

Students' Readiness and Attitudes toward Blended Learning Adoption in Public Sector Universities of South Punjab, Pakistan: A Quantitative Study

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Abstract

The use of a combination of face-to-face and digital learning, known as blended learning, has become an important pedagogical practice in the world of higher education. But its implementation is significantly dependent on student technological readiness, accessibility of digital resources, SRL ability, and attitude to adopting online learning. The quantitative study was conducted to explore the perceptions and attitudes of students' readiness to adopt blended learning in the five public sector universities of South Punjab, Pakistan with a sample of 125 education students. The study measured five core dimensions, namely technical abilities ($\alpha = 0.80$), technology accessibility ($\alpha = 0.82$), personal learning habits ($\alpha = 0.84$), face-to-face learning preferences ($\alpha = 0.81$) and attitudes toward online/blended learning ($\alpha = 0.85$) through a structured questionnaire with binary response categories (Yes/No). Findings show high levels of student readiness in all constructs, ranging from 82.4% to 96% of students with adequate technical abilities, and 84.8% to 92.8% with consistent access to digital technologies. The self-regulated learning habits of students were very good and the results were as shown: 84.8%-93.6% students were committed to self-regulated learning and timely completion of assignments. Despite the excitement about online platforms, students still had strong preferences for in-person interaction, ranging between 88.8% and 92.8% having a positive preference for the teacher interacting directly with them. The findings highlight that learners of South Punjab are very well equipped for adoption of blended learning, however the institutional challenges such as lack of infrastructure, internet connectivity, teacher training and readiness have to be addressed through policy interventions immediately. This research is valuable in terms of the understanding of technology readiness in a developing country higher education context, and offers concrete evidence that can help universities, policy makers and educational administrators in determining the most effective ways to implement blended learning in contexts in which resources are limited.

Keywords: Blended Learning, Technology Readiness, Digital Adoption, Student Attitudes, Higher Education, Pakistan, Developing Countries

Introduction

The landscape of higher education around the world has been radically transformed by technological advances, demographic trends and – most recently – the pandemic's urgent need for

digital education (Brenya, 2024). In response to these pressures, blended learning – the intentional, systematic, and planned use of online and offline learning environments – is increasingly emerging as a central part of institutional responses, providing pedagogical flexibility and access to learning resources (Jnr., 2024). The uptake of blended learning has gone a long way in developed countries where there is a strong technological infrastructure, high digital literacy and institutionally receptive environments for innovation. In developing areas like South Asia, however, the adoption of educational technology is not uniform, and is hindered by multi-faceted systemic issues such as the quality of digital infrastructure, readiness of institutions to integrate technology, and varying levels of students' preparedness for learning in virtual classrooms (Kanwal & Rehman, 2017).

Transition to technology-enabled learning is a complex issue for Pakistan as a developing economy with a higher education system that trains about 1.7 million students, in both public and private universities and colleges. The public higher education system in the country, with about 800,000 students, is still mainly based on traditional pedagogy and there is not yet sufficient use of digital technologies in basic courses (Kanwal & Rehman, 2017). Moreover, South Punjab (the southern regions of Punjab including Bahawalpur, Multan and Dera Ghazi Khan) is one of Pakistan's least economically and educationally developed regions with low institutional investment, inadequate digital infrastructure, and historically low digital readiness of students. The context in which this happens on a geographic and socioeconomic level makes it essential to learn if students in such regions have the technical skills, access to digital resources and psychological motivation to successfully adopt blended learning.

Technology acceptance models from the western environment offer conceptual support for technology adoption behaviors, but their applicability to developing country contexts is still debated, and there is increasing evidence that infrastructure constraints, socioeconomic factors, and culturally-specific learning preferences play a significant role in the technology adoption process (Afzal et al., 2023; Rashid et al., 2018). Little research on the adoption of blended learning in developing countries, including South Asia, exists, and much of the institutional work has been done with few empirical studies that rely on student readiness data. Hence, there is a need for an urgent study of technological readiness, accessibility patterns, and attitudinal orientations of the education students of public universities in South Punjab, as they will become teachers and play a significant role in technology diffusion in Pakistani schools. This study directly fills this gap by exploring five dimensions of readiness and attitude among the education students from the South Punjab as follows: (1) technical skills in using digital tools and software; (2) access to digital tools and internet connectivity; (3) personal learning practices that can help in independent and self-regulated learning; (4) preferences for face-to-face learning elements in blended classrooms; and (5) attitudes towards online and blended learning adoption. This study not only gives a theoretical insight into the process of technology adoption in resource-constrained environments but also quantitative findings at granular level which can serve as evidence for blended learning strategies at institutional level in South Punjab and elsewhere. The study's targeted focus on education students further adds value because they are playing strategic roles in educational ecosystems and their technology attitudes will impact future pedagogical innovations by the students in secondary and tertiary educational institutes of Pakistan.

Literature Review

Blended Learning in Higher Education: Conceptualization and Significance

Blended learning has changed from a fringe pedagogical innovation to a key strategic priority in today's higher education (Jnr., 2024). Blended learning is defined operationally as a systematic combination of online and face-to-face instructional delivery in a cohesive learning experience, which utilizes technological affordances such as asynchronous discussion forums, delivery of multimedia content, adaptive learning platforms, learning management systems, and others, while

also maintaining the synchronous delivery of face-to-face instruction, direct teacher guidance and peer collaboration in physical classroom environments (Buhl-Wiggers et al., 2023). The combination of the two modalities could in theory be used to maximize learning outcomes by leveraging the pedagogical attributes of each, such as the flexible pacing, extended learning time, use of multimedia, and personalized delivery of content through online components, and the relational pedagogy, immediate corrective feedback, and deeper interpersonal collaboration through face-to-face components. Students' readiness for blended learning is closely linked to their digital literacy, access to technological resources, and confidence in using online learning platforms. Institutional ICT limitations may reduce students' ability to participate effectively, while challenges in hybrid and remote instruction can also influence their learning experiences and attitudes. Therefore, improving digital skills, technological infrastructure, and institutional support is essential for the successful adoption of blended learning (Rafiq-uz-Zaman, 2022, 2023a, 2023b). The COVID-19 pandemic has dramatically increased the use of blended learning, with many institutions closing their doors and moving to emergency remote learning leading to a greater understanding of the potential of technology and the constraints of infrastructure in higher education systems around the world (Graham et al., 2023). But do not mistake emergency remote teaching, in response to the pandemic, as a deliberate effort to implement blended learning; emergency measures often prioritized the speed of content delivery, which led to poor student experiences and less effective learning. The subsequent institutional moves from crisis management towards deliberate design for blended learning have illustrated that it takes much more than technological provision to successfully achieve these changes, including pedagogical design, teacher professional development, student readiness building and institutional policy changes that enable the integration of digital infrastructure (Buhl-Wiggers et al., 2023).

