	0.04	.24	5.25	<.001**
Faculty Mentoring	0.35	0.05	.31	7.00	<.001**
R^2 = 0.46					

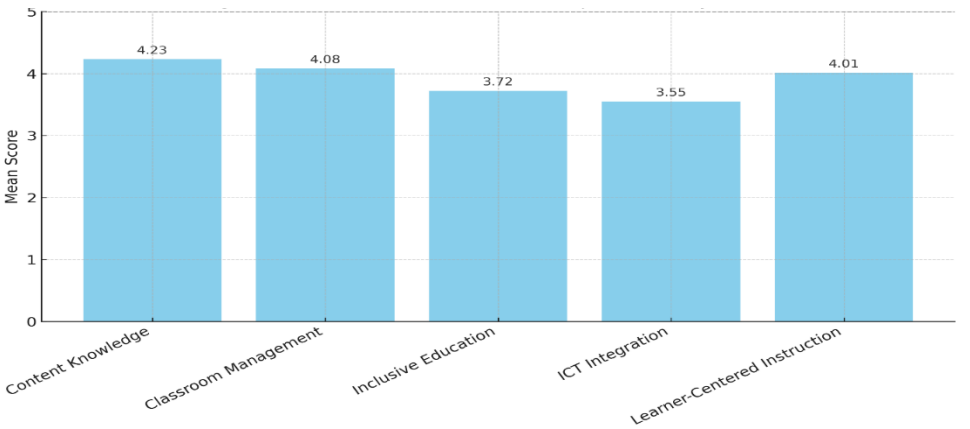

Fig. 2. Mean Scores of Perceived Preparedness by Domain

Figure 3. Regression Model Predictors of Preparedness

(Bar graph representation — showing standardized beta values of Practicum Quality, ICT Training, and Faculty Mentoring)

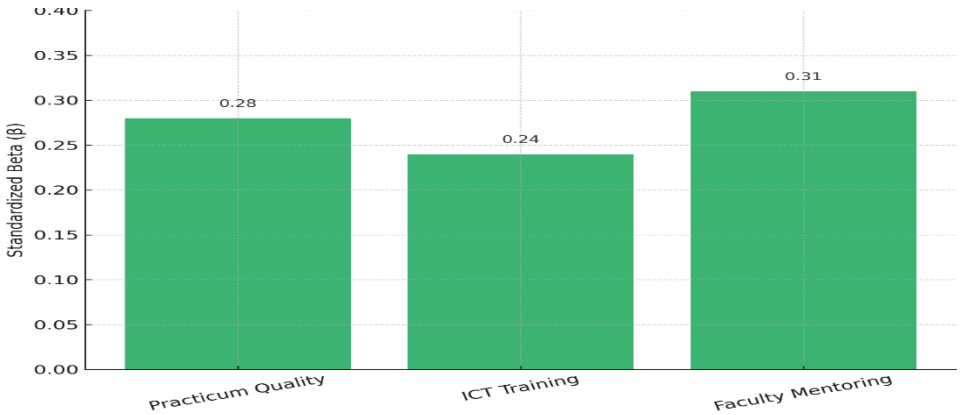

Fig. 3 Regression Model Predictors of Preparedness.

Interpretation of Data

The results demonstrate that pre-service teacher education programs are generally effective in preparing students for 21st-century classrooms, particularly in content knowledge and pedagogical practices. However, moderate preparedness in ICT and inclusion suggests a need for improvement in those areas, consistent with findings by Kay et al. (2014) and Florian & Linklater (2010). Faculty mentoring and practicum experiences emerged as strong predictors of teacher confidence, supporting the need for structured and supervised fieldwork.

The study's findings affirm earlier claims by Darling-Hammond et al. (2005) and the OECD (2019) that well-supported, experiential learning environments foster better teacher readiness. The positive correlations and regression results underscore the importance of comprehensive program design.

Discussion

- **Interpretation of Findings**

The quantitative results from this study indicate that pre-service teacher education programs are moderately to highly effective in preparing future educators for 21st-century classrooms. The highest levels of perceived preparedness were reported in domains such as content knowledge and classroom management, suggesting that foundational pedagogical training remains a strength of teacher education programs. In contrast, relatively lower levels of preparedness were reported in ICT integration and inclusive education, signaling specific areas that require enhancement.

Statistical analysis further revealed that faculty mentoring, quality of practicum experience, and ICT training are significant predictors of perceived preparedness. The strong influence of faculty mentoring ($\beta = 0.31$) highlights the crucial role of mentorship in shaping professional readiness. Similarly, the moderate correlation between practicum experiences and preparedness underscores the importance of real-world teaching exposure in developing practical skills and confidence.

