ASSESSING THE ROLE OF DIGITAL LITERACY AND SOCIOECONOMIC FACTORS IN TECHNOLOGY ACCEPTANCE AMONG POSTGRADUATE STUDENTS IN BLENDED CLASSROOMS AT MEHRAN UNIVERSITY

Mariam Mahnoor
MS Scholar, English Linguistics,Centre of English Language and Linguistics (CELL)
Mehran University of Engineering and Technology (MUET), Jamshoro, Pakistan
Email: mariammahnoor06@gmail.com

Shazia Muheoddin
Lecturer at CELL, MUET, Jamshoro.Centre of English Language and Linguistics (CELL)
Mehran University of Engineering and Technology (MUET), Jamshoro, Pakistan
Email: shazia.muheodin@faculty.muet.edu.pk.

Salahuddin
MS Scholar, English Linguistics,Centre of English Language and Linguistics (CELL)
Mehran University of Engineering and Technology (MUET), Jamshoro, Pakistan Email: salahuddin2336@yahoo.com

Abstract

This research surveys how digital literacy and socioeconomic conditions impact Technology Acceptance of 75 postgraduate students in Mehran University, Pakistan based on the Technology Acceptance Model (TAM). Dwelling upon blended learning, the study investigates Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Behavioral Intention (BI) in the framework of the quantitative, cross-sectional survey. Non-parametric statistics (Spearman correlation, Mann-Whitney U, Kruskal-Wallis, Shapiro-Wilk) were utilized in the analysis of data that were gathered through a validated questionnaire (CronbachAlpha 0.80 and above). The results show that there are no significant associations between digital literacy and TAM constructs (e.g., DL vs. PU: rho=0.028, p=0.810) or among PU, PEOU, and BI, which question the predictive validity of TAM in the given context. There is a large gender difference in PU (U=479, p=0.033) indicating that the females see higher academic advantages. Socioeconomic variables (e.g., internet access, family education) did not make a significant impact perhaps because of institutional access to resources. To a linguistics audience, the findings point at the linguistic difficulty in using English-language online platforms, a factor that could lead to non-significant results. The research highlights the digital divide in Pakistan (37.3% 2G, 22.7% no internet) and demands specific measures of digital literacy training and enhancing the infrastructure. Qualitative understanding and language prescriptions should be subjects of future studies that can help improve the adoption of blended learning.

Keywords: Digital literacy, technology acceptance, blended learning, socioeconomic factors, TAM, postgraduate students, Pakistan

Introduction

Blended learning, a combination of the conventional face-to-face training and the internet-based educational practices, has acquired a life-changing strategy in the higher education departments of various countries of the world. By integrating the advantages of face-to-face classroom communication with the convenience and flexibility of online learning, blended learning allows the chances to increase student engagement, promote self-directed learning and achieve better academic performance (Garrison & Vaughan, 2008). Technologies exploited in this pedagogical model include Learning Management Systems (LMS) audio/video conferencing tools, and online discussion forums to build upon the dynamic

learning environments by supporting the needs of diverse learners. Yet, blended learning requires not only the institutional infrastructure to be effective but also presupposes the readiness of students to work with digital tools along with their willingness to embrace the technology-mediated educational process.

In emerging economies such as Pakistan, blended learning adoption encounters distinctive hindrances due to the combination of insufficient digital foundation and socioeconomic diversity and technological fluency of the learners. The sector of higher education in Pakistan is becoming more digitalized, especially after following worldwide trends and disruptions, like the COVID-19 pandemic that imposed online and hybrid learning as the new standard (Mahmood, 2021). Though these improvements are encouraging, they have been uneven in terms of access to reliable internet connection, modern devices as well as digital skills especially in rural settings or among populations that are economically deprived. These obstacles evoke significant concerns regarding both the perceptions and behavior of students in blended learning classrooms and the concern of whether students digital literacy and socioeconomic status play a role in their receptivity towards these technologies.

A key to be successful in indulging in blended learning is digital literacy which is the capacity to critically and proficiently find, curate, and disseminate information by application of digital technologies (Ng, 2012). The latter includes the ability to use LMS systems, find valid academic sources on the Internet, engage in online discussions, and resolve technical problems. Digital literacy is essential especially to postgraduate students who are supposed to be conducting advanced research and self-guided studies. Nevertheless, in Pakistan, where 37.3 percent of the population has either restricted or no access to the internet (Pakistan Telecommunication Authority, 2023), and where the digital training curricula in educational institutions are usually not thorough, students have vastly different levels of digital literacy. Such inconsistency can influence how they feel about the usefulness and ease of use of blended learning technologies, which will consequently impact on their intention to use the tools.

To understand these dynamics, this research paper will build on Technology Acceptance Model (TAM) which is a popular model in comprehending user acceptance of information system (Davis, 1989). According to TAM, Perceived Usefulness (PU), or the belief by a user that a technology will improve his/her performance, and Perceived Ease of Use (PEOU), or the belief by a user that a technology is easy to use, are the two main constructs that explain the Behavioral Intention (BI) of an individual to use a technology. With respect to blended learning, PU students notions of whether the use of digital tools can enhance their academic performance, whereas PEOU measures students confidence in their ability to use digital tools without much effort. BI is their desire to keep on using blended learning platforms in an academic manner. Using TAM, this study aims at elucidating the perceptions of postgraduate students at Mehran University regarding blended learning and whether such perceptions are influenced by their digital literacy and socioeconomic status.