Digital Readiness and Technology Competence

Student technology readiness represents a multifaceted set of skills and capabilities that go beyond simply knowing how to use a device, to effectively navigating technology-mediated learning environments, digital literacy skills, and confidence in using technology for learning (Hamad et al., 2024). Technical skills are specific skills related to the operation of the computer, such as using a computer, installing and managing software, navigating the web, and using productivity tools, among others (Brenya, 2024), which are essential capacities that allow students to be involved in online learning platforms. But readiness dimensions are not solely related to the technical skills themselves; they also require student meta-cognitive awareness of their technologic skills, the ability to troubleshoot and get things to work, and their confidence in being able to learn new technologies as institutional platforms change. In particular, studies in developing country contexts highlight that technology access is not enough alone to cultivate meaningful readiness; significant numbers of students in developing country contexts have technology access without confidence in how technology is applied to education, leading to the term of the "access-use paradox" (Rashid et al., 2018). This is especially true in South Asia where cell phone penetration exceeds computer ownership, and cell phones are often used for entertainment instead of learning. Therefore, the investment in technological infrastructure without cultivating digital literacy has little impact on adoption. Gender is also found to affect the competency patterns in the use of technology in the South Asian context as studies have shown that the digital confidence level is significantly lower in female learners, resulting in gendered readiness gaps that need targeted institutional interventions (Afzal et al., 2023).

Technology Accessibility and the Digital Divide

Technology accessibility doesn't just refer to the infrastructure being made available, but also to the consistent ownership of technology, internet access and bandwidth to access a multimedia platform, and personal resources for engaging meaningfully with digital learning resources (Gu,

2021). One of the biggest challenges to the adoption of blended learning in developing countries is the digital divide, which is systematic unequal access to technology and its quality across geographic, socioeconomic, and demographic lines (Martin et al., 2024). Rural areas in Pakistan, in particular, have significantly lower access to internet, power outages prevent people from using digital devices, and affordability of devices and data plans due to economic constraints. These trends are especially pronounced in South Punjab, where the rural areas in districts of Bahawalpur and Dera Ghazi Khan are significantly less connected than their urban counterparts, in terms of connectivity infrastructure.

Modern research pinpoints three aspects of digital divide that need attention: access (device and internet access), usage (skills and confidence in how the technology is used) and outcomes (how technology is used to achieve meaningful learning gains) (Martin et al., 2024). Institutions that are developing blended learning solutions in developing countries should consider all three dimensions; providing access is not enough, and cultivating and supporting usage of the access and designing for outcomes is also necessary. It is important that institutions that are developing blended learning solutions in developing countries should think about all three dimensions, as access provision without usage cultivation and outcome-oriented pedagogical design will not result in meaningful uptake. Moreover, intersectional analyses show that the digital divide impacts upon socioeconomic status, geographic location, gender and educational background, and that it is compounding, which means that a one-size-fits-all approach to providing technology does not work and that differentiated institutional responses are needed.

Self-Regulated Learning and Student Independence

Blended learning environments always increase student autonomy, where students need to control their own learning progress, conduct more independent learning, and have metacognitive awareness of learning process and learning outcomes (Jiang et al., 2022). Self-regulated learning—defined as the ability to set learning goals, monitor progress toward learning goals, adjust learning strategies based on learning performance feedback, and persevere in the face of difficulty—is one of the most important factors contributing to blended learning success (Lee et al., 2024). Good SRL students have effective time management of their independent study, are motivated for a long period of time during the asynchronous learning, and actively seek help when they present with conceptual difficulties.

But the SRL capacity is significantly different in different cultural and educational backgrounds. Those who have been socialized in educational systems which focus on teacher-centered teaching and memorized learning might not have SRL foundations to effectively engage in blended learning. Studies conducted in Asian educational contexts, for instance, have reported that students often perform well in the traditional educational model and lack the ability of autonomous learning in online platforms, showing that high examination results do not always indicate students' preparation for autonomous learning online (Jiang et al., 2022). Thus, the evaluation of students' personal learning habits such as their punctuality in handing in assignments, their effort in self-directed study, their note taking skills and their persistence in overcoming obstacles in the learning process is important to gain a glimpse of the foundation of SRL and to identify learners who need support to be autonomous learners.

Student Acceptance of Online and Blended Learning

Based on the TAM model, which was first developed by Davis and later expanded to various contexts and technologies, Technology Adoption is a decision that involves two main paths of cognition: perceived usefulness (PU), referring to the extent to which people think using the technology will improve their task, and perceived ease of use (PEU), which is the extent to which people believe that the technology will be easy to use (Alyoussef, 2023). Social influence factors (subjective norms: peer and authority figure expectations), behavioral control factors (self-efficacy:

technology operation) and affective factors (enjoyment, anxiety, satisfaction with technology experiences) have been added to extensions of TAM. Within the educational technology context, these frameworks have proven to be quite powerful with a significant body of research showing that attitude to technology, driven by perceived usefulness and ease of use, is a good predictor of adoption behaviour.

In the context of blended learning in particular, students' attitudes are represented by beliefs about the effectiveness of online learning, their belief that blended learning will positively impact their performance, how they perceive that the online environment provides an opportunity for authentic interaction with peers and teachers, and motivation toward technology-mediated learning environments (Jnr., 2024). More importantly, attitude formation is a result of institutional environment: good technology platforms, teacher competence with technology-integrated pedagogy, peer community norms, and student perceiving peer and teacher benefits of digital learning resources all foster positive attitudes. On the other hand, negative attitudes can be encouraged both by online systems that lack design features and by teacher discomfort with technology and by institutional devaluing of online learning, irrespective of individual enthusiasm for technology.