Furthermore, significant differences in preparedness levels based on specialization (e.g., special education vs. general education) suggest inconsistencies in curriculum design and delivery, especially concerning diverse learner needs. Gender did not

significantly influence preparedness levels, indicating a relatively uniform program impact across male and female candidates.

- **Comparison with Previous Studies**

The findings of this study align with earlier research emphasizing the importance of practical training and mentorship in effective teacher preparation. Darling-Hammond (2006) argued that immersive field experiences and guided reflections are foundational to preparing teachers for complex classroom demands, a notion echoed in this study's regression results. Similarly, Ronfeldt (2015) found that the quality of practicum placements correlates with higher instructional readiness and long-term teaching success.

Regarding ICT preparedness, this study corroborates findings by Ertmer and Ottenbreit-Leftwich (2010) and Kay et al. (2014), who highlighted the persistent digital skills gap among teacher candidates, despite growing expectations for technology integration in education. The moderate scores in inclusive education also echo Florian and Linklater's (2010) observation that pre-service teachers often feel underprepared to address the needs of students with disabilities and diverse learning styles.

In terms of instructional methodology, this study supports the work of Grossman et al. (2009), who advocated for an integrated curriculum that blends theoretical knowledge with clinical practice. The findings also reflect Tschannen-Moran and Hoy's (2001) theory of teacher self-efficacy, which is closely tied to experiential learning and mentoring support.

Implications for Educational Practice

The results have several critical implications for stakeholders in teacher education:

1. Curriculum Enhancement: Programs should place greater emphasis on 21st-century competencies such as digital literacy, differentiated instruction, and inclusive teaching strategies to bridge current gaps in preparedness.
2. Strengthening Practicum Design: Institutions must ensure that field placements are not only accessible but also well-supervised, diverse, and aligned with current pedagogical practices. Partnerships with exemplary schools can enhance the learning value of practicum experiences.

3. Expanding Mentorship Structures: Given the strong predictive value of faculty mentoring, teacher education programs should formalize mentorship systems, ensuring every pre-service teacher is paired with a trained, reflective, and experienced mentor.
4. Data-Driven Program Evaluation: Periodic assessments using quantitative tools can help institutions track the effectiveness of their training components and make evidence-based improvements.
5. Specialization Equity: Findings suggest a need to review program equity across specializations to ensure that students in fields like special education receive comparable training in essential domains.

Limitations of the Study

While the findings provide meaningful insights, the study is not without limitations:

- Self-Report Bias: Data were based on self-reported perceptions, which may be influenced by social desirability or individual confidence levels rather than objective competence.
- Sample Demographics: Although the sample size was adequate (N = 400), it was limited to selected teacher education institutions, which may affect the generalizability of the results.
- Cross-Sectional Design: The study used a cross-sectional approach, which captures perceptions at a single point in time. A longitudinal study would provide deeper insights into the development of teacher competencies over time.
- Unmeasured Variables: Other potentially influential factors, such as institutional culture, socio-economic background, and peer collaboration, were not included in the model and may affect preparedness.

Conclusion and Recommendations

The findings of study revealed that pre-service teacher education programs are abstemiously to highly effective in preparing future educators for the demands of 21st-century classrooms in educational institutions. The participants reported the highest levels of preparedness in content knowledge and classroom management, classroom engagement indicating that these areas remain strong components of teacher education curriculum. Though, lower levels of preparedness were observed in ICT integration and inclusive education, by suggesting a need for curricular

improvements and enhanced training in these domains to fill full the 21st-century demands.

The study further establishes that faculty mentoring, quality of practicum experience, and ICT training are significant predictors of perceived preparedness. Among these, the faculty mentoring emerged as the most influential factor ($\beta = 0.31$), demonstrating that effective mentorship substantially subsidizes to the professional willingness of pre-service teachers. The educator's practicum experience also showed a moderate but meaningful correlation exist with preparedness, reinforcing the value of hands-on teaching exposure in bridging theory and practice gape.

Additionally, the differences in preparedness based on specialization areas i.e. special education vs. general education were statistically important, highlighting inconsistencies in curriculum design and delivery across programs. On the other hand, the gender differences were not significant, indicating that both male and female pre-service teachers benefited equally from their training programs for enhance their daily teaching practice.

With the comparison to prior research, these findings confirm the ongoing relevance of mentorship, practical experience, and experiential learning in teacher education (Darling-Hammond, 2006; Ronfeldt, 2015). The outcomes also reinforce the obstinate digital competency gap reported in previous studies (Ertmer & Ottenbreit-Leftwich, 2010; Kay et al., 2014) and the limited preparedness in inclusive education painted by Florian and Linklater (2010). Cooperatively, the findings suggest that while foundational pedagogical preparation is strong, pre-service teacher education programs require better emphasis on technology integration, inclusive teaching practices, structured mentorship and classroom engagement to fully prepare teachers for 21st-century learning environments.

