HYBRID TRAINING FOR EARLY CHILDHOOD CARE AND EDUCATION TEACHERS IN SOUTHERN PUNJAB: EFFECTIVENESS, CHALLENGES, AND SUSTAINABILITY IN RESOURCE-CONSTRAINED CONTEXTS

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Abstract

Early Childhood Care and Education (ECCE) teachers in resource-constrained contexts face significant barriers to accessing quality professional development. This mixed-methods study examined the perceived effectiveness of hybrid training combining online and face-to-face instruction, for ECCE teachers in Southern Punjab, Pakistan. Survey data from 403 teachers across 11 districts were analyzed using chi-square tests, independent t-tests, and one-way ANOVA, alongside thematic analysis of 268 open-ended responses. Analysis of quantitative and qualitative data revealed critical insights into training implementation and sustainability requirements. The study concludes that hybrid training offers promise for enhancing ECCE teacher competence in under-resourced regions; however, sustained impact requires robust technological infrastructure, continuous expert support, and institutional commitment to ongoing professional development.

Keyword: Hybrid training, professional development, learning behavior, digital literacy, integrated training approach, education quality

Introduction

The landscape of education is undergoing a significant transformation, marked by the convergence of traditional and digital learning approaches. In the context of Early Childhood Care and Education (ECCE), this convergence is particularly critical, as teachers play a central role in shaping the developmental outcomes of young children. Traditional teacher-centered strategies have long been foundational, yet the evolving needs of both educators and learners now demand more flexible, interactive, and holistic approaches. Digital technologies offer opportunities for personalized learning, collaboration, and accessibility (Li, 2024), and hybrid training-combining online and face-to-face instruction - emerges as a practical model to integrate these benefits.

In Pakistan, and specifically in Southern Punjab, ECCE teachers face unique challenges such as limited resources, uneven access to technology, and varying levels of professional preparation. While previous research has demonstrated the potential of hybrid training to enhance pedagogical competence and digital literacy, little is known about how ECCE teachers in Southern Punjab perceive and apply such training in their professional practice. This gap is particularly important given the government's emphasis on ECCE reforms and the need for sustainable teacher development models in resource-constrained contexts.

To address this gap, the present study adopts a mixed-methods design, combining quantitative survey data (e.g., ratings of training effectiveness, frequency of engagement, demographic comparisons) with qualitative insights (e.g., teachers' reflections on challenges, motivations, and classroom practices). This dual approach allows for a comprehensive understanding of how hybrid training influences ECCE teachers' learning behaviors and

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professional development goals. By integrating statistical patterns with thematic narratives, the study seeks to generate evidence-based insights into the sustainability of hybrid training models and their potential to raise the quality of early childhood education in Southern Punjab.

Significance of the Study

This study holds significance on multiple levels. At the practical level, it addresses the pressing need for effective professional development models for ECCE teachers in Southern Punjab, a region where resource constraints, technological barriers, and uneven access to training often limit the quality of early childhood education. By examining teachers' perceptions of hybrid training, the research provides evidence on how blended approaches can overcome challenges of accessibility and sustainability in low-resource contexts.

At the policy level, the findings contribute to ongoing education reforms in Punjab, particularly initiatives under the Punjab Human Capital Investment Project (PHCIP) and the ECCE Policy (2017). While these frameworks emphasize teacher training, there is limited empirical evidence on how hybrid models are received and applied by ECCE teachers in practice. This study fills that gap by offering insights into both the quantitative outcomes (e.g., effectiveness ratings, engagement frequencies) and the qualitative experiences (e.g., challenges, motivations, strategies) of teachers. Such evidence can guide policymakers in designing training programs that are not only scalable but also contextually relevant.

At the academic level, the study advances the literature on hybrid training by situating it within the ECCE context of Southern Punjab. Previous research has demonstrated the potential of hybrid learning to enhance pedagogical competence and digital literacy, but few studies have explored its impact on ECCE teachers working in resource-constrained environments. By employing a mixed-methods design, this research captures both the breadth of teachers' perceptions and the depth of their lived experiences, thereby contributing to a more nuanced understanding of hybrid training effectiveness.

Ultimately, the study is significant because it provides actionable insights into how hybrid training can strengthen ECCE teachers' learning behaviors, professional development goals, and classroom practices. In doing so, it supports the broader aim of improving the quality of early childhood education and ensuring that young children in Southern Punjab receive inclusive, engaging, and developmentally appropriate learning opportunities.

Scope and Limitations

This study explores the influence of hybrid training approaches on ECCE teacher education, focusing on a sample of teachers from 11 districts in Southern Punjab. The scope includes both quantitative measures (such as ratings of training effectiveness and engagement patterns) and qualitative insights (teachers' reflections on challenges, motivations, and classroom practices).

However, the findings must be interpreted with caution. The sample size and regional focus limit generalizability to all ECCE teachers in Punjab or Pakistan. Data is based on self-reported perceptions, which may be subject to bias or selective recall. Moreover, the study primarily captures short- and medium-term impacts of hybrid training, making it difficult to assess long-term effects on teacher development and student learning outcomes. Future research with larger, more diverse samples and longitudinal designs will be necessary to evaluate the sustained influence of hybrid training on ECCE practices and child outcomes.