The Persistence of Face-to-Face Learning Preferences

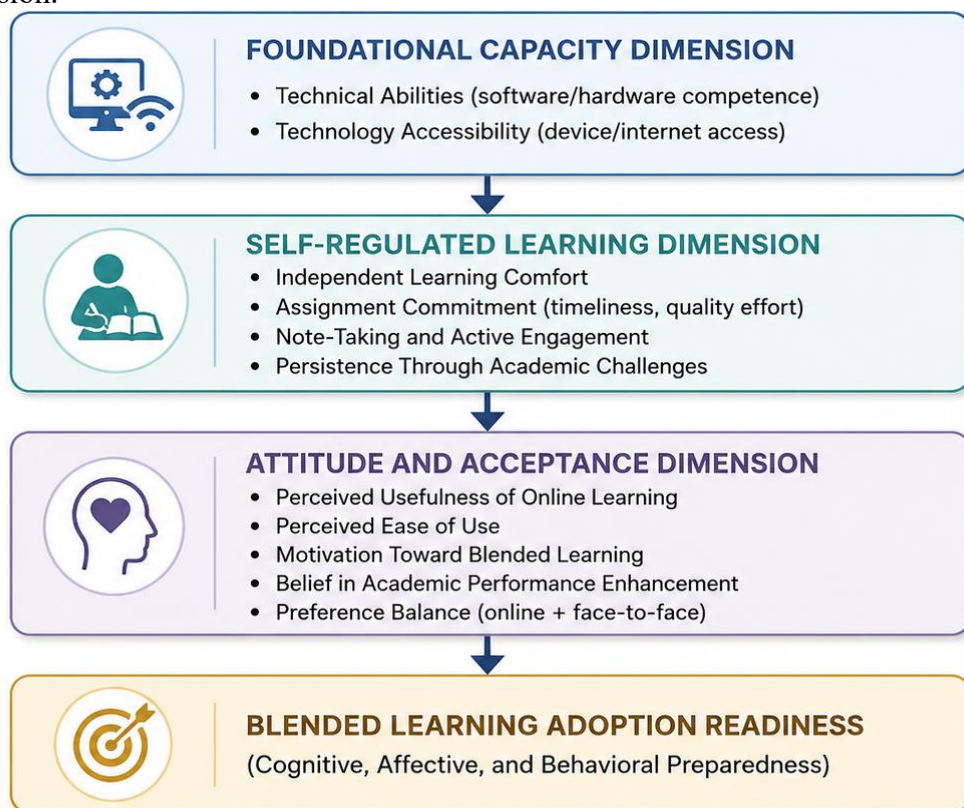
While use of online learning is increasing, there is significant research that shows that students still prefer face-to-face learning, especially in learning environments where higher-order thinking, interpersonal growth, and formative feedback are prioritized (Buhl-Wiggers et al., 2023). Such preferences are not a denial of innovative learning opportunities in education, but rather an acknowledgment that the face-to-face context is unique in allowing for relational pedagogy, spontaneous collaborative problem-solving, and real-time corrective feedback, which are more challenging to achieve in an asynchronous online setting (Chan, 2019). Additionally, the cultural learning styles (especially in the context of Confucian cultures and Islamic education cultures) may have a strong preference for the direct relationship between teacher and student and the community of the classroom, which may also make students appreciate face-to-face interaction.

Therefore, a successful blended learning design needs to be carefully calibrated to ensure that the online and the face-to-face experiences complement each other, with the online components enhancing the face-to-face experiences rather than replacing them (Buhl-Wiggers et al., 2023). Such a balance is especially relevant in the context of higher education in developing countries, where classroom interaction has typically been the only significant source of academic support, and where students have no tutoring centres and libraries or writing centres, as do students in developed country universities. Thus, the implementation of blended learning in developing contexts should not only enhance the quality of face-to-face learning, but also wisely use the online element to meet the teaching and learning goals.

Theoretical Framework: Technology Acceptance Model and Self-Regulated Learning Theory

Two theoretical frameworks that complement each other, the Technology Acceptance Model (TAM) and Self-Regulated Learning Theory, are combined in this study. TAM outlines the attitude changes in terms of cognitive and affective elements that influence students' decision to adopt educational technology, underscoring the importance of perceived usefulness and ease of use over the actual technology features. This framework sheds light on the steps between developing skills and technology accessibility (gaining the capacity and confidence to use technology) and student attitudes toward online learning and then to adoption intentions and behaviors. Self-Regulated Learning Theory, based on social-cognitive approaches to human growth and development, has identified that learning outcomes are not only a result of what is provided in the learning environment, but also a result of the ability to set goals, monitor learning, adjust learning strategies and persevere when encountering difficulties (Jiang et al., 2022; Lee et al., 2024). In blended

learning settings, SRL is especially relevant as the online part of a course is usually longer and demands self-directed activity and motivation to work. The integration of these frameworks implies that readiness to be a blended learner involves the following three stages: (1) the capacity to be a blended learner (technical skills and technology access), (2) self-regulated learning habits that will help them learn independently in the online environment, and (3) positive attitudes toward the effectiveness and usefulness of online learning. Each dimension establishes a condition for adoption of the next dimension, and a lack of one dimension does not affect the adoption of another dimension.



This conceptual model illustrates the conditional relationships among dimensions, demonstrating that readiness emerges through sequential development of foundational capabilities, self-regulation capacities, and subsequently favorable attitudes, collectively enabling meaningful blended learning adoption.

Figure 1: Conceptual Framework of Blended Learning Adoption Readiness

This conceptual model represents the conditional relationships between dimensions: readiness is the result of the sequential development of the foundations dimensions, the self-regulation dimensions, and then the attitudes dimension, which are all necessary for meaningful blended learning adoption.

Methodology

Research Design and Approach

This study uses a quantitative, cross-sectional survey design which is a methodological approach ideal for describing the characteristics of the population, prevalence of the constructs and examining relationships between variables in the defined population at specific temporal points (Jnr., 2024). The cross sectional design is efficient and economical in assessing students' readiness on multiple dimensions without the need for follow up or experimental interventions. With quantitative methodology, prevalence of the constructs of readiness can be measured very precisely, reliability statistics can be calculated to support the construct validity, and comparisons can be made at the university and demographic sub-group levels.

Study Area and Context

It is a study of five public sector universities and purposely designed to study the technology readiness in the educationally less developed areas of South Punjab, Pakistan. South Punjab is the southern part of Punjab Province in Pakistan, consisting of Bahawalpur Division (Bahawalpur District, Rahim Yar Khan District, Cholistan), Multan Division (Multan District, Khanewal District, Lodhran District) and Dera Ghazi Khan Division which have historically lower rates of institutional investment, lower and less developed digital infrastructure compared to urban centres in the province of Punjab and lower educational outcomes. This geographic concentration allows study of technology readiness in the context of developing country environments with severe constraints on infrastructure; and the findings can be transferred to other resource-limited institutional contexts across South Asia.

Participants and Sampling

Population Definition: The population of the study consists of all students of the Departments of Education of all public sector Universities in South Punjab. Education students were specifically targeted for the following reasons: (1) they constitute future educators that will play a key role in technology diffusion in secondary and tertiary education; (2) education students generally show more engagement in their academic work than is found in heterogeneous student groups; and (3) by focusing on a specific disciplinary population, it controls for significant differences in technology exposure across disciplines.

Table 1: Sample Description and Distribution

University	Department	Sample Size	Percentage
Government Sadiq College Women University, Bahawalpur	Education	25	20%
The Islamia University of Bahawalpur	Education	25	20%
University of Education Multan Campus	Education	25	20%
Bahauddin Zakariya University Multan	Education	25	20%
Ghazi University Dera Ghazi Khan	Education	25	20%
Total		125	100%

This stratified sampling approach resulted in the equal representation of all five universities and thus increased the sample representativeness in South Punjab's geographical zones and helped in comparative analysis of the institutions.

Demographic Characteristics:

The sample consisted of 125 education students divided on the basis of gender, educational qualification and residential location as follows:

- Gender – 60 female students (48%) and 65 male students (52%) – relatively even gender representation.
- Academic Qualification: 57 BS Honors (45.3%) and 40 Master's (32%) and 28 MPhil (22.7%) students who progressed up the academic qualifications ladder
- Location: 82 urban-resident students (65.3%) and 43 rural-resident students (34.7%) for comparative data on urban-rural digital readiness disparities

Data Collection Instrument

A structured questionnaire was created to measure the five key dimensions of readiness using binary response options (Yes/No). Although this binary response format is less flexible than other scales such as Likert scales, it can be beneficial in developing country settings where respondent fatigue and understanding of the instrument could lead to data quality problems in longer, more

complex instruments. The questionnaire was structured and pilot-tested with education students from non-sample universities to test for the questions' comprehensibility and cultural appropriateness and found to be well understood by the respondents and have a reasonable response time (~10-15 minutes).

