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Pre-service Teachers' Experiences of Blended Learning: A Diffusion of Innovation Theory Perspective Using Mixed Methods

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Abstract. Blended learning, an emerging technology-based instructional approach, remains relatively new across many higher education institutions (HEIs) worldwide, reflecting its growing but still developing adoption. However, pre-service teachers who use it experience challenges that hinder effective learning. Limited studies examined the adoption of blended learning through the lens of the diffusion of innovation theory, which this paper adopts as the theoretical framework. This paper investigated pre-service early childhood education (ECE) teachers' experiences of blended learning at a HEI in Lesotho. This study is among the few that employ a concurrent mixed-method design to investigate blended learning, especially in the ECE programme. The data were collected from six participants through two focus group interviews and 271 respondents using questionnaires. The thematic analysis method was used to analyse qualitative data. Descriptive statistics and inferential statistics were used to analyse quantitative data. The findings showed that blended learning gave pre-service teachers flexible learning options while fostering improved collaboration. They highlighted that pre-service teachers faced significant challenges due to limited access to technology resources and insufficient technology support, which impacted their learning experience. The inferential statistics, based on Pearson correlation analyses (N = 271), indicated no significant differences between pre-service teachers' perceptions and experiences of blended learning and the theoretical framework variables (all correlations, $r < 0.3$, $p > 0.05$). This study recommends that pre-service teachers be provided with ongoing support to overcome the challenges and complexities associated with blended learning technologies.

Keywords: Blended learning; early childhood education; educational technology; higher education; pre-service teachers

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1. Introduction

HEIs worldwide have recently undergone a substantial educational transformation through the adoption of blended learning, which integrates in-person and online modalities to enhance teaching and learning experiences (Ampo et al., 2025; Nkhi et al., 2023). While blended learning gained widespread prominence during the COVID-19 pandemic as a necessary adaptation to social distancing, the concept and practice of blended learning had existed long before, as foundational work by Driscoll (2002) documented. The contemporary studies discuss blended learning in the context of recent educational trends (Dziuban et al., 2018; Macaruso et al., 2020). The pandemic accelerated blended learning adoption as institutions used it to overcome disruptions (Esawe et al., 2023; Hua et al., 2024), marking a lasting shift in pedagogical practices, especially in HEI. Nevertheless, its implementation remains diverse and continues to evolve.

Historically, HEIs relied primarily on face-to-face instruction featuring direct educator-student interaction. This traditional approach facilitated active engagement and immediate feedback in the learning process (Alea et al., 2020; Antwi-Boampong, 2021; Brenya, 2024). Ashraf et al. (2022) note that universities are increasingly integrating innovative technologies to meet evolving educational demands. This transformation reflects a broader trend towards modernising instructional methods and enhancing the overall quality of education.

Post-pandemic studies have documented a significant increase in blended learning uptake across various African contexts, including Egyptian universities (Esawe et al., 2023), South African institutions (Mahaye, 2020), and Lesotho's HEIs (Nkhi et al., 2023). Despite this shift, many institutions faced challenges. They were unprepared due to inadequate infrastructure, limited staff training, and a lack of strategic planning, which impacted the creation of flexible learning environments inclusive of all students, particularly pre-service teachers in ECE programmes.

These challenges underscore the urgent need for targeted investments and policies to support the sustainable integration of blended learning in African HEIs. Under-researched regions, including Lesotho, reveal limited empirical insights, predominantly within ECE programmes. Blended learning has been widely adopted, yet empirical research on pre-service teachers' experiences and adoption processes within Lesotho's ECE teacher training programmes remain scarce. These programmes face unique infrastructural and pedagogical challenges that warrant focused investigation. This study explores how pre-service teachers at Lesotho College of Education (LCE) perceive and engage with blended learning innovations, aiming to address a critical gap in the literature by offering context-specific insights to guide effective implementation strategies.