Literature Review

Currently in Pakistan over one-third of children of the age of going primary school are not attending school, and 42% of the total population (over 10 years of age) is unschooled. There are

great differences in education measures linked to regions, places (urban and rural areas) and gender. According to review there are more than 6.7 million kids who are out of school from which 62 percent comprises of girls. Studies show that combination training may be highly effective for ECCE when correctly applied. It is usually connected with improved information retention and engagement, when the online and in-person components are well-integrated and active. Research also shows that mixing modalities might better support teachers' learning habits, including self-regulation, critical thought, and adaptation. However, efficacy depends on offering adequate technology help, continual evaluation, and feedback methods to rectify any gaps between online and in-person talks (Ministry of Education & AEPAM, 2015).

Overview of ECCE and Teacher Professional Development

All things considered, hybrid training offers advantageous opportunities for early childhood care and education (ECCE); nevertheless, the success of this training is contingent on the careful resolution of technological and motivational difficulties in order to ensure that all participating instructors are able to acquire knowledge in an equal and productive manner (Mulenga & Shilongo, 2025). Hybrid learning, on the other hand, improves generalizability by providing additional data that may be used to identify major impacts and anticipate students' assessments based on learning activities throughout the course of time. Raes et al., (2019) conducted an investigation to determine which scalable technique is the most effective in terms of professional development, pedagogical capabilities, and capacity restrictions. By allowing students who were physically present in the classroom as well as those who were located at a distance to take part in learning activities at the same time, the study investigated how a hybrid learning environment may influence the experiences of students, the learning behaviors of teachers, the implementation, and the design of technology.

Pedagogic competence, which may be developed through both technical and non-technical trainings, is the essential ability that an ECCE instructor should have. Similar studies have been carried out in which teachers were given specialized training to improve their methods of education. Thus, the goal of this study is to ascertain how pedagogical competency is impacted by hybrid training. The research population consisted of 83 kindergarten teachers who were training participants. A Likert scale was used to take the measurement. The results of the study showed that hybrid learning-based training can improve teachers' pedagogical competence. (Evania et al., 2021).

STEAM (science, technology, engineering, arts, and mathematics) curricula, according to Taysever (2016), enhance students' skills. This study looked at how a one-week online STEAM professional development course affected teachers' behavior and self-efficacy in integrating STEAM ideas into their lesson planning, extracurricular activities, and classroom teaching. Online professional development was found to have a generally beneficial impact on students' views and perceptions about how self-efficacy is taught in STEAM courses. The findings of the pre- and post-test surveys indicated that teachers' self-efficacy in STEAM instruction was influenced by the STEAM online professional development.

The core of the hybrid professional development experiences of ten teachers from six schools was captured through qualitative transcendental phenomenological research that described the lived experiences of teachers' hybrid professional development. Interviews, focus groups, and artifact analysis were used to gather data. To solve the question, data were examined using creative variation and phenomenological reduction. A) feedback, B) lifelong learner, C) direction, D) safety, E) time, and F) dissatisfaction were the six themes that emerged from the data analysis. Asynchronous active learning exercises are useful for frontloading and making teachers

responsible for getting ready for group participation activities, according to the research. Furthermore, the findings showed that hybrid TPD contexts necessitate distinct safety concerns before group involvement can take place, particularly when it comes to contentious issues like equality. Additionally, practitioners want to think about how administrators and facilitators work together to offer engagement and feedback in all contexts including collective involvement. (Francis, L., 2023).

All instructors must have access to thorough, excellent ECE professional development in order to embrace the quality of ECCE. This professional development helps put knowledge into practice and promotes the beneficial development of young children. To investigate a community-based platform for ECE instructors in childcare facilities, pilot research was carried out. Teachers got the 15-month hybrid professional development. Developmentally appropriate practices and fundamental training are lacking in around 40% of the U.S. early care and education (ECE) workforce, which can affect the quality of ECE. The findings demonstrate that community-based ECE settings may successfully use a hybrid approach to complete, fundamental professional development. As important growth facilitators, teachers cultivate a positive connection with their coaches and accommodations. More ECE instructors may become competent and better serve all young children in care if they are given the time and assistance to finish fundamental ECE training. (Lang et al.,2024).

According to some academics, the development of cutting-edge technology and the relationship between teacher education and assessment improved learning settings. According to research by Rodrigues (2023), a new paradigm in teacher education is being built for a globalized and digitalized society. This paradigm aims to value knowledge and professional growth for teachers, which may be maintained through cooperation and teamwork. Analyzing the factors that may influence training models within a novel educational paradigm that supports transformational active learning is the goal of this study. Research on hybrid and blended learning models, innovations, difficulties, and future directions in educationwhich saw a shift from traditional to hybrid learning modelswas carried out by Mulenga and Shilongo in 2025. A hybrid approach in today's technologically advanced society combines the greatest aspects of online and in-person instruction; by providing personalized learning experiences, automating tests, and developing interactive simulations, technological developments are transforming hybrid education. It's Pedagogical transitions to hybrid learning settings from competency-based education and classrooms. It is predicated on active participation and student-centered education. These developments revolutionize hybrid learning, which increases educational accessibility, engagement, and adaptability to a range of learning settings. (Mulenga & Shilongo., 2025).