The socioeconomic indicators such as the family residence (urban/rural), family educational level, access and ability to use technology, and internet connectivity are of great significance in determining the nature of technological experiences of students in Pakistan. As an example, students in rural areas, making a large part of the population, typically struggle with unstable internet (e.g., 2G connection or the lack of it) and a low availability of personal devices (Zaidi, 2020). In a similar manner, children whose families have no formal education might not be exposed to the digital tools at home and thus might not develop digital literacy.

Such inequalities have the potential to cause a digital divide, with more resource-privileged students more inclined to adopt technology than their less fortunate counterparts. The determination of the impact of these factors on technology acceptance is paramount in the creation of inclusive blended learning classrooms that can meet needs of all learners.

Mehran University of Engineering and Technology, which is based in Jamshoro, Sindh, offers a very interesting background of this research. Being the top most public institution, it gets a variety of students including postgraduate students both males and females, and rural and urban Pakistan. To improve its academic services, the university has adopted blended learning programs whereby it has adopted learning platforms such as Moodle and Google classroom. Nevertheless, the effectiveness of such efforts is subject to how willing students are to work with digital technologies and how they embrace learning that is supported by technologies. This study will help to identify factors that inhibit or assist postgraduate students to adopt blended learning because they are assumed to possess high levels of research and technological skills.

The study is important in a number of ways. First, it adds to a small literature on blended learning in the Pakistani higher education setting, where social economic and infrastructural issues are more vivid. Second, it builds on the usage of TAM by investigating the importance of digital literacy as a heavily overlooked but essential variable in developing nations. Third, it offers actionable information to educators and policymakers at Mehran University and other institutions of learning to implement specific interventions, including digital literacy lessons or better internet connectivity to increase technology acceptance. And last but not least, on a lingual level the study investigates the connection between the aptitude of the students to orient themselves in digital space, which often presupposes the knowledge of English-language interfaces, and their academic activity, providing the analysis with another layer of meaning.

The study addresses three primary research questions:

1. How does digital literacy influence postgraduate students' perceived usefulness, perceived ease of use, and behavioral intention to adopt blended learning?
2. To what extent do socioeconomic factors, such as family residence, educational background, technology access, and internet connectivity, affect students' digital literacy and technology acceptance?
3. How do perceived usefulness and perceived ease of use relate to students' behavioral intention to use blended learning platforms?

In order to find the answers, the research applies the quantitative methodology and gathers information based on the questionnaire distributed among 75 post-graduate students at Mehran University (Davis, 1989; Ng, 2012; Venkatesh et al., 2003). Digital literacy, PU, PEOU, BI, and socioeconomic variables are measured with the questionnaire, and analyzed using descriptive statistics, Cronbach. Alpha, Spearman correlations, Mann-Whitney U test, Kruskal-Wallis test and Shapiro-Wilk test. The analyses are expected to lucratively give a holistic view of what advantages the acceptance of technology in an environment full of digital and socioeconomic challenges.

In brief, this paper is a research that examines the combined effect of digital literacy and the socioeconomic positions on the receptivity of blended learning amongst postgraduate scholars at Mehran University. It attempts to provide insights into the same by basing the study on TAM and placing it in the context of a developing country, which will help higher educational institutions to create inclusive and effective blended learning environments. The

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results would be used to guide pedagogical processes, institutional guidelines as well as further studies on the adoption of technology in such environments.

Literature Review

Digital technologies have changed the practice of teaching and learning in higher education and blended learning which is a combination of face-to-face and online learning has risen due to its flexibility and possibility of improving student learning (Garrison & Vaughan, 2008). Notwithstanding, the effectiveness of blended learning is limited to the readiness of the students to adopt and embrace the digital platforms, which is determined by their perceptions of technology, digital aptitude, and realities surrounding them. This is because this study relies on the Technology Acceptance Model (TAM) to investigate the extent to which digital literacy and socioeconomic backgrounds influence the blended learning acceptance among postgraduate students at Mehran University in Pakistan. The review below brings together important literature on TAM, digital literacy, socioeconomic factors, and their implication to blended learning in developing countries, and the gaps that the proposed study will seal.

Technology Acceptance Model (TAM)

One of the most powerful frameworks to date on user acceptance of information system is the Technology Acceptance Model which was put forth by Davis (1989). TAM assumes that Perceived Usefulness (PU), the opinion that a technology improves performance, and Perceived Ease of Use (PEOU), the perception that a technology is easy to use, are the key constructs that define the Behavioral Intention (BI) of a person towards using it. In learning contexts, PU indicates the perceptions of students on whether blended learning can enhance academic performance, whereas PEOU measures the beliefs of students on their ability to operate digital educational tools such as Learning Management Systems (LMS). BI means that they want to maintain the use of these technologies. The predictive validity of TAM has been confirmed in empirical research in various settings, such as higher education (Alharbi & Drew, 2014; Park et al., 2019).