Higher education, which follows secondary education and is provided by universities or colleges, involves acquiring knowledge, developing skills, and enhancing intellectual capacities to solve complex problems through multiple approaches, a challenge reflected in the blended learning integration context of this study (Lekhetho, 2018). Addressing this gap offers valuable guidance for

tailored blended learning strategies suitable for similar developing-country settings.

1.1 Research Objectives

The objectives of this study were:

- To explore ECE pre-service teachers' experiences of blended learning and how they believe it enhances their academic performance in a Lesotho HEI.
- To investigate the nature and strength of the relationships among the DIT factors and determine how these factors predict the adoption and utilisation of blended learning by pre-service teachers in ECE programmes at a Lesotho HEI.

1.2 Research Question

- How do pre-service teachers in ECE programmes at a Lesotho HEI perceive and describe their experiences of blended learning and its effectiveness in enhancing their academic performance?
- What is the nature and strength of the relationships among the DIT factors, and how do these factors predict pre-service teachers' adoption of blended learning in ECE programmes at a Lesotho HEI?

1.3 Hypothesis Statement for Quantitative Research Purpose

There are significant positive relationships among the DIT factors, and enhanced perceptions of relative advantage, compatibility, trialability, and observability, alongside reduced perceived complexity, significantly predict greater adoption and utilisation of blended learning by pre-service teachers in ECE programmes at HEI in Lesotho.

2. Literature Review

2.1 Blended Learning Models

Blended learning has been increasingly adopted across all educational levels, primarily in HEIs and implemented using various designs. The literature shows that it has been implemented in schools and HEIs through models, such as face-to-face, online, flex, rotational, self-blend, and enriched virtual (Kömür et al., 2023). In a face-to-face model, online resources supplement traditional classroom instruction, with the educator remaining central to the learning process (Ampo et al., 2025). The online model incorporates both synchronous and asynchronous learning and primarily engages students through online platforms (Febrianto et al., 2020; Kömür et al., 2023; Nkhi et al., 2023).

The flex model offers students a flexible learning path primarily through online delivery, with educators providing face-to-face instruction as needed (Priya & Gowrishankar, 2022). The rotational model requires students to rotate among different learning stations on a fixed schedule, combining face-to-face and online learning (Kömür et al., 2023). In the self-blend model, students independently select additional online classes to supplement their traditional courses (Priya & Gowrishankar, 2022). Lastly, the enriched virtual model blends face-to-face sessions with significant online learning components, allowing one to supplement

the other as required (Mahmud, 2020). HEIs implement models that best meet their specific educational needs.

2.2 Implementation and Benefits of Blended Learning

Blended learning is best implemented by selecting models that align with institutional goals and student needs, while using user-friendly Learning Management Systems (LMS). Antwi-Boampong (2021) found that students experienced blended learning as a transition from in-person lectures to online components, appreciating its role in improving planning, interaction, and timely lecturer feedback. Fadel et al. (2019) note that lecturers prepare materials and videos uploaded to Moodle, where they also use forums for assignments and questions, while students submit work through this LMS.

Sabah (2020) reported that universities adopted Moodle to create individualised learning environments, motivating students through features such as socialisation, collaborative, and self-regulated learning, as supported by Islam et al. (2022), Mphuthi and Makura (2024), and Topping et al. (2022). These studies highlight students' appreciation for controlling their studies, emphasising the need for well-organised LMS-based courses to enhance performance and educational quality.

El-Maghraby (2021) noted that students benefit from Moodle's forums and submission tools, while Fadel et al. (2019) highlighted platforms such as WhatsApp, Zoom, and Moodle, especially during the COVID-19 pandemic. Mpungose (2020) confirmed that South African lecturers widely use Moodle to share materials, promoting self-study. Blackboard, another commonly used LMS, offers assessment tools and engagement features tailored to student needs (Nyabawa, 2016). Horvat et al. (2015) found that older students valued Moodle's features more than younger ones, possibly due to prior experiences or adaptation challenges, while gender differences were insignificant. These LMS resources support personalised, student-centred education with interactive tools such as quizzes and collaborative Wikis.