A study on college students' opinions about hybrid course usage was carried out by Yudko et al. (2008). When hybrid learning was combined with traditional lectures, student views were generally favorable. Although students did not self-report any real influence on attendance, they believed that hybrid courses had a negative effect on attendance. Compared to pupils with limited computer and internet skills, individuals who are computer and internet literate strongly think that they benefit from modern technology. The impact of attitudes and beliefs on pupils in the setting of rural culture was determined.

Wong et al. (2023) investigated how academics assess hybrid teaching and learning methods. Feedback on their experience giving synchronous hybrid instructionin which students attended sessions both on-site and remotely was gathered through a focus group interview and a questionnaire survey. Ten focus group interviews were held, and 76 survey questionnaires were given to academics. It was discovered that the participating academics thought they were generally

well-prepared to deal with technological problems. They also said that the students in their hybrid classrooms were less motivated, engaged, and interactive than those in their regular face-to-face sessions. A lack of experience with interactive teaching designs suitable for hybrid classrooms, difficulties tracking students' progress, and a heavy workload for lesson planning and managing both in-person and virtual classrooms were some of the difficulties the participants faced when it came to hybrid learning and teaching. It was suggested as a way to increase students' interest and participation in online learning. These findings provide insight into the experiences of scholars using hybrid teaching and learning approaches and provide potential fixes for their issues.

Theoretical Framework - Social Cognitive Theory by Albert Bandura

According to Albert Bandura's Social Cognitive Theory (Bandura, 1960) learning new behaviors and abilities is the result of dynamic interactions between a variety of behavioral, cognitive, and environmental factors. The three fundamental elements of the theory are self-efficacy beliefs, the mediating process, and observational learning. According to observational learning, learning occurs by seeing role models. The steps a person takes to adopt a behavior are determined by the mediating process. Self-efficacy is a person's belief in their own capacity to complete a task.
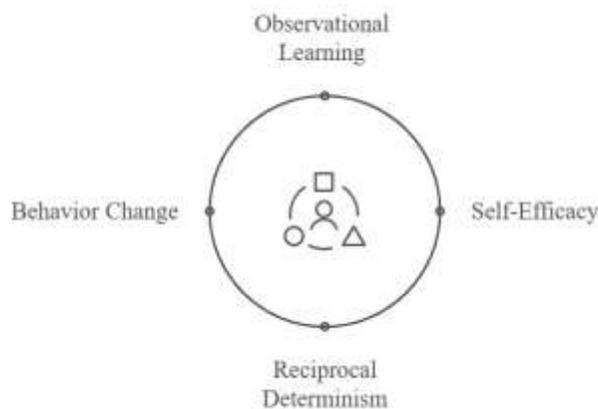
The following idea serves as the foundation for the current study and increases ECCE instructors' self-efficacy views in their ability to participate in and gain from hybrid training. Increased self-efficacy may result in a stronger sense of effectiveness and desire for professional development. Teachers' perceptions of the training's relevance and usefulness may also be influenced by their own growth and progress in learning new teaching techniques. The impression of training efficacy is influenced by behavioral elements, such as the teacher's participation in training activities, self-reflection, and application of training knowledge.

Peer interactions, group projects, and feedback from instructors and coworkers may all improve the learning process and make hybrid training seem more encouraging and successful. Teachers' perceptions of the viability and efficacy of hybrid training are influenced by the availability of resources (such as time, technology, and administrative assistance) as well as a supportive school climate. Teachers' perceptions of efficacy might be influenced by training structure and accessibility. In order to assess how well hybrid training affects instructors' learning behaviors and to employ teaching and learning techniques that support long-term professional development in ECCE. A human behavior concept known as reciprocal determinism holds that all three elements; personal, behavioral, and environmental determinants; have an impact on one another.

The quality of ECE in Pakistan has historically been impacted by the shortage of qualified professors. Because ECE receives little funding and little attention, young children are taught by the least experienced or trained teachers (Hunzai, 2009). Only 3,860 of the 1.35 million instructors employed nationwide were in pre-school education, while 399,517 (29%) were in primary schools, according to the National Education Census. Preschool and primary school instructors make up a fairly small percentage of the total number of students in this age range (70.9%, or 25.3 million) (GoP, 2005). In order for certified and qualified ECCE teachers to provide high-quality instruction in both public and private schools, a CPD framework must be incorporated into the education policy.

Continuous Professional Development (CPD)

The process by which professionals keep, improve, and expand their knowledge, skills, and abilities in order to stay competent and productive in their professions is known as continuous professional development. Formal training, self-directed learning, reflective practice, and experiential activities that are adapted to each participant's career objectives and the needs of the business are frequently combined in CPD. CPD is not simply a means of upholding professional standards but also a calculated strategy for both professional and personal development, especially in domains like education that directly affect the lives of others (Smith, 2021).

Models of Teacher Professional Development

There are several approaches to teacher professional development (TPD), and each has advantages and disadvantages of its own. Frequently, a combination of these approaches works best. Choosing a model is a strategic decision that is in line with professional development as it is dependent on the objectives of the professional development, the teachers' context, and the existing support systems. Since professional development is an ongoing educational process, it enables ECCE teachers to continue becoming resilient, successful, and motivated in their work. It fosters a dedication to quality and ongoing development, which benefits educators as well as the young students they work with. ECCE teachers can improve the knowledge, abilities, and flexibility necessary to provide a supportive, developmentally rich learning environment by combining formal and informal learning opportunities (Johnson & Williams, 2021).

