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RESEARCH PAPER

Ubiquitous Learning in Higher Education in Pakistan: The Usage, and Acceptance

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ABSTRACT

This study aims to investigate the determinants of the use and acceptance of ubiquitous learning in higher education in Pakistan, offering lessons on how to overcome challenges to improve its use. The integration of ubiquitous learning within institutions of higher learning is challenged by considerable hurdles, especially in developing countries. The study utilized a cluster sampling technique to select participants from public sector universities in Pakistan. Data was collected through an online questionnaire of a seven-point Likert scale to measure responses. The insights from correlation and regression analyses revealed that contextual awareness, hedonic motivation, personal innovativeness, and self-directed learning have significant influences on ubiquitous learning technology acceptance in higher educational institutions in Pakistan. The study proposes enhancing contextual awareness by making digital content suitable to students' needs and increasing hedonic motivation through interactive, intuitive interfaces. Building up personal innovativeness and self-initiated learning through structured facilitation to improve ubiquitous learning technology adoption.

KEYWORDS Learning, Ubiquitous Learning, Self-Directed Learning, Pervasive Learning, Ubiquitous Learning Acceptance

Introduction

The advent of a connected society is a consequence of globalization and converted our world into a cohesive and interlinked community. The rising significance of technological improvements in the global environment has expedited progress and transformation from any historical viewpoint of human development. The advancement of technology has ushered in the digital era, facilitating swift communication via information and ICT.

The 21st century is referred to as the age of digital learning. Higher educational institutions have undergone significant transformation due to information and communication technologies and social flexibility to rapid changes (Ahmed, Burdi, & Abbasi, 2024).

Ubiquitous Learning Technologies

Ubiquitous technologies denote the use of technology in the educational process to give continuous, widespread, and accessible learning experiences for students. It entails the utilization of sophisticated technical instruments and platforms to assess students' performance, facilitating seamless interaction among the learners and educational resources.

Figure. 1 Ubiquitous Learning Technologies Infrastructure

Additionally, ubiquitous learning technology involves students learning processes, involving data collection and digital tools to enhance the learning experiences. It is increasingly important in education, particularly through smart classroom technology, as it provides an efficient and cost-effective transformation of knowledge delivery, enhancing the overall learning experience (Rapaka et al., 2025).

Pervasive learning a form of ubiquitous learning not only assesses factual knowledge but also evaluates students' competence levels and decision-making processes (Arif, Nugroho, Aini, Fauzan, & Garcia, 2024). The use of such systems enables immediate grading, and prompt feedback, and can eliminate issues of privacy concerns, while significantly reducing time-consuming and monotonous tasks. Pervasive learning technology, such as online assessments and smart classroom tools, incorporates select-response tests (e.g., multiple-choice questions) that can be marked instantly, promoting engagement and allowing for the evaluation of various question types. These systems ensure the quicker announcement of exam results and make assessment more dynamic and interactive. Additionally, it allows for the preservation and recording of teaching and learning activities (e.g., video and audio recordings), which can help educators reflect on their teaching gaps and assist students in reviewing past lessons (Arif et al., 2024). The COVID-19 pandemic caused the cessation of conventional educational activities in various countries, prompting a rapid transition from in-person learning to online formats, which gained pervasive learning acceptance as a viable option for ongoing education. Digital assessment or wireless communication is a unique learner assessment tool in higher educational institutions in Pakistan, providing digital education and accessibility. It was vital during the COVID-19 pandemic to complement digital learning during the COVID-19 pandemic. During the pandemic, the Higher Education Commission in Pakistan emphasized the importance of implementing pervasive learning technologies to ensure connectivity and access to learning resources, urging higher educational institutions to accept and use the pervasive learning setting for educational continuity and safety.

Pervasive learning has profoundly altered the delivery of information, particularly for younger generations. The incorporation of Ubiquitous learning into higher education poses considerable obstacles, especially in developing countries. This research aims to examine the factors affecting the efficacy and determinants of Ubiquitous learning initiatives, offering practical insights and techniques to assist higher education institutions in navigating hurdles and effectively implementing Ubiquitous learning environments.