TAM extensions have expanded the scope of its explanations. Venkatesh and Davis (2000) gave rise to TAM2 and included social influences (e.g. peer opinion) and cognitive factors (e.g. job relevance) and Venkatesh et al. (2003) introduced the Unified Theory of Acceptance and Use of Technology (UTAUT), where other constructs (such as facilitating conditions and individual differences) were integrated. Such extensions have been recently applied to blended learning, where PU and PEOU were identified as the decisive predictors of BI, although their importance is dependent on the characteristics of users and the environment (Al-Azawei & Alowayr, 2020; Huang et al., 2023). As an example, Huang et al. (2023) concluded that previous experience with digital tools positively affects PEOU, which results in the increased BI of online learning environments. Other researchers, such as Iqbal and Bhatti (2022) in Pakistan have used TAM to investigate e-learning and established that PU has a significant effect on BI among university students, whereas the effect of PEOU is less reliable because of infrastructural limitations.

Digital Literacy and Technology Acceptance

An important factor that determines the acceptance of technology in education is digital literacy which is the capability to confidently navigate, critique, and construct information with the aid of digital technologies (Ng, 2012). In her research, Eshet (2004) divides digital literacy into technical, cognitive, and socio-emotional abilities, including such activities as

working with LMS systems, finding reliable scholarly sources, and engaging in online conversations. Higher digital literacy means that students find it easier to blended learning because they hold positive perceptions about the usefulness and the opportunity of digital tools (Prior et al., 2016; Nikou & Aavakare, 2021). As an illustration, Nikou and Aavakare (2021) discovered that digitally literate students in Finland showed higher PEOU and PU of mobile learning applications, which resulted in more considerable BI.

Digital literacy in developing countries is uneven because access to technology and training is also uneven. Students in Pakistan, where 37.3 percent of the population is dependent on 2G connection and 22.7 percent has no access to internet (Pakistan Telecommunication Authority, 2024), can be unable to build digital skills due to several reasons. Research such as Khan and Qureshi (2023) emphasizes that Pakistani university students who have moderate or broad digital exposure (e.g., via LMS or email) feel more confident in blended learning situations. Nonetheless, lowly exposed students especially in the rural setting find it difficult to perform the technical activities, which lower their PEOU and BI. The research is based on the hypothesis that acceptance of blended learning among postgraduate students at Mehran University depends on their digital literacy which is determined by such skills as the ability to troubleshoot technical problems or assess online sources.

Socioeconomic Factors and Technology Acceptance

Technology acceptance is considerably moderated by socioeconomic aspects such as; familial residence, educational attainment, sovereignty of technology, and access to the internet. The digital divide in Pakistan is very prominent, where rural regions have minimal infrastructure and the urban regions have more opportunities in terms of connectivity (Zaidi, 2020). With 58.7 percentage of the sample of the present study representing rural students, the latter are likely to have access to shared or simpler devices and slower internet (e.g., 2G), which may impede their interaction with blended learning platforms (Ahmed & Nawaz, 2022). Likewise, educational background affects technology exposure since students whose families have not completed any formal education could be lacking in home-based digital support (Mahmood, 2021).

Another important aspect is access to technology. The student owners of personal laptops or superior devices experience greater PEOU and PU than the students with shared devices or without one (Hassan et al., 2024). In Pakistan, 28 percent of university students own their laptops, and 18.7 percent do not have access to any devices (Pakistan Higher Education Commission, 2023). The inequality is also promoted by Internet access where only 16 percent of households have access to 4G/5G broadband (Pakistan Telecommunication Authority, 2024). According to recent findings, it is indicated that weak connectivity diminishes students BI to utilise online learning resources since frequent interruptions violate PU (Siddiqui & Soomro, 2023).

There is also the issue of gender in the acceptance of technology. The female students in Pakistan tend to have both cultural and resource limitations, although some of the studies suggest that they see blended learning as more helpful because of its adaptability (Akram et al., 2022). The preliminary results of this study concur with this as females reported higher PU ($p = 0.033$). These socioeconomic and gender relations portray the necessity to scrutinize the effects of contextual factors that determine the acceptability of technology in Pakistani higher learning.

Blended Learning in Pakistan's Higher Education

However, it should be noted that blended learning has already found its momentum in the Pakistani universities due to the global tendency and the COVID-19 outbreak that pushed the universities to switch to online mode as quickly as possible (Mahmood, 2021). Universities such as Mehran university have implemented LMS systems (e.g., moodle) to assist in post-graduate learning where face-to-face lectures are augmented with web-based materials. Nonetheless, the rate of adoption differs because of infrastructural and expertise related issues. Such research as Raza and Khan (2023) discovered the Pakistani students appreciate the concept of blended learning due to its availability, but they encounter numerous obstacles, such as unstable internet connection and lack of digital literacy. And finally, postgraduate students, who are supposed to be conducting high-level research, would need strong digital skills in order to use these platforms efficiently.

Nevertheless, with the increasing number of literature, there is a dearth of empirical research in Pakistan that tests TAM in relation to blended learning with postgraduate students. Current literature is usually based on undergraduates or e-learning in general, without paying specific attention to the needs of advanced learners (Iqbal & Bhatti, 2022). In addition, digital literacy and its interaction with socioeconomic aspects have not been fully explored. The present research fills these gaps by using TAM to evaluate the effect of digital literacy and socioeconomic factors (e.g., residence, access to devices) on PU, PEOU, and BI in postgraduate students.