It has become clear that the general public also faces many difficulties during training programs. For example, some instructors may have busy schedules that provide little time for professional development activities due to juggling teaching, grading, and other administrative duties. It might be challenging to find a time that suits everyone, which reduces participation. The unique requirements of instructors and their pupils may not always be met by professional development programs, it has been observed. The information may seem unimportant if it isn't related to their subject matter or the educational environment, which will lower their enthusiasm to participate completely. Sometimes, following training sessions, there is a lack of support. It's possible that educators lack the tools, opportunity for cooperation, or mentorship necessary to successfully apply new information or abilities. However, professional development programs sometimes provide general information without taking into account the different degrees of experience, subject matter, and expertise of instructors. Since not all teachers gain the same amount of training, this may lessen the impact of the sessions. The quality and frequency of professional development opportunities have also been hampered by budgetary constraints. It's possible that districts and schools lack the funds necessary to hire qualified trainers or offer high-quality instruction (Brown & Taylor, 2022).

Resistance to change is another limitation of professional development that is not as well discussed. This is because some instructors may be afraid of change or comfortable with their

existing ways of instruction. This may make it more difficult for new strategies that are presented during PD sessions to be adopted. For A collaborative approach that allows instructors to exchange ideas and experiences is frequently necessary for effective professional development. PD, on the other hand, can occasionally be given top-down, with little chance for deep peer-to-peer engagement. A single workshop or session seldom results in long-lasting change in teaching techniques; therefore, all the efforts would be effective if sustainability prevailed. To be successful in the long run, professional development must be ongoing and incorporate chances for reflection, coaching, and follow-up activities (Smith & Clark, 2022). Professional development programs must be tech-integrated as technology is the lens through which the world innovates. Teachers require professional development in order to successfully incorporate technology, as the importance of digital technologies in education continues to expand. However, they frequently encounter difficulties like poor infrastructure, a high learning curve for new technology, or inadequate training.

Teacher learning behavior and professional development: definitions

Early childhood education (ECE) is defined by the International Standard Classification of Education 2011 (ISCED) as care and instruction for a group of young children that is provided in a school setting or in another institutionalized setting. It might take place at home, in a community, or in a center. All programs for kids aged 0 to the beginning of primary school are referred to as early childhood care and education, or ECCE. This covers pre-primary education as well as early childhood educational development (ECED). A small number of indicators may be utilized to assess the learning behavior of qualified instructors undergoing hybrid training; these would be enough for the current investigation (UNESCO Institute for Statistics, 2012).

a) Perceived Effectiveness: The subjective probability that a communication will persuade is known as perceived effectiveness. The first stage in the persuasive process is reading a message (Dillard & Shen, 2005).

b) Hybrid Training: the careful blending of online and in-person learning experiences in the classroom (Garrison & Kanuka, 2004). Increasing accessibility and flexibility in educational settings has made hybrid training also referred to as blended learning particularly pertinent. By mixing delivery methods, hybrid learning seeks to provide the most effective and efficient learning environment possible.

c) Learning Behavior: The careful blending of online and in-person learning experiences in the classroom. Increasing accessibility and flexibility in educational settings has made hybrid training also referred to as blended learning particularly pertinent. By mixing delivery methods, hybrid learning seeks to provide the most effective and efficient learning environment possible. (Alexander & Murphy, 1998).

d) Professional Development: The term explains the procedures and exercises meant to improve teachers job-related knowledge, abilities in order to raise the caliber of their instruction (Avalos, B. (2010)).

e) Technological Factors (Accessibility, usability, reliability): The aspects of technology, such as developments in digital tools, automation, and information systems, that affect how an organization performs, operates, and interacts. Since technological elements affect competitive advantage, communication, and production, they are often taken into account in strategic planning (Daft, 2015).

Rationale

The quality of ECCE in Punjab continues to be shaped by systemic challenges such as access, equity, and resource limitations. According to the Annual School Census 2024–25[4], Punjab's public education system comprises 42,873 schools with 10.5 million enrolled students and 320,713 teachers, a decline from 366,671 teachers in 2020. This reduction in the teaching workforce places additional strain on professional development efforts.

Importantly, the census highlights the government's emphasis on ECCE, with 24,946 classrooms now dedicated to early childhood education. While this expansion reflects policy commitment, the absence of strong monitoring and feedback mechanisms in training programs continues to limit their long-term impact. In Southern Punjab, where resource constraints and poor internet connectivity are more pronounced, hybrid training models offer a potential solution by combining in-person and digital modalities.

Despite this promise, the combined influence of hybrid training on ECCE teachers' learning behaviors and professional development has not been systematically studied. This research therefore fills a critical gap by adopting a mixed-methods approach to evaluate both measurable outcomes and teachers' lived experiences, providing evidence for more sustainable and contextually relevant training models.