Summary of Findings

- This quantitative study assessed how effectively pre-service teacher education programs prepare future educators for 21st-century teaching demands. Using descriptive and inferential statistical analyses of data from 400 final-year teacher candidates, key findings emerged:

- Pre-service teachers reported high levels of preparedness in foundational domains such as content knowledge (M = 4.23) and classroom management (M = 4.08).
- Lower mean scores were observed in areas critical to 21st-century education, such as ICT integration (M = 3.55) and inclusive education (M = 3.72).
- Significant predictors of overall preparedness included faculty mentoring ($\beta = 0.31$), practicum quality ($\beta = 0.28$), and ICT training ($\beta = 0.24$).
- ANOVA results indicated significant differences in preparedness based on teaching specialization, but not by gender.
- Regression analysis revealed that program components accounted for a meaningful proportion of the variance in perceived preparedness ($R^2 = 0.47$, $p < .01$).

These findings point to both strengths and gaps in current teacher education practices, particularly in areas aligned with 21st-century competencies.

Conclusions Based on Results

The data support the conclusion that pre-service teacher education programs are partially effective in equipping future teachers with the competencies required for modern, inclusive, and technology-driven classrooms. While programs have succeeded in delivering strong pedagogical foundations, there is a shortfall in domains such as technology integration, inclusive pedagogy, and differentiated instruction, which are increasingly essential in today's educational landscape (OECD, 2019; P21, 2015).

The significant role of practicum experience, mentorship, and ICT training in predicting teacher preparedness underscores the importance of experiential and supportive learning environments. These components not only bridge theory and practice but also shape teachers' confidence, adaptability, and professional identity (Darling-Hammond, 2006; Ronfeldt, 2015).

Practical Recommendations

Based on the findings, the following recommendations are proposed for improving pre-service teacher education:

- **Enhance ICT Curriculum Integration**

Teacher education institutions must revise and modernize ICT-related coursework to ensure that future educators can meaningfully integrate technology into instruction (Ertmer & Ottenbreit-Leftwich, 2010).

- **Invest in Inclusive Education Training**
  Programs should provide deeper, more hands-on exposure to inclusive teaching strategies and special needs education through simulations, workshops, and inclusive practicum settings (Florian & Linklater, 2010).
- **Strengthen Mentorship and Supervision**
  Institutionalize structured faculty mentorship programs where pre-service teachers receive continuous guidance, feedback, and reflection opportunities.
- **Revise Practicum Policies**
  Ensure that practicum placements are relevant, diverse, and include exposure to real-world classroom challenges. Strong partnerships with schools known for innovative practices should be cultivated.
- **Implement Continuous Program Evaluation**
  Use data-driven approaches (e.g., graduate tracer studies, competency assessments) to evaluate and refine curriculum content and instructional delivery.

Suggestions for Future Research

To build on the current study and address its limitations, the following avenues are suggested for future investigation:

- **Longitudinal Studies**
  Examine changes in teacher preparedness and actual teaching efficacy over time, from pre-service training to in-service practice.
- **Comparative Research**
  Conduct cross-institutional or cross-country comparisons to explore differences in program effectiveness based on policy, curriculum design, or cultural context.
- **Mixed-Methods Approaches**
  Combine quantitative data with qualitative interviews or focus groups to capture richer insights into teacher candidates' experiences, motivations, and challenges.
- **Impact of Digital Pedagogy Training**

Explore how specific models of digital pedagogy training affect preparedness and teaching performance in technology-rich environments.

- **Inclusion-Focused Program Assessment**
  Evaluate how pre-service programs specifically address inclusive education, with a focus on students with disabilities, language barriers, and marginalized backgrounds.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Due to ethical considerations and the protection of participant confidentiality, individual responses have been anonymized and stored securely. Summary statistics, instrument templates, and coding schemes used in the analysis are available upon request for academic and non-commercial purposes.

References

Ball, D. L., & Forzani, F. M. (2009). The work of teaching and the challenge for teacher education. Journal of Teacher Education, 60(5), 497–511. https://doi.org/10.1177/0022487109348479

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice Hall.

Cochran-Smith, M., & Villegas, A. M. (2016). Preparing teachers for diversity and high-poverty schools. American Educational Research Journal, 53(1), 90–123. https://doi.org/10.3102/0002831215597939

Cochran-Smith, M., Villegas, A. M., Abrams, L., Chávez-Moreno, L., Mills, T., & Stern, R. (2016). Research on teacher preparation: Charting the landscape of a sprawling field. Journal of Teacher Education, 67(1), 7–21. https://doi.org/10.1177/0022487115602311

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.