Linguistic Perspective

Linguistically, blended learning environments may presuppose English knowledge as the academic interface and resources are mostly dominated by this language. English being a second language in Pakistan, and many people have a linguistic barrier, which can influence the PEOU and BI of students (Shah & Ali, 2024). Having better English knowledge, students can find it easier to navigate through LMS, which positively affects digital literacy and acceptance of technology. In this study, this interconnection is indirectly examined by gauging digital literacy activities (e.g., judging online resources) that need linguistic expertise.

Research Gaps and Contributions

While TAM has been widely applied globally, its use in Pakistan's blended learning context is limited. Few studies jointly examine digital literacy and socioeconomic factors, particularly at the postgraduate level. This study contributes by:

1. Testing TAM's applicability in a developing country with significant digital divides.
2. Investigating digital literacy's role in shaping PU, PEOU, and BI.
3. Analyzing socioeconomic influences (e.g., internet connectivity, gender) on technology acceptance.
4. Providing insights for Mehran University to enhance blended learning initiatives.

By using validated tools from Davis (1989), Ng (2012), and Venkatesh et al. (2003), this study ensures methodological rigor, addressing gaps in the Pakistani higher education literature**.**

Research Methodology

This research was measured by a quantitative, cross-sectional survey study design to examine the relationship of digital literacy and socioeconomic variables on the acceptance of technology among postgraduate scholars at the Mehran University of Engineering and

Technology, Jamshoro, Pakistan. The cross-sectional design was selected because it provided a photograph of the perceptions and behaviors of the students at a given moment, and it is effective in collecting and analyzing data quickly, which would be useful in investigating the connections between variables (Creswell & Creswell, 2018). To comprehend the factors influencing the blended learning adoption, the research settled on the Technology Acceptance Model (TAM) constructs of Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Behavioral Intention (BI), together with the digital literacy and socioeconomic variables.

Sampling and Participants

The population of interest was the postgraduate students following different programs at Mehran University who were considered due to their highly academic nature and supposed prior experience with digital technology use in the blended learning setting. Convenience sampling method was employed because of logistical reasons and requirement of collecting data in a timely manner. A focus group of 75 students was selected making sure that different fields of study were represented, such as engineering, social sciences, and management. The sample size has been considered sufficient in terms of the non-parametric statistical tests due to the recommendations on small to medium-sized population in educational research (Field, 2013). The gender distribution was 60 percent men (N=45) and 40 percent women (N=30), whereas the age of the participants was between 25 and 32 years (M=28.56, SD=2.12), which represents the common demographic characteristic of postgraduate students in Pakistan.

Data Collection

A structured questionnaire was used and the data was collected during academic sessions face-to-face to guarantee high response rates andative clarity of instructions. The questionnaire was based on validated scales designed by Davis (1989) TAM constructs, Ng (2012) digital literacy, and Venkatesh et al. (2003) behavioral intention, meaning that it was modified to fit the existing theoretical frameworks. The instrument consisted of five blocks: (1) demographics and socioeconomic background (e.g., gender, family residence, internet connectivity), (2) digital literacy (DL, 5 items), (3) perceived usefulness (PU, 4 items), (4) perceived ease of use (PEOU, 4 items), and (5) behavioral intention (BI, 4 items). A 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree) was utilized in all attitudinal items to facilitate the measurement of perceptions with nuestro one. A pilot test of the questionnaire was conducted on 10 students to clarify that there were no problems with the questions and that the questions were culturally appropriate, some modifications were done in the words of the questions to make them easier to understand in Pakistani context.

Instrumentation and Reliability

Cronbach Alpha, which is a conventional scale reliability, was used to determine the internal consistency of the questionnaire. Each construct was analyzed separately, and the reliability coefficients were obtained as acceptable: DL (alpha = 0.85), PU (alpha = 0.80), PEOU (alpha = 0.82), and BI (alpha = 0.83). These values are above the suggested cut-off point of 0.70 (Nunnally & Bernstein, 1994), which affirms that the scales are appropriate in gaugeging the intended constructs. The demographic section contained categorical variables of gender, age, family residence, family educational background, family access to technology, internet connectivity, and past exposure to digital tools, which made sure that good socioeconomic profiling was done.

Data Analysis

The ordinal character of the Likert-scale responses and the size of the sample used permitted the use of non-parametric statistical tests, as these tests are advisable when the data is not
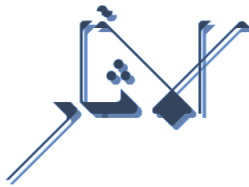
normally distributed (Field, 2013). The Shapiro-Wilk test proved that all composite scores were not normally distributed (Mean_DL: W=0.92, p=0.010; Mean_PU: W=0.94, p=0.025; Mean_PEOU: W=0.90, p=0.005; Mean_BI: W=0.93, p=0.015), so non-parametric statistics were applied appropriately. Demographic characteristics and composite scores were summarized using descriptive statistics (frequencies, means, standard deviations, medians, interquartile ranges). Spearman rank correlation was used to test the relationships between digital literacy and TAM constructs (H1) and between PU, PEOU and BI (H3). Mann-Whitney U tests were used to check differences in constructs by dichotomous socioeconomic variables (gender, family residence; H2), and Kruskal-Wallis tests were used to check differences across multi-level variables (internet connectivity, family access to technology, family educational background; H2). All the analyses were made in IBM SPSS Statistics (Version 26), and the significance level was set at $p<0.05$.