Literature Review

The utilization of ubiquitous learning technologies in research includes digital evaluation, online assessment, and wireless assessment. These resources enhance student engagement in interactive educational environments, increasing their participation. (Hassan, Abd Rahman, & Sumintono, 2024) indicated that the COVID-19 epidemic has posed challenges for higher education institutions around the world, prompting universities and colleges to forgo in-person learning methods in favor of internet-based approaches for evaluating the performance of students. Furthermore, his study examines students' use and acceptance of Ubiquitous learning tools during a pandemic. (Mulyani, Istiaq, Shauki, Kurniati, & Arlinda, 2025) assert that higher education institutions in Pakistan employ e-learning, m-learning, and ubiquitous technology. Undergraduate and postgraduate students were assessed regarding the nation's digital education system and their intentions to employ ubiquitous technology. Ubiquitous learning environments assess students' abilities and learning preferences in an online setting. In underprivileged nations, these measures can assist students in achieving their education cost-effectively (Amah & Okesipe, 2024).

The government may improve the digital assessment process by fostering widespread learning literacy, which depends on the technology environment and user proficiency, as assessment encompasses several methods for gathering data on students' performance and academic advancement. This research examines how the use of technical tools might optimize the grading process, therefore conserving time and minimizing expenses. It delineates the student's intent regarding these tools, emphasizing factors such as contextual awareness, self-directed learning, personal innovativeness, hedonic motivation, and the inclination to use ubiquitous learning technology.

Context awareness

Context awareness in technology refers to its ability to comprehend and address users' educational requirements. Technology integration in educational institutions must be fluid to enable students to utilize the system in alignment with their context and learning objectives without significant obstacles (Biegel & Cahill, 2004; Mateos & Bellogín, 2024). Comprehending students' requirements enhances contextual awareness in education. This study demonstrates that system alignment and responsiveness to the user's environment significantly influence the usage of learning technologies. Context-aware systems enhance efficiency and usability (González-Moreira, Ferreira, & Vidal, 2025)

Self-directed learning

Self-directed learning is an educational methodology in which learners assess their needs, establish objectives, discover resources, and evaluate results. The significance of pervasive technology is evident, as learners view these tools as means to work autonomously and interact with knowledge at their speed (Abdul Rahim Chandio, 2023).

Hedonic Motivation

Hedonic motivation, defined as the pleasure derived from technology use, significantly influences technological acceptance and serves as a predictor of a customer's

likelihood to engage with it. This concept, similar to perceived satisfaction, has been demonstrated to positively affect the adoption and utilization of omnipresent education.

Personal innovativeness

The capacity to experiment with novel information technologies is essential for individuals to adopt new technology, a capacity referred to as personal innovativeness (Zlatanović, Nikolić, Potočan, & Erić Nielsen, 2024). Individuals exhibiting high levels of personal innovation are more inclined to engage in risk-taking, thereby affecting their behavior and responsiveness to new technologies (Long, Wu, Ye, & Wang, 2025).

Moreover, thorough data analysis employing the UTAUT2, which includes context awareness, self-directed learning, hedonic motivation, and personal innovativeness, has shown that distinct factors significantly affect the intention to embrace u-learning in the 21st century. Realizing the efficiency needs of digital education Proficient understanding of information technology systems.

Material and Methods

Population and Sample

The target audience for the study includes students studying in the public sector higher educational Institutions of Pakistan. Furthermore, the Survey focuses on individual students with proficiency in ubiquitous learning technologies. Participants were selected using a cluster sampling method.

Data Collection Procedure and Instrument

Developed a Google Form online and distributed the link to participant educators via their contact numbers and email addresses. Students from public universities offered perspectives on multiple facets regarding the application of ULT technologies.

The research adhered to ethical standards throughout the study. The survey included the study's aims and methodologies for executing the research. This also included their rights as respondents, such as the option to withdraw at any point during the survey, along with the confidentiality and privacy of their responses ("Guidelines for Research Ethics in the Social Sciences and the Humanities," 2022).

Data Analysis

This research seeks to elucidate the motivations of digital assessment users during the COVID-19 pandemic, concentrating on individuals who utilize information technology for educational objectives. It aims to clarify the experiences of internet-based educational users in submitting their online assessments and evaluations (Viswanath Venkatesh, Michael G. Morris, Gordon B. Davis, & Fred D. Davis, 2003). A seven-point Likert scale was used for data collection in this survey. This survey used a Likert scale to collect data. The seven-point Likert Scale ranges from intense Disagree (1) to Strongly Agree (7). Correlation and regression analysis have been used to evaluate the validity of a theory.