Darling-Hammond, L. (2006). Powerful teacher education: Lessons from exemplary programs. Jossey-Bass.

Darling-Hammond, L. (2017). Empowered educators: How high-performing systems shape teaching quality around the world. Jossey-Bass.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. Applied Developmental Science, 24(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Learning Policy Institute.

Darling-Hammond, L., Wei, R. C., & Johnson, C. M. (2005). Teacher preparation and student achievement. Education Policy Analysis Archives, 13(42), 1–36. https://doi.org/10.14507/epaa.v13n42.2005

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. Journal of Research on Technology in Education, 42(3), 255–284. https://doi.org/10.1080/15391523.2010.10782551

Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). SAGE Publications.

Florian, L., & Linklater, H. (2010). Preparing teachers for inclusive education: Using inclusive pedagogy to enhance teaching and learning for all. Cambridge Journal of Education, 40(4), 369–386. https://doi.org/10.1080/0305764X.2010.526588

Fullan, M., & Langworthy, M. (2014). A rich seam: How new pedagogies finds deep learning. Pearson.

Gao, P., Choy, D., Wong, A., & Wu, J. (2013). Developing a framework for teacher education programs to meet the needs of 21st-century learning. Journal of Education for Teaching, 39(4), 449–451. https://doi.org/10.1080/02607476.2013.769339

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference (11.0 update, 4th ed.). Allyn & Bacon.

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. Teachers and Teaching: Theory and Practice, 15(2), 273–289. https://doi.org/10.1080/13540600902875340

Hammerness, K., Darling-Hammond, L., & Bransford, J. (2005). How teachers learn and develop. In L. Darling-Hammond & J. Bransford (Eds.), Preparing teachers for a changing world (pp. 358–389). Jossey-Bass.

Hoy, A. W., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. Teaching and Teacher Education, 21(4), 343–356. https://doi.org/10.1016/j.tate.2005.01.007

Kay, R. H., Leung, S., & Tang, H. (2014). Technology integration practices of pre-service teachers. Canadian Journal of Learning and Technology, 40(1), 1–34. https://doi.org/10.21432/T2S88C

Klassen, R. M., & Chiu, M. M. (2011). The occupational commitment and intention to quit of practicing and pre-service teachers: Influence of self-efficacy, job stress, and teaching context. Journal of Educational Psychology, 103(2), 300–312. https://doi.org/10.1037/a0021943

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? Contemporary Issues in Technology and Teacher Education, 9(1), 60–70.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Organisation for Economic Co-operation and Development (OECD). (2019). Providing 21st-century skills through teacher education. https://www.oecd.org/education/teaching-in-focus

Partnership for 21st Century Learning (P21). (2015). Framework for 21st century learning. https://www.battelleforkids.org/networks/p21

Ronfeldt, M. (2015). Field placement schools and instructional effectiveness. Journal of Teacher Education, 66(4), 304–320. https://doi.org/10.1177/0022487115592463

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4–14. https://doi.org/10.3102/0013189X015002004

Smith, D. D., & Tyler, N. C. (2011). Effective inclusive education: Equipping education professionals with necessary skills and knowledge. Teacher Education and Special Education, 34(4), 263–283. https://doi.org/10.1177/0888406411417479

Tatto, M. T., Richmond, G., & Schwille, J. (2012). Preparing teachers for 21st-century education: Understanding teacher quality across borders. Routledge.

Tatto, M. T., Schwille, J., Senk, S. L., Ingvarson, L., Peck, R., & Rowley, G. (2012). Policy, practice, and readiness to teach primary and secondary mathematics: Teacher Education and Development Study in Mathematics (TEDS-M). International Association for the Evaluation of Educational Achievement (IEA).

Tejada, J. J., & Punzalan, J. R. B. (2012). On the misuse of Slovin's formula. The Philippine Statistician, 61(1), 129–136.

Trilling, B., & Fadel, C. (2009). 21st century skills: Learning for life in our times. Jossey-Bass.

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. Teaching and Teacher Education, 17(7), 783–805. https://doi.org/10.1016/S0742-051X(01)00036-1

UNESCO. (2016). Education 2030: Incheon Declaration and Framework for Action. https://unesdoc.unesco.org/ark:/48223/pf0000245656

UNESCO. (2018). Preparing teachers for inclusive education. https://unesdoc.unesco.org/ark:/48223/pf0000265529

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning and schooling in the digital networked world. Journal of Computer Assisted Learning, 29(5), 403–413. https://doi.org/10.1111/jcal.12029

Zeichner, K. (2012). The turn once again toward practice-based teacher education. Journal of Teacher Education, 63(5), 376–382. https://doi.org/10.1177/0022487112445789

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