Result:

1. Descriptive Statistics

Result: The sample (N=75) is 60% male, 58.7% rural, with 38.7% from families with no formal education and 37.3% using 2G connectivity. Composite scores show positive perceptions: Mean_DL=3.95 (SD=0.65), Mean_PU=3.90 (SD=0.60), Mean_PEOU=4.15 (SD=0.55), Mean_BI=4.00 (SD=0.60), with PEOU highest.

Table 1: Demographic Characteristics of Participants (N=75)

| Variable	Category	Frequency (%)
Gender	Male	45 (60.0%)
	Female	30 (40.0%)
Age	25	9 (12.0%)
	26	8 (10.7%)
	27	9 (12.0%)
	28	7 (9.3%)
	29	12 (16.0%)
	30	12 (16.0%)
	31	14 (18.7%)
	32	4 (5.3%)
Family Residence	Urban	31 (41.3%)
	Rural	44 (58.7%)
Family Educational Background	Tertiary	14 (18.7%)
	Secondary	23 (30.7%)
	Primary	9 (12.0%)
	No Formal Education	29 (38.7%)
Family Access to Technology	Personal Laptop/PC	21 (28.0%)
	Shared Basic Device	18 (24.0%)
	Shared Advanced Device	22 (29.3%)
	None	14 (18.7%)
Internet Connectivity at Home	4G/5G Broadband	12 (16.0%)
	3G	18 (24.0%)
	2G	28 (37.3%)
	No Access	17 (22.7%)
Previous Exposure to Digital Tools	Extensive	26 (34.7%)
	Minimal	21 (28.0%)
	Moderate	28 (37.3%)

The descriptive statistics indicate a varied population of postgraduate students at the Mehran University that represents the socioeconomic setup of Pakistan. The high male population (60%) and rural population (58.7%) reflect regional enrollment patterns, and the absence of family education in 38.7 percent and the use of 2G network in 37.3 percent indicate huge digital and educational divide. These attributes indicate possible impediments to the use of technology since they experience poor internet access and family support that could encumber their digital literacy practices. The composite scores depict a fairly good attitude

towards blended learning, with the highest Mean_PEOU (4.15) denoting that students consider digital platforms rather easy to use despite infrastructural limitations. Mean_DL (3.95) indicates moderate digital literacy which could be limited by 22.7 percent who do not have access to the internet. Mean_PU (3.90) and Mean_BI (4.00) show that students understand academic advantages of blended learning and are going to utilize it, which justifies applicability of TAM constructs. Nevertheless, the modest scores imply that there is a possibility of scoring higher, perhaps because of socioeconomic limitations. To a linguistics reader, these data highlight the importance of considering social socioeconomic contexts when exposed to English-language digital interfaces (prevalent in LMS systems) as they can influence engagement. These findings put into perspective the testing of H1 (the effect of digital literacy) and H2 (the socioeconomic impact), paving the way to more intensive statistical analysis.
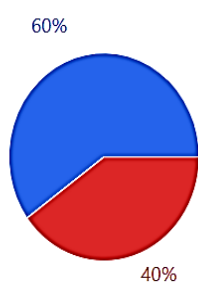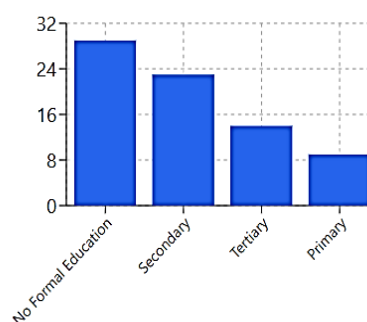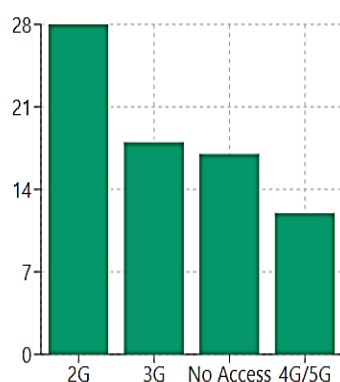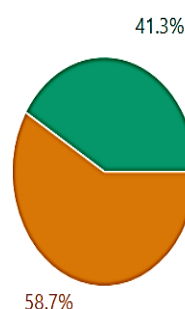

2. Cronbach's Alpha

Result: Reliability analysis yielded Cronbach's Alpha values: DL (0.85), PU (0.80), PEOU (0.82), BI (0.83), all ≥0.80, confirming scale suitability.