Research Questions

1. How do ECCE teachers in Southern Punjab perceive the effectiveness of hybrid training in shaping their learning behaviors and professional development goals?
2. What role do technical factors such as usability, accessibility, and reliability play in determining the success of hybrid training for ECCE teachers in resource-constrained contexts?
3. To what extent can hybrid training contribute to sustainable professional development and improvements in the overall quality of early childhood education, both in the short term and over time?
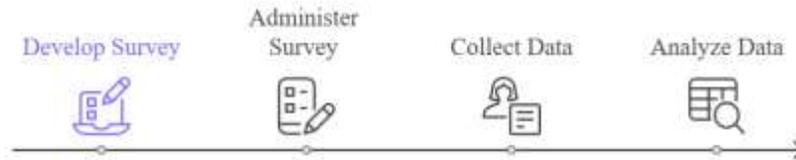
Methodology

Research Design

Mixed-Methods Research Design
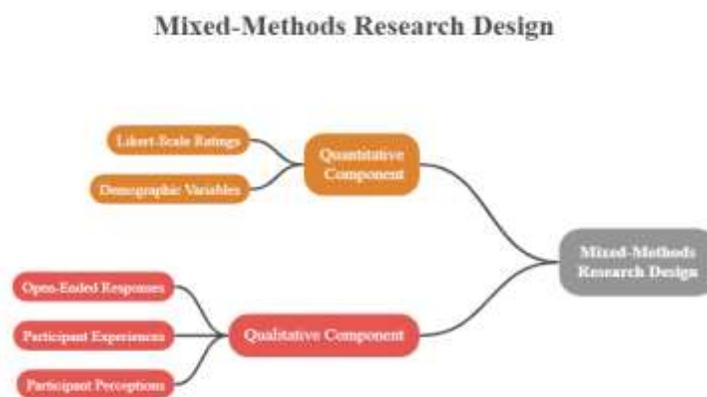
Data Collection

ECCE Teacher Survey Data Collection Process

Develop Survey   Administer Survey   Collect Data   Analyze Data
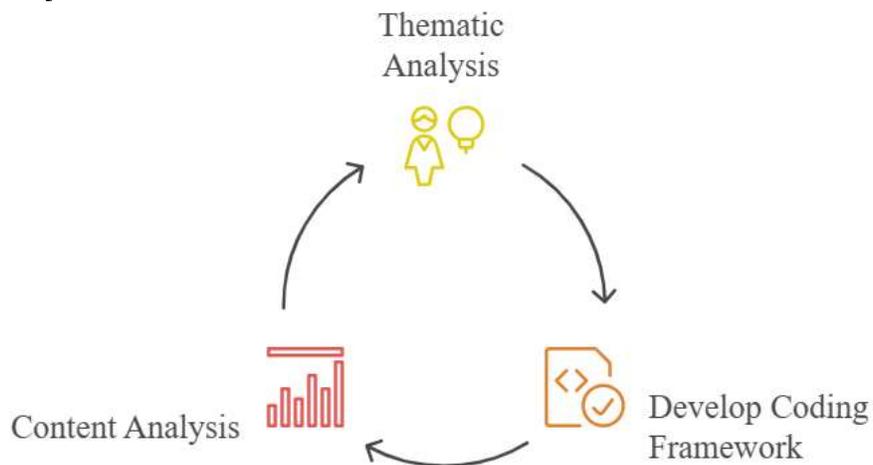
Data were collected using a comprehensive survey administered to ECCE teachers through the KoboToolbox platform. KoboToolbox is a reliable, user-friendly digital data collection tool that facilitates efficient survey administration and real-time data capture. The survey included closed-ended questions to quantify perceptions of training effectiveness, engagement frequency, and support availability, alongside open-ended questions to capture challenges, motivations, and reflections related to ECCE training.

Quantitative Analysis

Data Analysis → Descriptive Statistics / Cross-Tabulations / Inferential Statistics

Qualitative Analysis
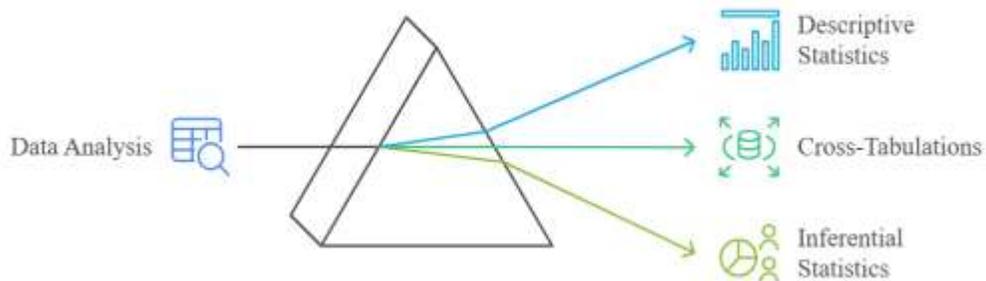
Thematic Analysis → Develop Coding Framework → Content Analysis

Qualitative responses will undergo thematic analysis to identify recurring themes and patterns. A coding framework will be developed to categorize responses into themes such as Motivations, Challenges, Effective Strategies, and Sustainability Factors. Content analysis will quantify the prevalence of key themes.