Blended learning offers benefits such as increased accessibility, flexibility, and engagement for pre-service teachers with diverse needs (Dima et al., 2022). Pardede (2019) emphasised its financial accessibility and removal of temporal and spatial constraints, enhancing personalised convenience. These advantages make it an appealing option as institutions strive to strengthen education and train technology-savvy teachers. However, pre-service teachers experience challenges, including high technology costs, insufficient training, adaptation needs of content, and decreased interpersonal interaction (Antwi-Boampong, 2021).

Brenya (2024) emphasises the importance of striking a balance between online and physical learning environments in adopting blended learning. Moreover, Syarah et al. (2020) note that ECE teachers still use technology scarcely. Given the significant pedagogical shift that blended learning represents for pre-service teachers in ECE, understanding their experiences through Rogers' Diffusion of

Innovation Theory (DIT) was expected to offer valuable insights into its adoption and barriers (Rogers, 2003).

2.3 Challenges Faced by Pre-service Teachers in blended learning Environments

Despite its benefits, pre-service teachers encounter several challenges within blended learning. Mphuthi and Makura (2024) and El-Maghraby (2021) state that pre-service teachers have experienced limited technological skills, unstable internet and low confidence as significant barriers reducing engagement in discussions and feedback. Matee et al. (2023) highlight issues such as inadequate training, limited technology devices and connectivity, unclear communication, reduced social interaction, confusing learning materials, and low motivation.

Makumane (2023) reported difficulties coming from sudden shifts to platforms like Thuto LMS without technical training, compounded by a lack of proficiency in hardware and software. Brenya (2024) and Topping et al. (2022) documented technical, social, and psychological obstacles encountered in blended learning, particularly during practicum or internship periods, highlighting the need for robust support systems. A study by Ampo et al. (2025) reveals that students showed a strong preference for traditional face-to-face learning, perceiving it as offering better understanding of learning resources, improved retention, and greater personal engagement with instructors.

This preference underscores the vital role of individual engagement in effective learning, particularly when tackling complex concepts. In another study, Mpungose and Khoza (2022) found that both lecturers and pre-service teachers preferred physical classrooms, citing discomfort with LMS platforms. Ashraf et al. (2022) also noted that blended learning requires multiple platforms, devices, and skills that many students currently lack. These challenges indicate that many pre-service teachers lack essential technology skills and encounter accessibility barriers, despite blended learning's anytime-anywhere design. Without sufficient resources, they often struggle and become frustrated. However, with appropriate support and training, they can gradually adapt to it.

These challenges suggest that many pre-service teachers lack the necessary technology skills and face accessibility challenges despite blended learning’s design as an anytime-anywhere approach. Innovations, such as blended learning, spread more effectively with proper training and support. Without adequate resources, pre-service teachers often struggle and become frustrated. They can gradually adopt it when support and training are provided.

2.4 Theoretical Framework

The adoption and implementation of blended learning in higher education have been widely studied in recent educational research, with particular focus on factors influencing its uptake. This study was guided by the Diffusion of Innovations Theory (DIT), acknowledged as widely developed by Everett M. Rogers in 1962 (Byamukama et al., 2022; Emmanuel et al., 2024). DIT was relevant because it explains how innovations such as blended learning spread and are accepted through populations (Rogers, 2003). It identifies five key factors affecting

adoption: relative advantage, compatibility, complexity, trialability, and observability (Min et al., 2019; Rogers, 2003). Despite growing interest in blended learning, limited research exists on how pre-service teachers in ECE programmes at the HEI perceive these attributes and how these perceptions influence their adoption and experiences of blended learning.