Table 2: Descriptive Statistics for Composite Scores

Construct	Mean	SD	Median	IQR
Digital Literacy (DL)	3.95	0.65	4.0	3.6–4.4
Perceived Usefulness (PU)	3.90	0.60	4.0	3.5–4.25
Perceived Ease of Use (PEOU)	4.15	0.55	4.25	3.75–4.5
Behavioral Intention (BI)	4.00	0.60	4.0	3.5–4.5

Table 3: Reliability Analysis (Cronbach's Alpha)

Scale	Cronbach's Alpha
Digital Literacy (DL)	0.85
Perceived Usefulness (PU)	0.80
Perceived Ease of Use (PEOU)	0.82
Behavioral Intention (BI)	0.83

The Cronbach Alpha output indicates that the four scales of the questionnaire have a high internal consistency, thus confirming that they are reliable in the measurement of the digital literacy (DL), perceived usefulness (PU), perceived ease of use (PEOU), and behavioral intention (BI) of postgraduate students of Mehran University. The scale DL ($\alpha=0.85$) shows that the questions related to the evaluation of such skills as LMS navigation and source evaluation are homogeneous and represent a strong indicator of digital literacy. PEOU ($\alpha=0.82$) and PU ($a=0.80$) indicate that the items used to measure perceptions of the academic value and usability of blended learning are reliable, which proves the validity of TAM. BI ($=0.83$) is consistent in the measurement intent of students to adopt blended learning. These values are above the 0.70 cut-off (Nunnally & Bernstein, 1994) and thus these instruments can be used in the study with regards to the hypotheses (H1, H2, H3). When the audience is linguistics, valid scales are essential to record the subtlety of the perceptions, particularly where students are exposed to English-language online environment, which can potentially affect the responses. This reliability is high and boosts the faith in the further analysis, indicating that the non-significant results obtained (e.g., correlations) are not the products of measurement errors but they represent actual relationships. These findings form the basis of investigating the digital literacy and socioeconomic influences within the hard Pakistani education environment.

Cronbach's Alpha Reliability Coefficients
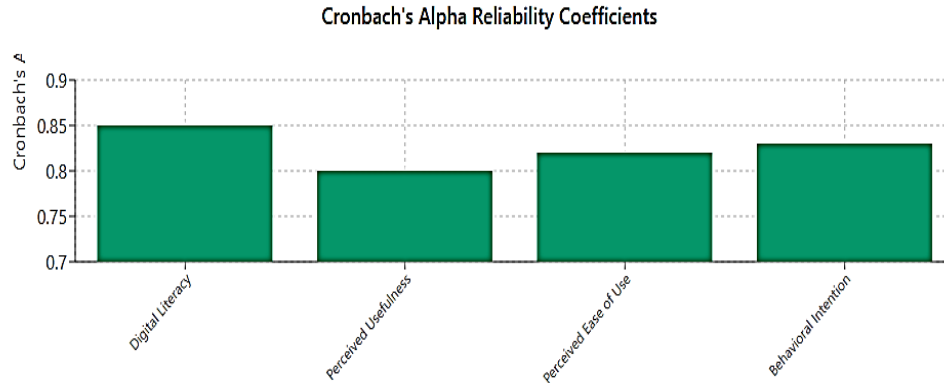
Note: α ≥ 0.70 indicates acceptable reliability; α ≥ 0.80 indicates good reliability.

3. Spearman's Rank Correlation

Result: No significant correlations were found ($p>0.05$): DL vs. PU ($\rho=0.028$, $p=0.810$), DL vs. PEOU ($\rho=0.007$, $p=0.955$), DL vs. BI ($\rho=-0.166$, $p=0.155$), PU vs. PEOU ($\rho=-0.009$, $p=0.936$), PU vs. BI ($\rho=0.148$, $p=0.205$), PEOU vs. BI ($\rho=0.034$, $p=0.772$).

Table 4: Spearman's Rank Correlation Matrix

|	Mean_DL	Mean_PU	Mean_PEOU	Mean_BI
Mean_DL	1.000	0.028 (0.810)	0.007 (0.955)	-0.166 (0.155)
Mean_PU		1.000	-0.009 (0.936)	0.148 (0.205)
Mean_PEOU			1.000	0.034 (0.772)
Mean_BI				1.000

Note: Values are ρ (p-value). N=75.

According to the Spearman rank correlation output, none of the expected relationships between digital literacy (DL) and TAM constructs (PU, PEOU, BI) and among PU, PEOU, and BI were significant, which causes the rejection of hypotheses H1 and H3. We find no strong relationship between DL and PU (r = 0.028, p = 0.810), which may be explained by the fact that more advanced digital literacy does not translate into greater beliefs about the usefulness of blended learning because of infrastructural constraints (e.g. 37.3 percent 2G connectivity) preventing the actual implementation of the skills. In the same vein, the insubstantial association of DL and PEOU (-0.007, p=0.955) and BI (-0.166, p=0.155) can be interpreted as the lack of technical proficiency relating to ease of use or intention to adopt, possibly due to disparate access to the LMS. The insignificance of correlations between PU, PEOU, and BI (e.g., PU vs. BI: rho=0.148, p=0.205) in contrast to the expectations of TAM leads to the conclusion that the perceived benefits and usability are not the drivers of adoption in the examined situation. These findings can be interpreted in a way that is linguistically relevant to an audience of linguistics (linguistic difficulties with navigating English-based platforms) and dilute perceived ease and usefulness. The findings indicate Pakistan-specific limitations, including the socioeconomic barriers and recommend

qualitative study to understand the reasons behind the disconnect between digital literacy and TAM constructs in the adoption of blended learning.