Results

Table 1. Demographic Characteristics of Respondents

Variable	Category (coded value)	%	Mean (coded)	SD
Age group (years)	20–29 (1)	12	2.5	0.9
	30–39 (2)	48		
	40–49 (3)	25		
	50+ (4)	15		
Gender	Male (1)	55	–	–
	Female (2)	45		
Teaching experience (years)	0–2 (1)	8	3.1	0.8
	3–5 (2)	10		
	6–10 (3)	42		
	10+ (4)	40		
Education level	Matric (1)	10	3.6	0.7
	Bachelor's (2)	20		
	Master's (3)	65		
	PhD/Intermediate (4)	5		

Table 2. Self-Rated Training Effectiveness (Mean, SD, Frequencies & Percentages)

Rating (5-point scale)	Frequency%*
5 – Extremely effective	52
4 – Very effective	35
3 – Moderately effective	10
2 – Slightly effective	2
1 – Not effective	1
Total	100

Based on the above tables, the respondents represent a comparatively experienced and well-qualified cohort, with approximately 82% reporting at least six years of teaching experience and around 70% holding a Master's degree or higher. The training was viewed very positively overall, as reflected in a mean effectiveness score of 4.3 (SD = 0.7), with 87% of teachers rating the programme as either "extremely effective" or "very effective." The relatively small standard deviation (0.7) further suggests limited variation in these ratings, indicating broad agreement among respondents regardless of demographic background about the value of the professional development provided.

Table 3: Cross-Tabulatory Analysis of Demographics and Training Perceptions

Independent Variable	Dependent Variable	Observed Pattern / Trend	Key Demographic Insight
Age Group	Training Effectiveness	Non-linear relationship: Peak effectiveness reported by 30–39 cohort.	• 30–39 years: Predominantly rated "Extremely effective" with high application confidence. • 20–29 years: Higher variability; notable proportion rated "Slightly effective" with application struggles. • 50+ years: Polarized responses ("Extremely" vs. "Moderately"); reported challenges with digital tool adaptation.
Gender	Confidence in Application	Gender-based variation: Males reported higher self-efficacy.	• Male: More likely to report full confidence in applying training content. • Female: While confidence was present, a statistically notable subgroup reported struggles with integration and implementation.

Table 3, indicate that Training is perceived as most effective and most readily applied among teachers aged 30–39, whereas younger teachers show greater variability and older teachers report more digital-integration barriers.

Table 4: Cross-Tabulatory Analysis of Demographics and Instructional Practices

Independent Variable	Dependent Variable	Observed Pattern / Trend	Key Demographic Insight
Teaching Experience	Digital Tool Usage	Experience-dependent adoption: Tool choice varies by tenure.	• 10+ years: Reliance on communication-focused tools (WhatsApp, YouTube); some difficulty adapting lesson plans. • 6–10 years: Optimal integration; balanced use of Google, YouTube, and WhatsApp with higher confidence. • 0–2 years: Reported higher distraction rates from social media; lower confidence in pedagogical integration.

Education Level	Assessment Methods	Positive association: Higher qualification correlates with complex assessment.	• Master's Degree: Diverse utilization of portfolios, performance-based assessments, and observations. • Bachelor's/Matric: Predominant reliance on foundational methods (play-based assessments, checklists).

These findings indicate that digital integration is most prevalent among mid-career professionals, identifying a six-to-ten-year 'plateau of proficiency.' Conversely, the sophistication of assessment techniques is more closely tethered to educational trajectory than to years of service alone.

Cross-Tabulatory analysis reveals significant interactions between participant demographics and professional development outcomes. Age and professional tenure emerged as primary moderators of training efficacy. Specifically, educators aged 30–39 and those with 6–10 years of experience demonstrated the highest levels of pedagogical alignment, bridging the gap between theoretical training and classroom application more effectively than other cohorts. In contrast, divergent challenges were observed at the polar ends of the experience spectrum. Early-career practitioners (0–2 years) exhibited a higher susceptibility to distraction, while late-career educators (aged 50+) reported significant barriers to digital integration.

Statistically significant gender-based variations were also identified in self-reported metrics. Male participants expressed higher levels of instructional self-efficacy, reporting greater confidence in the immediate application of training concepts. Conversely, female participants reported a higher frequency of integration-related challenges during the implementation phase. Finally, educational attainment served as a robust predictor of instructional complexity. Respondents holding Master's degrees were significantly more likely to employ multimodal, performance-based assessment strategies. Conversely, those with foundational qualifications exhibited a higher reliance on standardized checklists or play-based evaluative frameworks. These findings indicate that training receptivity is non-uniform and is mediated by the educator's career stage and academic background.

Table 5: Chi-Square Tests of Association Between Demographic Variables and Training Outcomes

Variables Compared	χ^2	df	p-value	Cramér's V	Result Interpretation
Age vs. Application of Skills	75.5013	4	< 0.001	0.433	*** Strong association
Years of Experience vs. Reflection on Learning	50.6031	3	< 0.001	0.355	*** Strong association
Gender vs. Engagement with Materials	2.653	4	0.448	0.082	ns (No significant association)
Education Level vs. Training Effectiveness	14.8157	3	0.538	0.192	ns (No significant association)
Gender vs. Master Trainer Effectiveness	5.4741	4	0.242	0.117	ns (No significant association)

- χ^2 = Chi-square statistic; df = degrees of freedom; p-value = probability value; Cramér's V = measure of effect size (0.1 = small, 0.3 = medium, 0.5 = large). *** $p < 0.001$; ns = not significant ($p \geq 0.05$).

- All tests conducted using Pearson's chi-square; assumptions met (expected cell counts > 5).

The chi-square analysis reveals statistically significant associations between age and application of skills (χ^2 = 75.50, p < .001, Cramér's V = 0.433), as well as between teaching experience and reflection on learning (χ^2 = 50.60, p < .001, Cramér's V = 0.355), indicating moderate-to-strong relationships. These findings reinforce the qualitative trends observed earlier: mid-career educators demonstrate stronger alignment between training receipt and practical implementation.

