

The Effectiveness of Personalized Learning Paths in Higher Education

Saira Khurram

Roots IVY Educational Complex, Faisalabad

Haleema Adnan

haleema.adnan@uow.edu.pk

Lecturer Department of Psychology, University of Wah

Muhammad Farhan

mfarkhan@hse.edu.ru

Master's in Regional and Global History, Department of History, National Research University – Higher School of Economics, Saint Petersburg, Russia

Mamoona Anam

Assistant Professor Department of Computing international Islamic university Islamabad

Kamran Mujahid

kamran.mujahid@umt.edu.pk

University Management Offices, University of Management & Technology, Lahore

Corresponding Author: *Haleema Adnan haleema.adnan@uow.edu.pk

Received: 11-07-2025	Revised: 25-08-2025	Accepted: 12-09-2025	Published: 28-09-2025
-----------------------------	----------------------------	-----------------------------	------------------------------

ABSTRACT

This research examined the impact of personalized learning paths within a higher education setting in Pakistan. It employed a mixed-methods approach in three prestigious universities located in the provinces of Punjab, Sindh, and Khyber Pakhtunkhwa. The sample frame comprised 450 undergraduate students studying computer science, business administration and engineering. The study utilized a quasi-experimental design which involved the use of personalized learning experiences for 225 of the students, while the other 225 experienced conventional methods of teaching. Over the duration of one academic semester, students were assessed and measured based on pre-assessment and post-assessment tests. Surveys regarding students' engagement, academic performance records, and 30 faculty interviews were also utilized. The quantitative data were analyzed using means, standard deviations, t-test and ANOVA through SPSS, while the qualitative data were analyzed through thematic analysis and pattern coding. The findings showed that students using personalized learning paths demonstrated greater improvement in their learning outcomes. The averages expressed a change from 65.4 to 78.2 while the control group increased only from 64.8 to 69.1. There was a significant increase in student engagement, and from a series of faculty interviews there were a number of challenges to operationalizing the strategy, however which were more than compensated by the positives to implementing it. The study concludes that despite technological, sociocultural, and other challenges, personalized learning facilitates students' seamless engagement and increased academic performance in higher education in Pakistan. The implications are important for educators and institutions wishing to incorporate adaptive learning systems.

Keywords: Effectiveness, personalized, learning paths, of higher education, Pakistan.

INTRODUCTION

Regular observations in the area of pedagogy have brought the concept of a complete re-design of the current educational model to our attention. This re-design can be attributed to the adoption of modern pedagogical approaches rather than the sole implementation of technology. The reason for this shift is based on the premise that the purpose of education should be focused on improving knowledge retention on the part of learners rather than the framework of having a prescribed module to complete in the dignity that it has been foretold. In light of this shift, learner-centric educational approaches have emerged (Basic, Lokareva et al. 2021). These methods provide opportunities in educational experiences that rely on automated and self-directed methods to freeing learning from conventional teaching and learning practices (Rasool, Qian et al., 2022). The basic principle of this learner centered approach is in accommodating the diverse learning needs of learners through the chosen pedagogical forms, cognitive levels, and faculties individuals possess. This is how we arrive at the notion of personalized learning. The notion that for each learner differential in terms of the learning outcomes they can achieve; provided the teaching, learning, and assessment strategies are accessible and adjust to their learning style (Shah and Campus 2021). Across the globe, and for that matter, particularly among developed mechanized countries and equipped with the trained human capital-strike and resources required, the idea of personalized learning has gained attention (Terzieva, Ivanova et al. 2025). In a country like Pakistan, pedagogical personalization is not simply challenging, but a Herculean undertaking given the lack of mechanization, resources, the cultural context, and more importantly, the different proficiencies of the students, and faculty in terms of digital competencies. However, despite all the challenges, higher education institutions in Pakistan are increasingly recognizing the need to not only understand, but embrace the diversity of their students as a means of personalizing the learning experience relative to what is being learned (Bratovic 2025).

The rise of the internet and computer technology in Pakistan shows there is an opportunity to develop and provide personalized learning for higher education students (Aslam, Aslam et al. 2025). The substantially higher penetration of education technologies with learning management systems, as well as adaptive learning systems, has improved the instructors' ability to teach university courses creatively. The new teaching approaches should nevertheless incorporate the existing local cultural socio-economic conditions and the indicators of the institution's capacity (Pasha 2022).

There are various international systems that have reported on the impacts of personalized learning approaches for learners. However, there is a gap in the literature when it comes to specifically providing personalized approaches in the higher education field in Pakistan. This gap in the literature is needed to provide situational analysis to inform policy for planning, strategies, and even faculty development at the institutional level, which is neglected in this case. In recognition of the significance of the gap of the literature in Pakistan's knowledge base, this is the justification for this study to cast light on personalized learning systems in higher education in Pakistan (Khan 2023).