This study uses DIT to explore pre-service teachers' experiences of blended learning in ECE programmes in Lesotho and their impact on adopting blended learning in early childhood education programmes. Blended learning is viewed as an innovation that transforms traditional teaching by integrating technology and internet-based resources through HEIs, acting as diffusion channels (Rogers, 2003). The study examines how the five DIT factors impact teachers' attitudes and behaviours toward the adoption of blended learning, including the perceived benefits of blended learning (relative advantage) compared to conventional methods, its alignment with existing educational values (compatibility), and teachers' ability to experiment with blended learning approaches (trialability). By applying DIT, the research sheds light on how blended learning can be effectively adopted and implemented within the ECE programme in HEI, especially in the context of this study.

3. Methodology

This study adopted a pragmatic research paradigm, which supports the use of multiple methods, assumptions, and data-generating and analysis forms within a single study (Leavy, 2023). This paradigm was chosen to provide robust evidence addressing the research problem and questions. It allowed flexibility in selecting research methods that best fit the research questions and context. It was used to help produce actionable knowledge by combining qualitative and quantitative approaches to capture multiple perspectives on blended learning adoption among pre-service teachers (Leavy, 2023). Pragmatism prioritises producing practical, actionable knowledge that addresses real-world problems.

Therefore, a concurrent mixed-method research design was used, allowing these methods to complement one another and offset individual weaknesses (Creswell & Creswell, 2018). Data collection and analysis were conducted separately but simultaneously, with numeric and textual results being linked during interpretation. Neither method was privileged over the other, consistent with pragmatic principles (Leavy, 2023). This approach ensured a comprehensive understanding of blended learning adoption by capturing both measurable trends and in-depth participant perspectives.

The study focused on LCE, the sole HEI in Lesotho responsible for training pre-service teachers across all pre-tertiary education levels. Lesotho's education system is hierarchical, starting with ECE, followed by basic (primary) and secondary (high school) education (Lekhetho, 2018). LCE prepares pre-service teachers for diplomas and degrees to teach ECE and primary education. As the only HEI training ECE teachers, LCE represented the relevant population for this study. Importantly, it adopted blended learning in response to the COVID-19

pandemic (LCE, 2022), making it an ideal context to investigate blended learning adoption in pre-service teacher education.

The study employed a combination of purposive and random sampling, allowing for the simultaneous collection of both qualitative and quantitative data (Creswell & Creswell, 2018). Qualitative data were collected through focus group interviews with six participants divided into two groups to facilitate manageable discussions. Since the population consisted of 324 pre-service teachers enrolled in the programme, quantitative data were collected via questionnaires distributed to the entire population, yielding 292 returns.

271 were deemed complete and valid after data cleaning, ensuring a robust sample for statistical analysis. The purposeful element ensured rich qualitative insights, while the random component drawn from the broader census supported quantitative generalisability (Leavy, 2023). Participation was voluntary and based on informed consent. Qualitative data were analysed thematically, while quantitative data were analysed using descriptive and inferential statistics.

The reliability and validity of the blended learning experience instruments were assessed through pilot testing with 20 pre-service teachers from a different, yet related, programme and were subjected to expert review. Feedback from the pilot testing and expert review guided the refinement of the questionnaire before reliability analysis. Cronbach's alpha was used to measure the reliability of each factor, confirming the instrument's appropriateness and relevance to the study context. The weaknesses and ambiguities were identified and addressed. Table 1 presents the internal consistency values for each construct and associated items.

Table 1: Reliability results of the questionnaire

Factor	**Cronbach's Alpha (α)**
Relative advantage	0.85
Compatibility	0.88
Complexity	0.79
Trialability	0.81
Observability	0.83

As presented in Table 1, the Cronbach's alpha values ranged from 0.79 to 0.88, indicating good internal consistency across all constructs. The focus group interview guide was similarly reviewed by two experts in educational technology and blended learning to confirm content validity before data collection. The content items reflected acceptable relevance. The results confirmed that the instruments were both reliable and valid for measuring and exploring pre-service teachers' experiences of blended learning based on Rogers' DIT. Pilot testing increased confidence that the questionnaire will generate accurate and generalisable data in the full-scale research.