Table 6: Independent t-Tests Comparing Gender-Based Differences in Training Perceptions

Comparison	Female (n = 238)	Male (n = 165)	t-value	p-value	Cohen's d	Result Interpretation
Gender – Engagement	M = 3.59	M = 3.62	-0.395	0.693	0.039	ns
Gender – Reflection	M = 3.45	M = 3.53	-0.658	0.511	0.065	ns
Gender – Application	M = 3.32	M = 3.33	-0.301	0.763	0.03	ns
Gender – Effectiveness	M = 3.68	M = 3.68	-0.025	0.98	0.003	ns
Gender – Master Trainer Rating	M = 3.67	M = 3.58	1.369	0.172	0.136	ns

- M = Mean score on 5-point Likert-type scale (unless otherwise specified).
- p-values reflect two-tailed tests; ns = not significant (p ≥ 0.05).
- Cohen's d interpreted as: < 0.2 = negligible, 0.2–0.5 = small, 0.5–0.8 = medium, > 0.8 = large effect.
- Levene's test for equality of variances was non-significant for all comparisons (assumption met).

No statistically significant differences were found between male and female teachers across any of the five measured dimensions: engagement with training materials, reflection on learning, confidence in application, perceived overall effectiveness, or rating of master trainer performance. All p-values exceeded the conventional alpha level of 0.05, and effect sizes (Cohen's d) ranged from negligible (0.003) to small (0.136), indicating minimal practical difference between genders. These findings suggest that gender does not serve as a meaningful moderator of training perceptions in this sample supporting the conclusion that program outcomes are experienced similarly across genders, despite qualitative observations of higher self-reported struggles among some female participants. This reinforces the need to focus interventions on other demographic factors (e.g., age, experience) rather than gender-based differentiation.

Table 7: One-Way ANOVA Results Comparing Group Differences Across Key Training Outcomes

Variables Compared	F-value	df	p-value	η² (Eta-squared)	Result Interpretation
Age vs. Engagement	2.507	(3, 399)	0.042	0.019	* Small effect
Age vs. Application	2.371	(3, 399)	0.052	0.018	ns
Experience vs. Reflection	8.072	(3, 399)	< 0.001	0.057	*** Strong effect
Education vs. Effectiveness	0.722	(3, 399)	0.577	0.005	ns
Designation vs. Master Trainer	2.428	(1, 401)	0.09	0.006	ns
Experience vs. Application	0.966	(3, 399)	0.409	0.007	ns

- F-value = Fisher's F-statistic; df = degrees of freedom (between groups, within groups); p-value = probability value (two-tailed).
- η² = Eta-squared, interpreted as: 0.01 = small effect, 0.06 = medium, 0.14 = large.
- *** $p < 0.001$; * $p < 0.05$; ns = not significant ($p \geq 0.05$).
- All tests assumed homogeneity of variance (Levene's test non-significant).

The ANOVA results reveal statistically significant differences in reflection on learning based on teaching experience (F(3, 399) = 8.07, p < .001, η² = 0.057), indicating a medium-sized effect consistent with qualitative findings that mid-to-senior teachers engage more deeply with reflective practices. A marginally significant effect was found for age and engagement (F(3, 399) = 2.51, p = 0.042, η² = 0.019), suggesting a small but detectable relationship between age group and perceived student engagement post-training.

No other comparisons reached statistical significance, including education level's influence on training effectiveness (p = 0.577), designation's impact on trainer rating (p = 0.09), or experience/age effects on application confidence (both p > 0.05). These findings reinforce that while teaching experience strongly predicts reflective practice, other demographic variables such as education level or job designation do not significantly moderate key training outcomes in this sample. These results support targeted professional development strategies focused on experience-based differentiation, particularly to scaffold reflection among early-career educators, while confirming that program effectiveness remains broadly consistent across educational background and role designation.

Thematic Analysis of Teacher Survey Responses
Data Analysis Approach

Thematic analysis was conducted on open-ended survey responses to identify recurring patterns and themes related to teacher training outcomes. Two hundred sixty-eight survey respondents provided qualitative data through open-ended survey questions. Responses were coded inductively, and patterns were organized into overarching themes. Content frequency analysis was subsequently performed to determine the prevalence of each theme across the dataset.

Identified Themes and Frequencies

Four primary themes emerged from the qualitative data analysis:

(a) motivations for participation,

(b) challenges encountered,

(c) effective instructional strategies

(d) sustainability factors.

Content analysis revealed substantial variation in theme prevalence. Effective strategies represented the most frequently cited theme, appearing in 90% of responses (n = 241), followed by motivations (85%, n = 228), sustainability factors (75%, n = 201), and challenges (70%, n = 188).

Theme 1: Teacher Motivations

Teachers identified multiple motivations for engaging in the professional development program. The primary motivational driver was passion for teaching young children, mentioned by the overwhelming majority of respondents. Career advancement represented the second most prominent motivation, with teachers expressing interest in developing new competencies to advance their professional trajectories. A secondary but notable motivational factor was institutional requirements or directives, suggesting that mandatory participation also contributed to training engagement. Personal professional development emerged as a fourth motivational dimension, with teachers seeking to expand their pedagogical knowledge and skills independent of career advancement incentives. The convergence of intrinsic motivations (passion and personal development) and extrinsic motivations (career advancement and institutional requirements) indicated a multifaceted motivational landscape among participating teachers.