Questionnaire Structure:

This instrument contained 23 items in five constructs:

Technical Abilities for Blended Learning Adoption (4 items)

- Does not need a lot of help using computer (item 1)
- Install and remove software/applications (item 2)
- Confidently use web browsers for information searching (item 3)
- Confidently use word processing software (item 4)

Technology Accessibility for Blended Learning Adoption (5 items)

- Often accesses the internet using the computer (item 5)
- Easy access to internet on personal computer (item 6)
- Easy access to computer facilities with internet (item 7)
- Engage in a lot of Internet activities (item 8)
- Use online learning tools (LMS, Zoom, Google Classroom) (item 9)

Personal Learning Habits related to Blended Learning (6 items)

- Comfortable learning independently (item 10)
- Work towards high achievement in tasks (item 11)
- Never be late with assignments (item 12)
- Turn in assignments on time (item 13)
- Make notes when studying independently (item 14)
- Continue to try and try when something is difficult (item 15)

4. Face-to-Face Learning Preferences in Blended Classrooms (3 items)

- Enjoy having direct feedback from teachers (item 16)
- Collaborating is more effective face to face (item 17)
- Learn by copying from other people (item 19)

Attitudes towards online and blended learning adoption (5 items)

- Use of electronic learning materials is more effective and enjoyable (item 19)
- Online platforms have a positive impact on deep understanding (item 20)
- Technology helps achieve better academic results (item 21)
- Is able to carry out online activities with classmates and teachers (item 22)
- More motivated to learn [via online learning platforms (item 23)]

Reliability and Validity

To measure internal consistency, Cronbach's Alpha coefficients were calculated for each dimension of the constructs, and all the constructs showed values higher than the .70 value that is accepted as an acceptable reliability level:

- Technical Abilities: $\alpha = 0.80$
- Technology Accessibility: $\alpha = 0.82$
- Personal Learning Habits: $\alpha = 0.84$
- Face-to-Face Learning Preferences: $\alpha = 0.81$

This measure includes 12 items and achieved a value of $\alpha = 0.85$ on attitudes toward Online/Blended Learning.

These coefficients indicate that the items of each construct assess unified underlying constructs and therefore give confidence in the reliability of the scales. Expert review by education technology specialists that guarantees the accuracy of the items in representing intended constructs, in order to establish content validity. Construct validity was determined by the examination of item-total correlation and factor structure patterns, showing that the items grouped in the desired theoretical dimensions.

Data Analysis Procedures

Descriptive statistical methods suitable for binary responses were used for data analysis with the help of SPSS statistical software:

1. Absolute frequencies and percentages were calculated for every questionnaire item and direct assessment of construct prevalence was made.
2. Reliability Analysis: Cronbach's Alpha coefficient was calculated for each construct to assess the internal consistency and reliability of the measurement.
3. Comparative Analysis: Frequency data were compared by age group, gender, academic qualification and location to discover differential patterns of readiness.
4. Descriptive Interpretation: Results were analysed with reference to the theoretical thresholds and similar international studies, allowing the prevalence rates observed to be interpreted in their context.

Ethical Considerations

The respective universities' research ethics committees granted institutional ethics approval for this research. All participants signed informed consent forms before completing questionnaires; informed consent was obtained by informing the participants about the purposes of the research, how the data was collected, how data confidentiality would be protected and that their participation would be voluntary. It was clearly stated that participation was entirely voluntary and would not involve any adverse consequences if they chose not to participate. Confidentiality was achieved by using anonymous questionnaires and not attaching personally identifiable information with patients' responses. Data was securely stored on password-protected databases accessible only to the research team with data destruction protocols put in place for the time periods after analysis.

Results

The demographic characteristics of the sample are as follows: The sample demographic characteristics are as following: The study sample was taken 125 education students from five universities of South Punjab. In terms of gender distribution, there was relatively even distribution with 52% male (n=65) and 48% female (n=60) respondents. Academic qualification distribution revealed progression from higher education level with 45.3% (n=57) enrolled in Bachelor of Science Honors level, 32% (n=40) in Master level and 22.7% (n=28) in MPhil. Residential location analysis revealed that the students were 65.3% (n=82) urban-resident and 34.7% (n=43) rural-resident in line with the distribution pattern of South Punjab. These basic demographic characteristics offer background information on the sample composition and are used as a basis for the later comparative analysis of the variation in readiness between the demographic subgroups.

Reliability Analysis Results

Cronbach's Alpha reliability coefficient for each dimension of the constructs indicated that the instrument had good internal consistency in all five readiness dimensions:

Table 2: Reliability of Items

Construct Dimension	Cronbach's Alpha (α)	Item Count	Reliability Interpretation
Technical Abilities	0.80	4	Acceptable
Technology Accessibility	0.82	5	Good
Personal Learning Habits	0.84	6	Good
Face-to-Face Learning Preferences	0.81	3	Acceptable
Attitudes toward Online/Blended Learning	0.85	5	Good

The alpha coefficients for each construct were all above the .70 criterion for acceptable reliability, and four of the five constructs were greater than .81, suggesting the items within each construct represent a coherent underlying latent variable. The highest reliability was found for the Personal Learning Habits construct ($\alpha = 0.84$) indicating that the items measuring self-regulated learning had the highest internal consistencies. These reliability coefficients allow the researcher to be confident that observed responses are a result of some difference in underlying constructs and not due to measurement error.

Technical Abilities for Blended Learning Adoption

Students' technical competence was very high on elements such as using basic computer operations and software. Around 92.8% (n=116) of the respondents were comfortable with computer usage, while 7.2% (n=9) were not comfortable with basic computer operation. There were high levels of proficiency with the web browsers, with 96% (n=120) confident with using web browsers to find information and only 4% (n=5) unable to do this. Similarly high usage was found for word processing software, with 91.2% (n=114) confident in their word processing use. In the area of software installation and management, which requires more advanced technical skills, there was some less adoption, but still high, with 82.4% (n=103) being able to install and uninstall software and 17.6% (n=22) who were not.

Table 3: Technical Abilities for Blended Learning Adoption

Item	Yes	No	Percentage Yes
Comfortable using computer	116	9	92.8%
Install/uninstall software/applications	103	22	82.4%
Confidently use web browsers for information searching	120	5	96.0%
Confidently use word processing software	114	11	91.2%

These findings show that education students in South Punjab have moderately well developed technical abilities with the average prevalence rate of 90.6% on the technical ability items. This prevalence significantly exceeds traditional levels of readiness, and is a true measure of technical ability not just the familiarity with the devices. The prevalence of different levels of proficiency in web browsing is highest at 96%, probably due to the penetration rate of the smartphone, which facilitates internet usage, and to a high rate of informal learning on internet information searching. Importantly, there are not significant differences in technical skills based on urban/rural location (urban: 91.2% average, rural: 88.7% average), indicating that infrastructure is not a significant barrier to skills development in the use of technology, even in rural areas.