Theoretical Approach

The study developed a framework based on UTAUT2 and TAM2 for evaluating technology users' intentions through digital evaluations. Moreover, the proposed structure is based on theoretical architecture and the literature from numerous studies. According to (Tang, Yuan, & Qu, 2025), the TAM2 model contains several variables derived from the intention of U- learning.

Theoretical Research Model

For this study the research proposed model is based on different major theories such as the theory of reasoned action, the extended unified theory of the technology acceptance model, and the extended technology acceptance theory. Furthermore, the research study factors such as hedonic motivation, context awareness, and self-directed learning, are derived from the unified theory of technology and acceptance model and hypothesized that the pervasive learning technologies would be affected by the personal innovativeness and self-directed learning from the extended technology acceptance model and theory of reasoned action.

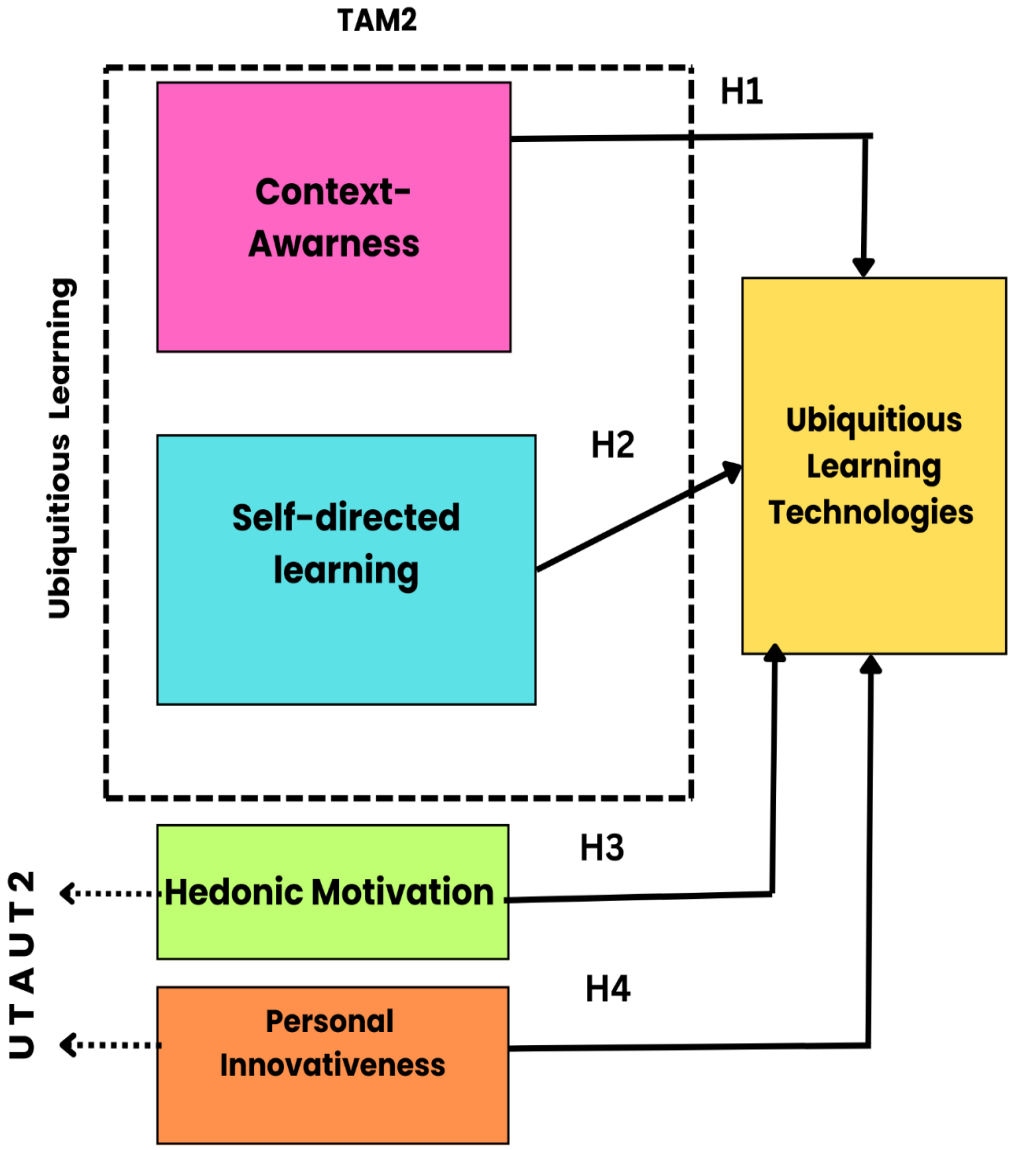

Figure. 2 Proposed conceptual model

Hypotheses

Hypothesis 1: Context awareness will have a significant positive effect on Ubiquitous learning technologies

Hypothesis 2: Hedonic Motivation will have a significant positive effect on Ubiquitous learning technologies

Hypothesis 3: Self-directed learning will have a significant positive effect on Ubiquitous learning technologies

Hypothesis 4: Personal innovativeness will have a significant positive effect on Ubiquitous learning technologies.