4. Results

The DIT framework facilitated analysis of how blended learning is adopted and adapted in HEIs' educational practices within Lesotho's ECE context. During quantitative data collection, participants were asked to express their perceptions of blended learning based on their experiences. As summarised in Table 2, Pre-service teachers' experiences and awareness of blended learning reveal nuanced perceptions and experiences on this educational innovation within Lesotho's ECE context at the HEI. Table 2 presents respondents' experiences of blended learning results.

Table 2: Pre-service teachers' experiences and awareness of blended learning

BLENDED LEARNING experiences		Often	Sometimes	Never
I enjoy learning with blended learning.	N	139	121	11
	%	51.3%	44.6%	4.1%
I learn more with blended learning than with face-to-face interaction.	N	88	165	18
	%	32.5%	60.9%	6.6%
Face-to-face learning allows a better understanding of complex concepts through direct interaction with lecturers and peers.	N	176	89	6
	%	64.9%	32.8%	2.2%
Online learning allows a better understanding of complex concepts through direct interaction with instructors and peers.	N	70	191	10
	%	25.8%	70.5%	3.7%
The online component of blended learning provides me with explicit activities and information.	N	152	113	6
	%	56.1%	41.7%	2.2%

The results suggest that many respondents (51.3%) often enjoy learning with blended learning, while 44.6% experience this enjoyment sometimes, indicating a generally positive attitude towards this innovative learning approach. Although only 32.5% perceive that they learn more through blended learning compared to face-to-face interaction, a combined 60.9% acknowledge this benefit occasionally.

Notably, 64.9% of respondents perceive face-to-face learning as more effective for understanding complex concepts, emphasising the continued value of direct interaction with lecturers and peers, compared to 25.8% who find online learning equally beneficial for comprehension. Equally, 56.1% frequently find the online component beneficial for providing explicit activities and information, suggesting blended learning's strengths in structured content delivery. These mixed yet predominantly favourable perceptions highlight a gradual and contextually adaptive adoption of blended learning by pre-service teachers.

Quantitatively, 95.9% of respondents reported their frequent or occasional engagement with blended learning components, indicating widespread awareness and acceptance of this approach over exclusive face-to-face learning. This high engagement level aligns with the DIT constructs: the perceived relative advantage of blended learning through flexible access to materials, compatibility with modern learning needs, and observability of benefits contribute to its

acceptance among pre-service teachers. They elucidate how blended learning innovation spreads through a social system based on perceived relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). However, the preference for face-to-face learning to comprehend complex concepts reveals perceived complexity in the online aspects of blended learning, indicating areas where further adaptation of innovations and support are necessary to deepen adoption.

Qualitative interviews revealed that although ECE pre-service teachers are aware of blended learning, their understanding of it varies significantly depending on their level of exposure. The findings showed that pre-service teachers received instruction through in-person lectures in physical classrooms. These face-to-face classes enabled them to engage actively with the material through interactive learning activities, aligning with the findings by Mphuthi and Makura (2024) and Topping et al. (2022). They noted that they utilised learning resources, such as PowerPoint presentation slides, which helped them review the content before and after the physical sessions.

Although conducted in a different context within the same country, the findings of this study are consistent with those of Nkhi et al. (2023), who studied lecturers' perceptions of blended teaching and learning. These findings highlight the uneven familiarity with blended learning among pre-service teachers, underscoring the need for more deliberate and consistent integration of technology in their training. Teacher education programmes must prioritise both hands-on exposure and scaffolded support that bridge theoretical knowledge with practical application to enhance their readiness.