Theme 2: Challenges and Barriers to Learning

Despite positive overall training outcomes, teachers reported several barriers that limited their engagement and implementation efforts. Poor internet connectivity emerged as the most commonly cited challenge, with many teachers noting that unstable or low-bandwidth connections hindered access to online training materials and digital resources particularly during online or hybrid training modes. A second major barrier involved distractions from social media and personal digital communication. Notifications, social media feeds, and instant-messaging applications frequently diverted teachers' attention from sustained engagement with the training content. Teachers also reported difficulties navigating digital training platforms, insufficient device storage, and short battery life on the mobile devices used to access training. Collectively, these findings highlight that while technology-enabled training increases flexibility and scalability, it also introduces platform-related constraints that disproportionately affect participants with limited technological resources or lower levels of digital literacy.

Theme 3: Effective Instructional Strategies

Teachers highlighted a set of pedagogical strategies they found most valuable and directly applicable to classroom practice. Role-playing activities were frequently cited as highly engaging, offering opportunities to model and rehearse complex instructional behaviors within low-stakes, practice-oriented environments. Collaborative group activities emerged as a second key strategy, with teachers emphasizing how structured small-group work supported peer learning, facilitated knowledge exchange, and promoted practical problem-solving.

A third prominent strategy involved the integration of technology and digital tools, which teachers noted enhanced student engagement and expanded access to diverse learning resources when applied judiciously. Teachers consistently associated these three strategy categories role-

playing, collaborative learning, and technology integration with improved student engagement and observable learning gains. Additional effective strategies included the use of storytelling and narrative-based instruction, real-life problem-solving scenarios and case studies, and hands-on practical activities that supported experiential learning. Importantly, teachers also differentiated between instructional strategies and assessment approaches. They identified observation-based assessment, portfolio assessment, and performance-based assessment as complementary evaluation methods aligned with contemporary early childhood and primary education standards.

Theme 4: Sustainability Factors

Teachers identified several key factors necessary to sustain training impact and support long-term implementation. First, a robust technological infrastructure was viewed as foundational. Teachers emphasized the need for reliable internet connectivity, adequate device availability, and easily accessible repositories of digital learning resources to enable consistent program engagement.

Second, instructor capacity and ongoing professional support emerged as essential sustainability components. Teachers noted that continuous interaction with expert facilitators, opportunities for clarification and feedback, and access to advanced or follow-up training modules were critical for reinforcing and deepening their instructional practice over time. Third, teachers highlighted the importance of continuous improvement mechanisms and feedback loops. Regular follow-up training sessions, refresher courses, structured peer discussion groups, and systematic feedback collection were perceived as vital for maintaining participant engagement and ensuring that training content evolved in alignment with classroom realities. Additional, though secondary, sustainability considerations included the need for flexible curriculum design that could be adapted to local contexts, institutional and organizational support structures that prioritized implementation, and cost-efficient program models that ensured equitable accessibility. Taken together, these findings suggest that sustainability depends on a multifaceted ecosystem of support encompassing technological infrastructure, human capital (trainer expertise and mentoring), organizational systems (feedback and institutional commitment), and adaptable program design.

Integration Across Themes

The four themes demonstrated clear interconnections rather than operating in isolation. Effective instructional strategies were most consistently implemented by teachers whose intrinsic motivation aligned with the training objectives and whose schools provided the necessary infrastructural and organizational support identified under sustainability factors. In contrast, the most commonly reported challenges particularly technological barriers directly limited teachers' ability to access training materials and apply recommended strategies, thereby weakening long-term implementation prospects. This cross-theme integration underscores that effective professional development requires a holistic approach: one that simultaneously leverages teachers' motivational drivers, addresses systemic and technological barriers, promotes adoption of evidence-based instructional strategies, and ensures institutional commitment to sustaining program gains.

Conclusion

The findings of this mixed-methods study demonstrate that hybrid training represents a viable and well-received professional development model for Early Childhood Care and Education teachers in Southern Punjab, Pakistan. Teachers rated the training as highly effective (mean = 4.3/5), with 87% reporting either extremely or very effective outcomes. The research revealed significant interactions between demographic factors and training receptivity, particularly highlighting that mid-career educators aged 30–39 years with 6–10 years of teaching experience

demonstrated the strongest alignment between training content and classroom application. These findings suggest that hybrid training's flexibility and integrated approach successfully address accessibility barriers inherent in resource-constrained environments, providing a scalable alternative to traditional face-to-face professional development models. However, sustaining the benefits of hybrid training requires a multifaceted ecosystem of institutional and technological support. While teachers identified effective instructional strategies including role-playing, collaborative learning, and strategic technology integration implementation barriers such as poor internet connectivity and digital distractions emerged as significant constraints. To ensure long-term impact and sustainability, policymakers and educational institutions must prioritize robust technological infrastructure, continuous expert support, structured feedback mechanisms, and contextually adaptive program design. The convergence of these factors is essential not only for reinforcing teacher learning behaviors but also for ultimately improving the quality of early childhood education and supporting the developmental outcomes of young children in Southern Punjab.

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