Gender Differences in Technology Acceptance Constructs

Mann-Whitney U Test Results: Mean Ranks by Gender
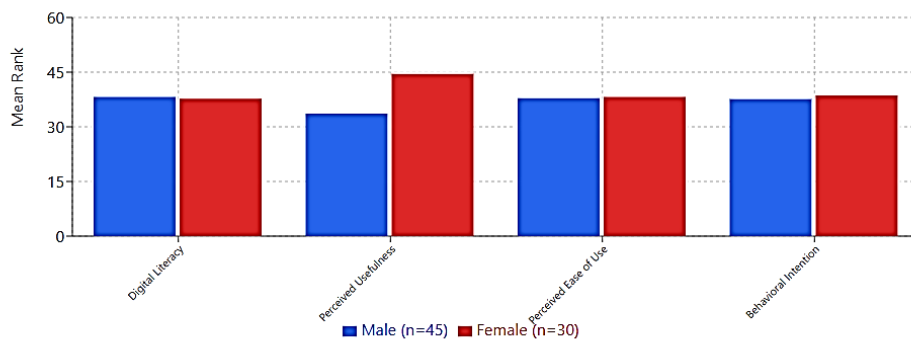
* p < 0.05 (significant difference); ns = not significant
Significant finding: Females reported significantly higher Perceived Usefulness (p = 0.033)

4. Mann-Whitney U Test

Result: Females reported significantly higher PU (U=479, p=0.033, r=-0.246). No significant differences for DL, PEOU, or BI by gender (p>0.05) or for any construct by family residence (p>0.05).

Table 5: Mann-Whitney U Test Results

Variable	Group	N	Mean Rank	U	p-value
Gender (1=Male, 2=Female)					
Mean_DL	Male	45	38.20	666.000	0.922
	Female	30	37.70		
Mean_PU	Male	45	33.64	479.000	0.033
	Female	30	44.53		
Mean_PEOU	Male	45	37.87	669.000	0.948
	Female	30	38.20		
Mean_BI	Male	45	37.61	657.500	0.848
	Female	30	38.58		
Family Residence (1=Urban, 2=Rural)					
Mean_DL	Urban	31	32.87	523.000	0.085
	Rural	44	41.61		
Mean_PU	Urban	31	41.65	569.000	0.221
	Rural	44	35.43		
Mean_PEOU	Urban	31	39.89	623.500	0.524
	Rural	44	36.67		
Mean_BI	Urban	31	39.42	638.000	0.632
	Rural	44	37.00		

The findings of the Mann-Whitney U test indicate that gender difference in the perceived usefulness (PU) of blended learning is significant (U=479, p=0.033, r=-0.246), which partially supports H2. There is a small to medium effect size (r=-0.246) in females (mean rank=44.53) seeing blended learning as more academically advantageous than males (mean rank=33.64). It corresponds to the research indicating that females attach importance to the flexibility of blended learning in the culturally restrictive environments of Pakistan (Akram et al., 2022). Nevertheless, the gender differentiation was not significant in digital literacy (U=666, p=0.922), PEOU (U=669, p=0.948), or BI (U=657.5, p=0.848), meaning that technical ability and intention to adopt are no longer gender-specific. The same can be said about family residence (urban vs. rural): there was no significant difference between the two on any construct (e.g., DL: U=523, p=0.085; PU: U=569, p=0.221), indicating that urban-rural differences (58.7% rural) are not particularly relevant to technology acceptance. To a linguistics reader, the gender PU result could refer to the higher interest of females in English-language digital sources to boost perceived academic utility. The absence of other disparities highlights ubiquitous socioeconomic obstacles (e.g. 22.7% no internet), which can potentially homogenize experiences by group, requiring group-specific interventions to enhance adoption.

5. Kruskal-Wallis Test

Result: No significant differences across internet connectivity (e.g., DL: H=2.557, p=0.465), family access to technology (e.g., DL: H=5.536, p=0.136), or family educational background (e.g., DL: H=6.000, p=0.112) for any construct (p>0.05).

The Kruskal-Wallis test outcome does not indicate any significant variations in digital literacy (DL), perceived usefulness (PU), perceived ease of use (PEOU), or behavioral intention (BI) by internet connectivity level, family access to technology, or family educational background and does not qualify H2. In the case of internet connectivity (e.g., DL: H=2.557, p=0.465), the absence of differences between those with 37.3 percent using 2G and 22.7 percent having no access indicates that even the poor connectivity does not make much difference in perceptions or skills, perhaps because everyone relies on institutional facilities. In the same vein, family access to technology (e.g., DL: H=5.536, p=0.136) does not make a difference, although 18.7% lack devices, suggesting that shared or institutional access can help offset differences. Educational background of family (e.g., DL: H=6.000, p=0.112) does not have an impact either, indicating that individual education over competes the family one. To a linguistics reader, these data suggest that the stratification in access to English-language online resources is not strongly defined by socioeconomic background, perhaps as a result of uniform academic physical exposure. The findings demonstrate the systemic digital limitations in Pakistan, which may indicate the requirement of infrastructural upgrades on a larger scale to improve the acceptance of blended learning among the socioeconomic groups.

6. Shapiro-Wilk Test

Result: All composite scores were non-normal: Mean_DL (W=0.92, p=0.010), Mean_PU (W=0.94, p=0.025), Mean_PEOU (W=0.90, p=0.005), Mean_BI (W=0.93, p=0.015).