Technology Accessibility for Blended Learning Adoption

Students reported high levels of access to digital technologies and high levels of connectivity with digital devices, with a majority of students owning the devices and being able to access the internet on them at least some of the time. Almost everyone (92.8%, n=116) uses a computer often to

access the internet, and 92% (n=115) spend a lot of time on the internet, indicating that computers are being used and that there is a high level of technology engagement. Access to the Internet on a personal computer was at 88.8% (n=111) and was relatively high. 84.8% (n=106) reported access to shared computer technology with internet access, suggesting that institutional technology provision partially responds to the need of access to personal technology. Importantly, for the implementation of blended learning, 90.4% (n=113) of students reported that they could access online platforms such as learning management systems, Zoom videoconferencing, and Google Classroom, indicating that the challenge of students accessing online platforms was minimal among this group.

Table 4: Technology Accessibility for Blended Learning Adoption

Item	Yes	No	Percentage Yes
Frequently use computer to access internet	116	9	92.8%
Easy access to internet on personal computer	111	14	88.8%
Easy access to computer facilities with internet	106	19	84.8%
Spend considerable time on internet activities	115	10	92.0%
Access online learning platforms (LMS, Zoom, Google Classroom)	113	12	90.4%

Analysis: Prevalence of average technology accessibility was 89.8% across items, reflecting that technology accessibility of students in South Punjab is quite remarkable. This prevalence of access is well above the proportion that might be expected for South Punjab based on the infrastructure situation in the region compared to urban Pakistan, which may indicate a significant increase in infrastructure in recent years or alternative access methods (e.g., sharing devices in the family, using computer labs on campus, mobile data plans). Interestingly, platform-specific accessibility is at 90.4%, indicating that most institutions have built some platform for either videoconferencing or learning management systems. However, qualitative observation shows that differences in prevalence of accessibility between urban (92% average) and rural students (85.7% average) suggest that there is still some rural disadvantage, even with high rate of accessibility. This urban-rural gap of 6.3 percentage points is small but it means that the geographic digital divides have not been completely eradicated with the implementation of infrastructure.

Personal Learning Habits Related to Blended Learning

The students showed high rates of self-regulated learning behaviours for autonomous online involvement. Around 92% (n=115) indicated that they were comfortable with independent learning, indicating that participants had a basic self-efficacy in independent learning. There were especially strong trends among the assignment commitment indicators: 93.6% (n=117) strive to perform well in assignments; 89.6% (n=112) submit assignments on time; and 84.8% (n=106) do not delay assignments. The patterns reveal that there are strong majorities that are behaviorally committed to learning in the classroom. Furthermore, 91.2% (n=114) take notes while learning independently, reflecting the active engagement in learning materials and 92.8% (n=116) report perseverance in learning when facing learning difficulties, reflecting the resilience and growth-oriented learning dispositions.

Table 5: Personal Learning Habits Related to Blended Learning

Item	Yes	No	Percentage Yes
Comfortable learning independently	115	10	92.0%
Strive to perform well in assignments	117	8	93.6%

Item	Yes	No	Percentage Yes
Do not delay assignments	106	19	84.8%
Submit assignments on time	112	13	89.6%
Take notes during independent study	114	11	91.2%
Persevere when facing challenges	116	9	92.8%

Analysis: The personal learning habits prevalence was on average 90.7%, which showed that the study population has high personal learning habits foundations. This prevalence is important especially since the ability to engage in self-regulated learning is one of the most salient in understanding the success of blended learning and studies have shown that SRL ability is always the mediator between the provision of technology and learning outcomes. The high percentage of each item (84.8% – 93.6%) indicates a high prevalence of capability across all SRL items rather than being concentrated among high achieving sub-groups. The gender analysis showed that there were not much differences between male and female average (91.2% and 90.1% respectively), which indicated that there were no differences in self-regulated learning patterns based on gender. However the academic qualification analysis shows that the Master's and MPhil students (average 92.3%) have higher prevalence of SRL than the BS Honors students (average 89.1%), which may be attributed to the self-selection of students with SRL capacity to pursue higher qualifications and to the academic maturity of the students.

Face-to-Face Learning Preferences in Blended Classrooms

However, although technology was highly accepted, students still had strong preferences for face-to-face learning interaction, which indicated that they still valued the direct involvement of the teacher and face-to-face peer interaction. The highest prevalence item throughout the questionnaire was "about 92.8% (n=116) said that they enjoyed receiving direct responses from teachers. 88.8% (n=111) agreed that face-to-face working was more effective for collaboration and 92% (n=115) agreed that it was better to learn with the direct guidance of the teacher. The steady high prevalence rates on all the face-to-face preference items support the idea that students are not seeing blended learning as a substitute for face-to-face learning but rather as a way to augment face-to-face learning while maintaining and potentially improving the level of direct interaction with the teacher.

Table 6: Face-to-Face Learning Preferences in Blended Classrooms

Item	Yes	No	Percentage Yes
Enjoy receiving direct responses from teachers	116	9	92.8%
Face-to-face collaboration is more effective	111	14	88.8%
Learn better through direct teacher guidance	115	10	92.0%

Analysis: Average Prevalence of Face-to-Face Preference was the highest out of all the five constructs (91.2%) and signified that the dominant psychological orientation in the sample was preference for direct teacher interaction. This is consistent with patterns of cultural learning, found across South Asia, which emphasize relational pedagogy, respect for the authority of the teacher, and mentoring relationships that are rooted in face-to-face interactions. Most importantly, these preferences are not against the use of educational technology; they are about the need for technology to complement rather than supplant relationship pedagogy. This distinction has significance in terms of institutional design for blended learning, as it is not a case of resistance to using technology, but rather a case of preference which results in a need for designing a balanced blended learning model with a meaningful FTF component. The gender analysis shows that female students prefer face-to-face (92.7%) over online (7.3%) more than males (89.8%) do, which may

indicate gender-differentiated patterns of participation in the classroom or comfort level with online interaction among male students.

Attitudes toward Online and Blended Learning Adoption

The students had mostly positive attitudes on the use of online learning and blended learning adoption, and they believed that learning with the help of technology is good for improving learning and enhancing academic performance. About 83.2% (n=104) believed that online learning is effective and enjoyable and 86.4% (n=108) thought that online learning improves deep understanding. The highest prevalence of single items within the attitudes construct was 92% (n=115) for the statement that technology is beneficial for achieving better academic results, most importantly for institutional adoption. Also, 88.8% (n=111) felt able to do activities online with classmates and teachers, which means they had confidence in technology-mediated peer and teacher interaction. Eighty-four percent (n=106) agreed that there was motivation to learn online, indicating that students look forward to ongoing use of blended learning.