The study investigated the relationship between pre-service teachers' experiences of blended learning in ECE programmes and DIT factors. Table 3 presents the results and the Pearson correlation coefficients among the five factors influencing the adoption of blended learning in their programme.

Table 3: Pre-service teachers' experiences of blended learning with DIT's features

Correlations						
		Relative advantage	Compatibility factor	Complexity factor	Trialability factor:	Observability factor
Relative advantage	Pearson Correlation	1	.286**	.191**	.260**	.244**
	Sig. (2-tailed)		0.000	0.002	0.000	0.000
	N	271	271	271	271	271
Compatibility factor	Pearson Correlation	.286**	1	.497**	.664**	.480**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000
	N	271	271	271	271	271
Complexity factor	Pearson Correlation	.191**	.497**	1	.648**	.440**

	Sig. (2-tailed)	0.002	0.000		0.000	0.000
	N	271	271	271	271	271
Trialability factor:	Pearson Correlation	.260**	.664**	.648**	1	.498**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	N	271	271	271	271	271
Observability factor	Pearson Correlation	.244**	.480**	.440**	.498**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	271	271	271	271	271
**. *Correlation is significant at the 0.01 level (2-tailed).*						
*. *Correlation is significant at the 0.05 level (2-tailed).*						

Relative advantage shows a positive correlation with all the other factors, compatibility (.286**), complexity (.191**), trialability (.260**), and observability (.244**), with $p < 0.01$. The compatibility factor is positively correlated with complexity (.497**), trialability (.664**), and observability (.480**), with $p < 0.01$. The complexity factor also shows a positive correlation with trialability (.648**) and observability (.440**), both significant at $p<0.01$. Finally, Trialability and observability factors show a positive correlation of (.498**), with ($p < 0.01$). These correlations suggest that these factors tend to move together; for example, a higher perception of compatibility is associated with a higher perception of trialability.

The correlations indicates that the DIT factors tend to move together; for example, a higher perception of compatibility is associated with a higher perception of trialability. These significant positive correlations collectively suggest that improvements in one innovation characteristic may support enhancements in others, thereby facilitating more effective adoption and integration of blended learning within Lesotho's ECE and higher education settings.

The results demonstrated that pre-service teachers used blended learning in the ECE programmes through synchronous and asynchronous learning. Their responses from the focus group interviews matched the explanation that in face-to-face learning, pre-service teachers received instruction and learning materials in person. The data indicate that they attended in-person lectures in a physical classroom.

The following extracts from three participants declared these.

> "*We have face-to-face lectures. That is to say, lecturers come into the class to lecture us. It is a sort of discussion. We, students, will be taking part in exchanging our views with lecturers*." (Manuel)

> "*During face-to-face lectures and even online, the lecturers would project the work on slides. In that way, we can visualise what she is talking about in the sense that there will be pictures. On the slide, there is writing, words and pictures*." (Marian)

> "*Sometimes, it is good to be taught through contact because some students catch up best when they are taught face-to-face. Lecturers elaborate on points when we are with them*." (Margie)

The phrase "it is good to be taught through contact" highlights the importance of direct, personal interaction between pre-service teachers and lecturers. This suggests that physical teaching can enhance learning experiences by helping pre-service teachers feel more engaged and connected when present in a lecture venue. The observation that "some students catch up best" acknowledges the diversity of their learning preferences. While some pre-service teachers thrive in online or remote learning environments, others benefit greatly from in-person instruction, where they can receive immediate feedback, clarification and support. Recognising individual learning styles is crucial.

The results demonstrated that using technology could benefit pre-service teachers in their future classrooms, as they engaged in blended learning during their ECE programmes. They emphasised the benefits of behavioural intentions to use technology. They gained from lecturers' competencies, skills, and knowledge in technology use. Satisfaction with technology use is a crucial factor in the success of blended learning. This point came from Manuel and Nestina, who said:

> "*I think our lecturers use technology. They are much advanced in … technology*." (Manuel)

> "*But not all. Blended learning forced many of them to use technology. Some use it well to teach us, but many cannot even help us when we encounter challenges*." (Nestina)

The above extracts demonstrate that pre-service teachers received classroom instruction from lecturers who used technology. Manuel believed that lecturers incorporated technology in their teaching. They used it because they had the skills to use it. However, Nestina shows that although lecturers use blended learning technologies, many are not more knowledgeable about using technology. Pre-service teachers do not receive quality learning from many lecturers.