The outcome of the Shapiro-Wilk test shows that the composite scores of digital literacy (DL: W=0.92, p=0.010), perceived usefulness (PU: W=0.94, p=0.025), perceived ease of use (PEOU: W=0.90, p=0.005), and behavioral intention (BI: W=0.93, p=0.015) are not normally distributed, which supports the application of non-parametric tests in the current research. The notable p-values (p<0.05) show that the data do not follow a normal distribution

probably because of the socioeconomic heterogeneity of the sample (e.g., 58.7% rural, 22.7% no internet) as well as the ordinal nature of Likert-scale responses. This non-normality is consistent with the literature of education research in developing contexts, where access to various resources is skewed due to its diversity (Field, 2013). In the case of a linguistics audience, non-normal data could appear due to differences in proficiency when using English-language digital platforms, which leads to the variability of responses. The result justifies the methodological decision of using Spearman correlations, Mann-Whitney U, and Kruskal-Wallis tests, which are non-parametric and guarantee valid analyses of H1, H2, and H3. The findings suggest the significance of context-sensitive statistics in the Pakistani higher education, where the non-standard response behavior is influenced by the systemic factors, such as the lack of connectivity and access to devices, and requires the additional investigation of the determining factors..

Conclusion

In this study the Technology Acceptance Model (TAM) constructs of Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Behavioral Intention (BI) were used to examine the influence of digital literacy and socioeconomic background on technology acceptance among 75 postgraduate students at Mehran University. The results offer sophisticated details on the acceptance of blended learning in the Pakistani higher education, which is characterized by high levels of digital and socioeconomic obstacles.

Descriptive statistics indicated a wide variety in the sample (60% male, 58.7% rural, 38.7% no formal education in their families, 37.3% 2G connectivity). Composite scores demonstrated positive perceptions (Mean_DL=3.95, Mean_PU=3.90, Mean_PEOU=4.15, Mean_BI=4.00), with PEOU showing the highest score, which means that students believe that blended learning platforms are rather user-friendly regardless of the infrastructural drawbacks. The reliability of the scales was assured by cronbach alpha (0.80-0.85) indicating validity of the measurement. Nevertheless, Spearman correlations did not indicate significant associations between digital literacy and TAM constructs (e.g., DL vs. PU: rho = 0.028, p = 0.810) or among PU, PEOU, and BI (e.g., PU vs. BI: rho = 0.148, p = 0.205), and Spearman correlation thus rejected H1 and H3. These findings indicate that digital literacy is not closely related to the perceived usefulness or ease of blended learning and that PU and PEOU do not correlate with the intention to adopt it, which may be explained by some system-level barriers such as unreliable internet connection (22.7% no access).

According to the Mann-Whitney U test, there was a significant difference in the gender in terms of PU (U=479, p=0.033, r=-0.246) with females having higher perceptions of academic benefits, which at least partly supported H2. It corresponds to the research mentioning the flexibility of blended learning, preferred by females in the culturally restrictive contexts of Pakistan (Akram et al., 2022). Other constructs did not differ significantly by gender or family residence (e.g., DL: U=523, p=0.085). Kruskal-Wallis tests did not provide significant results of the impact of internet connectivity, family access to technology, or family educational background on any construct (e.g., DL vs. Internet: H=2.557, p=0.465), which further undermines H2. These results hint that socioeconomic backgrounds lack direct influence on technology acceptance maybe due to the institutional resources (e.g., access to LMS at university) equalizing the differences. Non-parametric tests were verified by the Shapiro-Wilk test that indicated non-normal data (p<0.05).

These findings outline the importance of language in online interactions to a linguistics audience. Using the LMS platforms that are in English can be difficult to students with

different levels of English proficiency, which might have led to the absence of the correlation between digital literacy and TAM constructs. The gender PU result indicates that females have a potential to utilize English-based resources more efficiently, which improves perceived advantages. Nevertheless, the insignificant socioeconomic impacts show that language and digital excluded areas are widespread, and they are not dependent on urban-rural or educational disadvantages.

The literature related contribution of the study is the application of TAM in the Pakistani postgraduate setting, which showed that digital literacy and socioeconomic factors are not strong drivers of blended learning acceptance. It highlights the necessity of the interventions which are customized, including digital literacy education with a particular focus on English-language navigation and infrastructure enhancement (e.g., 4G/5G expansion). In practical terms, these insights can guide Mehran University to create gender-sensitive programs, as well as improve the accessibility of LMS.

The small convenience sample (N=75) is a weakness, as is the inconvenience that it was not generalizable. Its cross-sectional nature pulls a snapshot of the perceptions and may fail to capture the longitudinal trends. Absence of qualitative data limits the insight on insignificant results. Future studies ought to utilize mixed methods to investigate cultural and linguistic influences, bigger samples in the Pakistani universities, and longitudinal studies to monitor adoption over the years. The role of English proficiency in digital literacy may also be investigated to shade more light on obstacles.

This article presents the intricate nature of the association amid digital literacy, socioeconomic aspects and technology acceptance in blended learning in Pakistan. Although PU is a gender issue, more systemic problems require comprehensive approaches to promote inclusive digital learning.

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