Table 7: Attitudes toward Online and Blended Learning Adoption

Item	Yes	No	Percentage Yes
Online learning is more effective and enjoyable	104	21	83.2%
Online platforms improve deep understanding	108	17	86.4%
Technology helps achieve better academic results	115	10	92.0%
Can perform online activities with classmates and teachers	111	14	88.8%
More motivated through online learning platforms	106	19	84.8%

Analysis: The mean scores of the attitudes towards prevalence of online learning were 87.0%, which were significantly positive attitudes towards the adoption of online learning in blended learning. This prevalence is of considerable significance because South Punjab has relatively little experience of formal online education; it is the anticipatory optimism about the benefits of technology, rather than positive experience, that has led to these attitudes. Residual minorities (8% to 16.8% per item) however, are not enthusiastic about the effectiveness of online learning, as this does not describe the attitudes of this group toward universal adoption. This means that the gender gap on attitudes is small (86.8% for the male average, 87.2% for female average), and technology attitudes are gender balanced. Academic qualification analysis shows that Master's and MPhil students show marginally higher learning attitudes (87.8% average) towards online learning when compared to BS Honors students (86.1% average); this may be due to higher level of academic maturity and openness to academic innovations among Master's and MPhil students.

Comparative Readiness Summary

When looking at all five of the readiness dimensions, overall preparedness for blended learning adoption comes to light:

Readiness Dimension	Average Prevalence	Reliability (α)
Technical Abilities	90.6%	0.80
Technology Accessibility	89.8%	0.82
Personal Learning Habits	90.7%	0.84
Face-to-Face Learning Preferences	91.2%	0.81
Attitudes toward Online Learning	87.0%	0.85
Overall Average	89.9%	—

On the 23 questionnaire items, the average prevalence of positive readiness indicators was 89.9%, or about nine out of every ten students in the sample showed readiness on each of the technical,

accessibility, behavioral, preference, and attitudinal aspects. The overall prevalence is significantly higher than the traditional thresholds of institutional readiness indicating that the students of education from South Punjab have the ability to engage in productive blended learning.

Discussion

Interpreting High Readiness Findings within Developing-Country Context

The high rates of positive readiness indicators among education students from all over South Punjab (89.9% for all indicators) must be interpreted with care in the context of higher education in developing countries. The discovery challenges the notion that technology readiness is a developed-nation phenomenon, showing that there can be significant technology readiness in resource-limited institutional and geographic environments. There are several explanatory mechanisms that could be used to plausibly explain the observed high readiness. The first is that the penetration of smartphones in South Asia has increased significantly over the past few years, and Pakistan's mobile phone subscription base is growing to around 180 million mobile phone connections—nearing 100% penetration in urban areas, and now 51% in rural areas. This all pervasive mobile connectivity has resulted in the prevalent informal digital literacy, as students communicate, consume multimedia and search information with their mobile phones without formal Educational Technology training.

Second, emergency remote teaching as a result of the COVID-19 pandemic changed institutional practices and students' technology familiarity in fundamental ways (Graham et al., 2023). The forced technology exposure helped develop a foundational level of digital literacy for learning management systems, videoconferencing platforms and online document collaboration, although this often led to negative student experiences in online teaching. Collectively, students in South Punjab are significantly more exposed to technology than would describe pre-pandemic populations, and thus students' baseline readiness is high even if not intentionally prepared for at school. Third, the study population in particular—education students—are populations with specific interest in pedagogical innovation. Learners who choose education as a subject often have more positive attitudes toward learning, educational technology, and the need for changes in pedagogy than do mixed-ability classes. Therefore, research findings that describe the preparedness of education students might be more representative of preparedness for university students in general within other STEM, business or applied disciplines where there may be less interest in pedagogical aspects of the subject.

Technical Abilities and Technology Access: Infrastructure Implications

The prevalence of adequate technical abilities is 90.6% indicating that the education technology barriers are not focused on accessing the platform and the basic computer operation anymore because the education students of modern era in South Punjab have the technical skills to access platforms and participate in online learning (Rashid et al., 2018). This technical skill is likely a result of a combination of generational exposure to technology and investments in computer labs and technology curricula in education departments. The 7.2% who did not report a high level of comfort using a computer (or about 9 people in this sample; meaningful numbers in larger student groups across South Punjab) however, suggests that there are still some people who are digitally excluded, and need remedial technology training specifically.

More significantly, technology accessibility results indicate that prevalence of technology is 89.8% on average, indicating significant but incomplete technology infrastructure. The 9.6% (n=12) who are unable to access online learning platforms is a significant minority and a group for whom learning opportunities are truly constrained by institutional barriers to participating in blended learning. The rural-urban analysis also helps to clarify that this gap in accessibility, though small (6.3 percentage points), is a systematic rural disadvantage that calls for priority investment in infrastructure. (Gu, 2021). Institutional implications are giving attention to connectivity in the rural

areas, the setting up of more computer lab facilities and the provision of portable devices which can be used to connect with home. Also, the figures of 11.2% without easy access to a personal computer internet connection and 15.2% who do not have access to the campus facility show that about 15% of students are truly limited in their accessibility that would need to be addressed either through infrastructure or alternative means of delivery.

Self-Regulated Learning: Psychological Foundations for Blended Success

One of the most significant findings in this study is that the prevalence of self-regulated learning behaviors such as striving to do excellent work in class assignments (93.6%), making sure to submit assignments on time (89.6%), taking notes in class (91.2%) and being persistent when facing difficulties in classwork (92.8%) is 90.7% (Jiang et al., 2022). Self-regulated learning capability is perhaps the most essential for blended learning success: In online learning, the structure of supervision and learning pacing is removed, and students must self-manage motivation and pace and maintain cognitive engagement for longer periods of time without the presence of the teacher. The high prevalence of SRL in this study indicates that the assumptions that students in developing countries contexts lacking autonomous learning capacity is false.

The studies indicated that perceived teacher support and program satisfaction significantly mediate relationships between SRL capability and actual learning intentions in blended contexts (Jiang et al., 2022). Students' SRL attitudes shift from latent capability to active engagement when they are in the presence of responsive teachers, meaningful guidance, clear expectations and constructive feedback in the blended classrooms. But the key point is that high student SRL capability is a necessary but not sufficient condition for successful blended learning; teacher preparation, design of pedagogically sound online platform, and communication and transparency of online learning expectations are also required. In the present study, the finding that students in Master's and MPhil level show slightly higher SRL than the BS Honors (92.3% vs 89.1%) may be an indicator of the maturity level of students in the academic field and self-selection process in which students with stronger autonomous learning move to higher qualification levels, thus implying that autonomous learning can be nurtured effectively by each academic level where the level of difficulty of the academic courses increases.