Results

This study includes quantitative, cross-sectional online survey research. All hypotheses demonstrate a favorable connection between independent and dependent variables. Contextual awareness, hedonic motivation, personal innovativeness, and self-directed learning have a favorable correlation with the demand for digital assessment. This research used data from the public institutions of Sindh: Quaid-e-Awam University of Engineering, Science and Technology, Nawabshah Liaquat University of Medical & Health Sciences, Jamshoro, and the University of Karachi, Karachi. This study investigates the intentions of digital assessment users during the COVID-19 pandemic, with an emphasis on educational technology users. It analyses how electronic learning participants do online examinations and assessments. Data is gathered via a seven-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (7). The validity of a theory is evaluated by correlation and regression analysis.

Table 1
Demographic characteristics (n=301)

Variables	Description	Frequency	Percentage
Gender	Male	158	52.5%
	Female	143	47.5%
Age	21-30	140	46.5%
	31-40	161	53.5%
Education	Master/Bachelor	173	57.5%
	M.Phil./ Ph.D.	128	42.5%

Table 2
Descriptive analysis statistics of items

Item Code	Item	Mean	SD
CA1	I can receive useful information at the right time	5.4850	1.77124
CA2	I can receive appropriate information and services relative to my current location	5.3223	1.79048
CA3	I can receive contextual information that reflects my current situation.	5.4186	1.85765
HM1:	Using Pervasive Learning Technology is pleasurable.	5.8339	1.32123
HM2:	Using Pervasive Learning Technology is enjoyable.	5.8073	1.36482
HM3:	Using Pervasive Learning is entertaining.	5.6711	1.41943
SDL 1	I make my study plan for using pervasive learning.	5.8738	1.49354
SDL 2	I seek help when faced with Pervasive learning problems.	5.6877	1.42670
SDL 3	I manage my time well while using pervasive learning.	5.7774	1.16631
SDL 3:	I have set my Pervasive learning goals.	5.8605	1.22493
SDL 4:	I have set my Pervasive learning goals.	5.8605	1.22493
SDL 5:	I have high expectations for my Pervasive learning performance.	5.9701	1.12061
PI 1:	If I heard about a new information technology, I would look for ways to experiment with it.	5.5349	1.37947
PI 2:	In general, I am enthusiastic to try out Pervasive learning	5.1561	1.76603
PI 3:	In general, I am enthusiastic to try out Pervasive learning	4.9701	1.83006
ULT1:	I intend to use Pervasive Learning in the future	5.9535	1.36790
ULT 1:	I predict I will use Pervasive Learning in the future	6.2060	1.20724
ULT 1:	I plan to use Pervasive Learning in the future	6.1130	1.31929
ULT 1:	I would recommend Pervasive Learning to my colleagues	6.0664	1.29444

Hypothesis Testing

The hypotheses of the study were tested using regression and correlation analysis.

Table 3
Regression and correlation analysis statistics

HH. No.	Path relation	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
H1	**CA -> ULT**	-0.243	-0.230	0.075	3.256	**0.001**	**Accepted**
H3	**SL -> ULT**	0.363	0.356	0.061	5.984	**0.000**	**Accepted**
H4	**PI -> ULT**	-0.244	-0.229	0.075	3.256	**0.001**	**Accepted**
H5	**HM -> ULT**	0.246	0.235	0.064	3.823	**0.000**	**Accepted**

Significance at level of t-value =2.57 ***p<0.001 and t-value =1.96** p<0.05

In this research, 301 respondents provided feedback that contributed to the empirical study. The majority of students endorsed the implementation of ubiquitous assessment, and this study seeks to explore the cross-section that is advised for a longitudinal study to reinterpret users' intentions due to the dynamic nature of human behavior. The current study indicates that all proposed factors were supported and advises researchers to broaden the limitations and scope of research at the national level in Pakistan to elucidate technology users' intentions to use online assessments. Furthermore, parental involvement and public participation in the forthcoming investigation of electronic learning in the education sector must be incorporated, necessitating an expansion of the study's scope.