Contrary to the results of descriptive statistics, the study revealed weak Pearson correlation coefficients between pre-service teachers perceived relative advantage of blended learning and four key factors influencing technology adoption: compatibility (0.286), complexity (0.191), trialability (0.260), and observability (0.244). This weak correlation suggests that ECE pre-service teachers may require a more in-depth understanding of how blended learning can enhance their educational experiences. It highlights the necessity for targeted support and resources to strengthen their perceptions and facilitate the effective adoption of blended learning strategies in education settings.

5. Discussion

5.1 Pre-service Teachers' Satisfaction with Blended Learning

Several studies have identified factors influencing pre-service teachers' satisfaction with blended learning, particularly those related to the relative advantage in the DIT (Min et al., 2019; Rogers, 2003). In this study, the positive

attitude of ECE pre-service teachers toward blended learning was driven by its benefits to their academic performance. Quantitative data revealed high engagement and satisfaction with blended learning, highlighting an appreciation for the flexibility and control over the learning pace, consistent with findings from other blended learning research (Islam et al., 2022; Mphuthi & Makura, 2024). Correlation analysis revealed a strong relationship between compatibility and trialability (0.664) and a moderate correlation between complexity and trialability (0.497), reinforcing the idea that blended learning suits individual learning preferences. These results align with Aji et al. (2020), who found that students valued blended learning for providing access to course materials beyond the traditional classroom.

Qualitative focus group findings supported the quantitative results, showing that the flexibility of blended learning helped participants balance their academic and personal commitments, thereby enhancing their overall educational experience. These findings align with Rogers' (2003) concept that users adopt innovations based on perceived relative advantage and compatibility. They also reflect Islam et al. (2022), who highlighted the flexibility and accessibility of blended learning resources. Additionally, studies by Antwi-Boampong (2021), Fadel et al. (2019), and Mpungose (2020) reveal that students accessed learning materials through Moodle in various locations. Overall, blended learning significantly enhances educational experiences by offering flexibility and diverse access to resources, allowing ECE pre-service teachers to manage their studies effectively.

5.2 Experiences of Technology Competence and Support

Quantitative data suggested a positive correlation between favourable blended learning experiences and increased confidence in using educational technologies, aligning with Brenya (2024) and El-Maghraby (2021), who emphasise that positive learning experiences enhance technology acceptance. However, qualitative findings suggested issues such as poor internet connectivity and technical difficulties, limiting full engagement with blended learning's online components, consistent with Makumane (2023) and Matee et al. (2023). These combined results suggest a complex relationship between the benefits of blended learning and the barriers that pre-service teachers face.

Key concerns included a lack of resources, insufficient training on digital tools, and limited support from lecturers, management, and the institution. These findings align with those of Makumane (2023) and Mpungose and Khoza (2022), who also found that lecturers and students have limited knowledge of blended learning technology. The study further revealed that pre-service teachers' limited technology skills were worsened by many lecturers' inadequate knowledge of blended learning tools, which hindered effective facilitation. While this challenge is longstanding, Matee et al. (2023) note that it originates primarily from lecturers rather than students. These findings highlight the urgent need for improved training and institutional support to maximise the effectiveness of blended learning and prepare pre-service teachers for technology-mediated instruction.