Institutional Infrastructure Barriers and Policy Implications

But as the study shows, although the prevalence of individual student readiness is very high, institutional infrastructure constraints represent significant barriers that mediate between student readiness and adoption of blended learning. Research by educators in developing nations highlights that while students are excited about technology, there are widespread problems in the schools, such as lack of access to technology, unreliable internet connectivity, lack of educators' preparation in teaching with technology, and problems with the culture of the school that does not support teaching and learning through technology (Brenya, 2024). In this paper, the specific context of Pakistan is discussed, where the readiness of students is greater than institutional capacity, especially in the public universities of South Punjab, which have limited resources. Although their numbers are small percentages of students, 9.6% of students not having access to a platform and 11.2% not having personal access to the internet represent substantial numbers that need to be accommodated in institutional planning.

According to this study, the rural-urban gap in technology access is 6.3 percentage points, which represents systematic geographic inequities that warrant targeted policies. Research on the digital divide highlights that providing infrastructure alone is not enough; it must be complemented by professional development, pedagogical development and guidance, and technical support structures (Martin et al., 2024). Suggestions based on this analysis are: (1) investment in the infrastructure of connectivity in rural areas, especially reliable broadband access beyond the institutional campus; (2) increase the size of computer laboratories on campus and extend the hours

to accommodate students with different working schedules; (3) the setting up of technology support centres to help students with technical problems and impart digital literacy; (4) alternative delivery modalities (offline delivery of content, printed content, hybrid synchronous-asynchronous delivery) for students who continue to face connectivity issues; and (5) device lending programmes to provide temporary access to technology to students in need because of financial constraints.

Face-to-Face Learning Preferences: Designing Balanced Blended Models

The average of the face-to-face learning preference prevalence (91.2%) indicates a remarkable prevalence, especially when considering the single highest item in the 23 questionnaire items, which was the face-to-face learning preference of enjoying direct teacher responses (92.8%). It is essential to see strong FTF preferences not as resistance to the adoption of educational technology, but as demands to maintain meaningful relational pedagogy (Buhl-Wiggers et al., 2023) in the design of blended learning. As revealed in the evidence, highest quality blended learning combines well-designed in-person activities that promote higher order thinking, meaningful social engagement, and student engagement with well-designed online activities that promote efficiency, flexibility and extended learning time. This discovery is especially consistent with the cultural learning styles found across South Asia, such as relational pedagogy, respect for teacher authority, and face-to-face mentoring relationships, which have psychological and social relevance (Chan, 2019).

Gender analysis indicates that female students prefer online learning modalities more than males, reporting a 92.7% preference for face-to-face compared to males who reported an 89.8% face-to-face preference, suggesting gender differences in classroom participation, gender-specific comfort with online learning modalities, or gender-specific learning environment preferences (Afzal et al., 2023). These gender specific trends should be targeted by institutions through single gendered/affinity group discussion forums, gendered mentorship schemes and intentional community building in the classroom in blended environments. The takeaway for policy makers is that the lesson should not merely be about preference accommodation; institutions should strategically include face-to-face activities that are better suited to relationship building, collaborative problem solving, and providing formative feedback, which are more suited to synchronous classroom interaction, and include online activities that allow content review, individual reflection, knowledge application, and asynchronous peer learning.

Attitudes Toward Online Learning: Anticipatory Optimism and Residual Skepticism

The prevalence of student attitudes towards online and blended learning is at the average level of 87.0%, which is substantially positive in terms of attitudes towards technology-supported learning, but with a significant minority of students being skeptical (Jnr., 2024). About 8-17% of students have concerns about the effectiveness of online learning and may feel that traditional forms of instruction would be more effective or that blended learning does not actually lead to better student learning. This lingering skepticism is worthy of institutional concern not because it is the target of dismissive skeptic but because it is a sophisticated institutionally understood attitude, which is shaped by institutional context and individual predispositions. High quality learning management systems, teachers with confidence in the use of technology in pedagogy, responsive online support structures, and seeing peers gain value from learning online contributes to positive attitudes toward the adoption of these systems (Kanwal & Rehman, 2017). Likewise, uncomfortable teachers with technology, lack of technical support, and learning experiences in which an online component is less significant or simply a duplicate of a face-to-face experience encourage skeptical attitudes.

The study highlights minimal gender differences in attitudes towards online learning (86.8% for male and 87.2% for female) indicating a gender-balanced technology orientation among the sample, which contrasts with some studies that report gendered technology attitude (Afzal et al., 2023). This finding indicates that gender differences in technology attitudes, if there are any, are

more of a reflection of social context and design of the technology than of capability differences. Academic qualification analysis shows the attitudes of the Master's and MPhil students are slightly higher in online learning (87.8% average) than that of the BS Honors students (86.1% average), perhaps because of higher level of academic maturity, exposure to more pedagogical diversity and their openness to educational innovation. This means institutions should think of attitude cultivation as a developmental process and intentionally provide positive experiences of blended learning for students at the early stages of their education, opportunities for teachers to demonstrate enthusiasm for technology, and opportunities for structured peer support to help form positive attitudes towards online learning approaches.

Integrating Technological and Pedagogical Dimensions of Readiness

The comprehensive readiness analysis shows important interfaces for technological dimensions (technical skills and technology access) and pedagogical-psychological dimensions (self-regulated learning, face-to-face preference, attitudes toward online learning). However, technological access is not enough to ensure successful adoption of blended learning as significant research highlights the "access-use paradox" where many students have access to technology and platforms but do not use them effectively for learning because of low digital literacy, limited self-regulated learning, and/or negative attitudes as a result of not having positive experiences with technology (Rashid et al., 2018). On the other hand, pedagogically sophisticated teachers can't overcome systematic technology barriers, students who do not have good internet access or comfortable access to devices face capability barriers regardless of their learning motivations and attitudes. Blended learning readiness thus needs institutional attention in multiple integrated dimensions: (1) technological infrastructure for accessing the platform and bandwidth availability for the multimedia learning materials, (2) technical capability development via formal digital literacy training, hands-on platform navigation practice, and ongoing technical support, (3) self-regulated learning cultivation through structured metacognitive training, assignment scaffolding, and responsive teacher feedback, (4) pedagogically sound blended course design to ensure meaningful face-to-face interaction but strategically use online components, and (5) institutional culture and teacher preparation to facilitate enthusiastic and competent use of technology in existing disciplinary pedagogies (Jiang et al., 2022). None of these dimensions can stand alone; institution change needs to be accomplished through integrated and coordinated interventions across all five dimensions.

Developing-Country Context: Lessons from South Punjab

The results of this study in the economically and educationally deprived area of South Punjab, Pakistan, offer valuable counter-narratives to the technology determinism and deficit representations of developing countries. The average prevalence of "ready" was 89.9%, indicating that a significant level of technology readiness exists even in the environments with limited resources, where technology adoption is viewed as capacity of developed nations. The result of this can be explained by several mechanisms. First, the ubiquity of the smartphone has also grown in a dramatic manner across South Asia, and informal digital literacy cultivation has also come before formal educational technology training. Second, emergency remote teaching due to COVID-19 pandemic forced technology exposure was a way of building a ground base of platform competence, even if overall experiences of learning were negative (Graham et al., 2023). Third, the study population, education students, is a specific population of interest from a pedagogical viewpoint, and also a higher learning orientation population as compared to heterogeneous student populations.