Discussion

This study's findings provide significant insights into the determinants affecting the acceptance of ubiquitous learning technologies in higher education institutions in Pakistan. The analysis utilized a sample of three hundred and one participants, offering a thorough examination of the demographic attributes and the principal factors influencing the acceptance of Ubiquitous Learning Technologies.

Hypothesis 1: CA has a significant influence on the acceptance and usage of ULT

The results indicate that (CA) is positive and significantly affects the acceptance and usage of Ubiquitous Learning Technologies (ULT) in higher educational institutions in Pakistan, as shown by a path coefficient of 0. 217. Moreover, participants are more likely to use and accept the U-learning in HEI in Pakistan. Additionally, the information provided is related to their current context. However, this study indicated the importance of confirming that the information distributed via P-learning apparatuses is appropriate for the students' present educational situation.

Hypothesis 2: HM has a significant influence on the acceptance and usage of ULT

It has a significant influence on the acceptance and use of U-learning technologies in higher educational institutions in Pakistan, as demonstrated by a path coefficient is 0.471. Moreover, the findings indicate that students are more likely to use ubiquitous learning tools when the experience is enjoyable and pleasurable. This emotional satisfaction is a key motivator for ongoing engagement and use of pervasive learning technologies.

Hypthesis-3: PI has a positive significant effect on User Behavior Intention.

This hypothesis indicates positivity between PI and BI with the parameter signs. The path coefficient is 0.001, with a standard deviation of 0.075. At a significance level of < 0.05, with a t-value of 3.256, the path estimates exceed the threshold of 1.96, signifying their significance. Therefore, the result of PI is positively supported. The findings of this study reveal that PI has a significant impact on BI regarding the acceptance and utilization of PL in higher education institutions (HEIs) in Pakistan. An increase in PI will positively influence practitioners in HEIs in Pakistan to accept and use ULT.

Hypothesis 4: SDL has a positive and statistically significant impact on the acceptance and usage of ULT

Self-Directed Learning (SDL) significantly impacts the acceptance of ubiquitous learning, evidenced by a path coefficient of 0.530. The research indicates that students who actively manage their learning by establishing goals, organizing plans, and soliciting assistance when necessary are more inclined to utilize ubiquitous learning technologies. This indicates that cultivating self-directed learning behaviors is essential for enhancing the effective utilization of ubiquitous learning tools.

Conclusion

Ubiquitous Learning Technology and Its Impact on Students' Learning

Ubiquitous learning technology refers to the integration of digital tools and platforms into the learning process, which gained considerable significance during the COVID-19 pandemic and lockdown in Pakistan. The outcomes of pervasive learning technology are shaped primarily by students' perceptions of their learning experiences, facilitated through information and communication technologies and the internet.

However, challenges such as inconsistencies in the education system and insufficient investment in technology impact the widespread adoption and effective use of pervasive learning tools. In Pakistan, students need to develop a deeper understanding of information technology, with IT courses becoming a compulsory part of each discipline, to meet the requirements of the digital learning environment. This would help boost overall technology literacy among students and ensure they are equipped for the evolving educational landscape.

Students must adopt and use ubiquitous learning technologies to assess their education and fulfill online learning criteria. This transition is essential not only during the epidemic lockdown but also to equip students for future disruptions. Predictable educational approaches, including natural disasters or crises.

Recommendations

Higher educational institutions should initiate educational initiatives that emphasize the significance of context awareness in the application of U-learning technologies within Pakistan's higher education sector. Students must cultivate the necessary skills to create and interact with contextually relevant educational resources, ensuring that pervasive learning technologies meet the specific needs and contexts of learners.

Educational institutions must prioritize emotional satisfaction with ubiquitous learning tools and equipment. Additionally, enhances learners' satisfaction with the technologies obviously and adopt, use, and engage with them.

It must prioritize SDL performances due to their noteworthy impact on the use of ubiquitous learning tools and give proper resources to aid students in setting goals,

managing time, and obtaining assistance. By imparting SDL skills, institutions can equip students to utilize pervasive learning technologies and assume responsibility for their education.

Facilitate resources and infrastructure for the incorporation of ubiquitous learning technologies into educational curricula. Faculty training and student access to devices and dependable internet are incorporated. Policies facilitating the extensive implementation of ULT in education are imperative.

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