5.3 Engagement and Collaboration

ECE pre-service teachers' collaboration experiences of blended learning moderately correlated with the influence of other pre-service teachers' observed constructs. Inferential statistics confirmed descriptive statistics results. As Table 3 displays, a moderate correlation was found, indicating that participants were comfortable engaging with peers in blended learning. The findings of this study align with the findings of Islam et al. (2022), which revealed that students were motivated to utilise blended learning because it provided them with engagement benefits. While many pre-service teachers were satisfied with blended learning, the findings of this study complement the findings other studies including one by Ampo et al. (2025), revealing that some students tend to prefer traditional face-to-face learning because it facilitates more profound comprehension of complex content, supports long-term retention of information, and enables direct, real-time interaction with lecturers, which enhances opportunities for immediate feedback and clarifications.

Lecturers must use blended learning effectively and engage them in activities that help them to learn from and with one another. Taken together, the correlations reveal that the successful adoption of blended learning innovations in Lesotho's ECE and HEI depends on how well the innovation fits existing educational practices, how easily pre-service teachers can try and see the benefits, and how manageable they perceive its complexity to be. However, qualitative insights revealed that some pre-service teachers miss collaborative opportunities that traditional classrooms provide.

6. Conclusions

This study uniquely explored the experiences of ECE pre-service teachers engaging in blended learning in a HEI in Lesotho, framed within the DIT. The findings revealed that blended learning offered advantages, including flexibility and access to a diverse range of learning resources. However, pre-service teachers also faced challenges, including technological barriers and the need for effective pedagogical strategies, such as incorporating interactive content and facilitating collaborative discussions. Blended learning facilitated deep learning and understanding through enhanced peer interaction, allowing pre-service teachers to actively engage, collaborate and construct knowledge together in its components.

However, limited resources and infrastructure, including inadequate computer facilities and financial constraints, hindered the effective use of blended learning, which impacted academic results. Perceptions of different DIT factors influencing blended learning adoption were strongly interrelated, indicating a mutually reinforcing relationship. The study suggested that blended learning was in the early to mid-stages of diffusion among these pre-service teachers at LCE's ECE programmes, with positive experiences fostering readiness for broader adoption. Yet, challenges highlighted the need for ongoing improvements in online instruction quality and support to ensure blended learning aligns with learning preferences. Theoretically, this research contributes to understanding blended learning adoption by mapping ECE pre-service teachers' diffusion stages within

the DIT framework and revealing the strong interrelations among DIT adoption factors.

7. Limitations of the study

The limitations of this study include its focus on a single HEI in Lesotho, which may limit the generalisability of the findings to other HEIs or contexts. The population and sample predominantly consist of pre-service teachers in ECE programmes; the results may not apply to students in different disciplines or at different professional stages. However, this study adds value to scholarly work. It can complement or refute the results of similar research conducted at a single HEI, such as by Ampo et al. (2025), which used a qualitative research approach.

8. Recommendations

Based on the juxtaposition of findings regarding ECE pre-service teachers' blended learning experiences, this study recommends that HEIs must commit to providing the essential infrastructure and resources needed for compelling blended learning experiences in ECE programmes. This includes ensuring reliable internet access, supplying necessary hardware and software, and developing user-friendly online platforms that facilitate smooth interaction between pre-service teachers and lecturers. To fully leverage the advantages of blended learning while addressing its challenges, comprehensive training should be provided to all participants, with a focus on integrating technology into instructional practices.

Such efforts are crucial in enabling pre-service teachers to benefit from the flexibility and resources that blended learning provides. As Syarah et al. (2020) highlight, ECE teachers often lack adequate knowledge to effectively utilise website-based blended learning and technology, making it vital to provide technology-driven educational support in ECE settings. By addressing these needs, HEIs can promote the successful implementation of blended learning and foster lifelong learning, thereby enhancing engagement and learning outcomes in this evolving educational landscape.

Data Availability Statement

The data for this study are available, and templates and examples can be accessed in the instructions for authors. Data were used for obtaining a PhD. Therefore, it is confidential and a property of the university.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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