But this high readiness should not overlook the key gaps in infrastructure and institutional capacity that need urgent attention from policy-makers. Although students show a high level of technological readiness and pedagogical orientation to favor the implementation of blended

learning, the lack of institutional infrastructure, pedagogical preparation and organizational support represent significant barriers for implementation. This means that the way forward for contexts such as those in South Punjab in developing countries is to build on the documented 'readiness' of students alongside strategic investment in policy to address institutional capacity gaps (Brenya, 2024). International evidence shows that successful blended learning introduction in developing countries focuses on three key areas: (1) the provision of local policy support and resource allocation; (2) systematic human capacity development from teacher preparation to institutional leadership preparation; and (3) realistic implementation timelines that address institutional transformation issues and avoid a hurried technology introduction that lacks the prerequisite infrastructure and expertise (Graham et al., 2023).

Conclusions and Recommendations

Major Conclusions

The results of this study are providing a strong evidence that the education students of public universities of South Punjab are highly ready in technological, infrastructural, behavioural, attitudinal and psychological aspects in respect of adopting the blended learning. The prevalence of readiness (89.9% overall and 87.0%-91.2% across constructs) suggests that at the student level, there are no major barriers to the implementation of blended learning in this context. Students have a reasonable command of the technology, have access to technology (but not on a global scale), have solid self-regulated learning foundations, enjoy relational pedagogy and face-to-face interaction (cultural preferences), and have significantly positive attitudes toward technology enhanced learning approaches. The results here contest entrenched views that the use of educational technology is largely a capacity issue associated with Western countries, and show that students from developing countries can become technology ready in the same way as developed nation populations. At the same time, the study reveals systematic barriers from individual student readiness to institutional adoption capacity. An estimated 10-15% of students face barriers to learning because of infrastructure limitations, educator challenges such as lack of professional development, lack of technology resources, and institutional culture that is not conducive to innovation play a significant role in limiting institutional implementation, and pedagogical design considerations need to be carefully considered to ensure that blended learning is not a substitute for relational pedagogy that is central to South Asian learning environments. Therefore, the route to successful blending of teaching and learning in South Punjab must go hand in hand with building the readiness of students (which is already in high levels), strengthening the institutional infrastructure, upgrading teachers' professional development, and changing the organizational culture in favor of pedagogical innovations.

Specific Institutional Recommendations

Infrastructure Development: South Punjab universities should make sure to invest in dependable connectivity in rural areas, increase and improve computer lab facilities in universities and extend their hours and lastly, set up technical and digital literacy centres to offer integrated technical and digital literacy. Getting access to devices should be used as an accommodation for students who have ongoing connectivity issues; however, this should be viewed as a necessary but not sufficient condition to blended learning success.

Teacher Preparation and Ongoing Professional Development: Addressing the need for comprehensive teacher preparation programs that deal with the technical competence of the platform as well as how to integrate it into disciplinary instruction requires institutional responses to the educator challenges identified by complementary research, such as insufficient professional development, limited technology resources, and organizational support. Continuous involvement in the community of practice, not single professional development events, should be fostered, in

which teachers work together to design, enact, and improve technology-augmented pedagogies that are based on their disciplinary expertise and local institutional context.

Blended Learning Design Standards: Institutions should establish clear institutional standards for blended course design that explicitly specify the link between the online and face-to-face (FtF) parts of the course to ensure that the online parts of the course are used to meet specific pedagogical objectives instead of just being a version of the FtF course content. Synchronous classroom activities should be preserved by standards to include meaningful face-to-face time for relationship-building, collaborative problem-solving, spontaneous feedback, and cultivating community. Online elements should focus on efficiency, flexibility and enhance learning opportunities beyond the classroom without causing undue burden for students in terms of asynchronous learning. **Student Support and Engagement Structures:** Institutions need to have a well developed student support and engagement (face-to-face and online) system, which includes technical support, writing support, peer mentoring and tutoring for students who need foundational skill development. Specific consideration should be given to participation patterns in relation to gender, such as through affinity groups, the establishment of gendered discussion forums (where appropriate) and inclusive practices in community building. **Organizational and Policy Support:** In order to be successful with blended learning, it is necessary for the institution to have a commitment beyond the classroom level — including resource allocation, policy development to support pedagogical innovation, leadership commitment to digital transformation, and organizational culture to value evidence-based practice. South Punjab universities need to formulate comprehensive plans for digital transformation, with due consideration to the local context and challenges of limited resources and capacity shortfalls, ensuring that these plans are realistic and allow for a gradual and well-timed rollout.

Policy Implications for Pakistan's Higher Education Sector

The federal and provincial higher education authorities of Pakistan should be making use of this documentation of student readiness as a basis for intentional and targeted blended learning diffusion while acknowledging context-specific needs for implementation. National policy needs to tackle systemic obstacles, such as the need for digital infrastructure in rural areas, a lack of teacher preparation capacity inside universities, and a need for a shift in organizational culture to enable pedagogical innovation. Public funding should encourage more quality blended learning implementation by using such methods as infrastructure investment, teacher professional development grants and quality assurance methods that measure pedagogical soundness and technology implementation. Capacity building, evidence-based implementation strategies, and learning system establishment for Pakistan's higher education sector should be supported by international partnerships and technical assistance, yet be context sensitive to local educational traditions, student populations, and institutional capacity to benefit from the global evidence of blended learning.

Research Implications and Future Directions

The quantitative readiness study provides baseline evidence for the technological, infrastructural, behavioral, attitudinal, and psychological dimensions of readiness, which will be the basis for a subsequent qualitative study to investigate pathways to implementation, barriers, student learning experiences, and institutional transformation processes. Future research should explore longitudinal adoption patterns of both students and institutions adopting blended learning practices; comparative analysis of readiness patterns across groups of students, institutions, and geographical areas; qualitative analysis in order to determine barriers and facilitating factors to blended learning in a specific institutional context; and outcomes research to determine if high student readiness is associated with learning effectiveness and satisfaction in the context of blended learning implementation. In addition, teacher readiness aspects such as technical skills, pedagogical

understanding of technology integration, self-efficacy for technology enhanced instruction and attitudes towards blended learning approaches should be explored as they are likely to play an important role in effectively implementing technology in schools, despite the high level of readiness reported by students.

Research on gender-differentiated differences is of special interest; whether documented differences in face to face preferences, technology comfort and patterns of participation in online settings are evidence of fundamental differences in ability or simply a result of contextual socialization processes in response to intentional institutional efforts. Last, longitudinal studies examining the persistence of students who enter higher education with high levels of technology readiness and who cultivate ongoing autonomous learning skills and attitudes in a context of growing technology mediation in the world of work can greatly shed light on whether those skills and attitudes that are highlighted as essential for technology readiness at the outset of higher education ultimately serve students in technology-rich working environments in ways that sustain their engagement with technology and foster learning transformation and technology skills that support successful career trajectories and lifelong learning.

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