Pakistani higher education aims to serve a vastly and highly diverse body of students who have a range of socio-economics and contrasting over education process, and levels of education and learning (Saqlain and Shahid 2024). The students represent a culture and civilization are from urban and rural geography, and study in universities across the country. The large education and learning process, together with the ability to speak a rich language, poses an immense challenge to the personalization of the education process designed in the country (Saqlain and Shahid 2024).

Using teaching practices which entail very limited differentiation, resulting from the one way approach caused many students to disengage in the universities of Pakistan. The lack of full time educators, coupled with high student to educator ratio, normalized approach to group testing, and a absence of scaffolding

prohibit mastery, individualized feedback, support, individualized instruction, and mastering the skills desired in the course. Thus students, after the course, do not possess the skills to perform the job function for which they were trained leading to the reasons for high dropout rates, level of dissatisfaction, and not preparing students with employable skills (Nasir, Khan et al. 2025).

The rise of computer and internet technology in Pakistan suggests that there is capacity for creating and implementing customized learning in higher education (Aslam, Aslam et al. 2025). Significantly greater penetration of educational technologies along with learning management systems (LMS), and adaptive learning systems (ALS) has improved the instructor's ability to teach university courses in new ways. However, new methods of delivery should be integrated with local cultural socio-economic conditions and the institution's capabilities (Pasha 2022).

Numerous international settings have published results on the impact of personalized learning strategies on learners. However, there is a lack of literature on the implementation of such strategies in higher education pedagogy in Pakistan. This lack in the literature is warranted for a situational analysis in order to inform a policy for institutional faculty development and a plan or strategy, which has in fact, been neglected in this case; in accordance with its importance, and acknowledging this gap in the knowledge-base context in Pakistan, this is precisely the reason for undertaking this study; to shed light on personalized learning systems in higher education pedagogy, in Pakistan (Khan 2023).

Similar to many other countries, the start of the COVID-19 pandemic acted as an unexpected catalyst for many tertiary education institutions in Pakistan (Khamis, Naseem et al. 2021). The necessity to move almost all teaching and learning activities to digital space demanded the rapid adoption and integration of many digital and online tools and resources which were previously available but underutilized (Aslam, Aslam et al. 2025). This allowed the development of a unique, 'live' context for the designing and implementation of personalized teaching and learning. The rapid transition to the digital and blended learning environment surfaced the true promise of educational technology, and many of the challenges and barriers to the incorporation of technology into education made the case for this research important and warranted (Rafiq, Batool et al. 2021).

The practical implications of this study will address the gaps uncovered in the higher education system of Pakistan. The issues of education quality, student satisfaction and learning outcomes of the educational institutes in Pakistan is documented. The research on personalized learning will benefit the institutes, policymakers and advocates of educational technology and personalized learning in the country.

Research Objectives

To assess the effects of personalized learning modules on the academic success and learning achievements of undergraduate students in universities in Pakistan within the context of alternative modes of instructional tailoring.

To measure the students' motivation, engagement, and satisfaction levels relating to personalized learning pathways, as compared with traditional pedagogy in the higher education context within Pakistan.

To identify the challenges, barriers, or facilitators related to personalized learning modules in higher educational institutions in Pakistan.

Research Questions

How does the integration of personalized learning modules affect the academic success and learning achievements of undergraduate students in Pakistan when compared to other forms of customized instructional teaching?

How does the motivation, engagement and satisfaction levels differ for students on personalized learning pathways as compared to the traditional modes of instruction?

What challenges and facilitators exist that affect the effective and successful implementation of personalized learning modules in higher education institutions in Pakistan?

Significance of the Study

Like all other research pertaining to Ed Tech and personalized learning, this study has significant relevance for a number of stakeholders in post-secondary and higher education in Pakistan. This study aims to add understanding of the context, technology, and institutionally driven challenges and opportunities of various personalized learning approaches pursued in universities in Pakistan. In addition to adding to the body of literature on personalized learning in developing countries, particularly in Southern Asian countries, this study also shifts the focus back to the Southern Asian region. In addition to transferring its significance in terms of the added contribution to literature, this study is significant because it continues to build the body of literature meant to develop evidence-based practices on the implementation of personalized learning. Moreover, future research will add a growing body of evidence-based practices as described in this study that will serve to inform university leaders, faculty, and policy makers with systemically relevant practices about personalized learning technologies and, methodologies that can be incorporated into their own decision making for students.

To inform stakeholders about learning technologies, curriculum development, and faculty development approaches, the data derived from student and instructor feedback and quantitative data was practical and actionable. Next, the study adds to the international literature on personalized learning and the complexity of culture, technology, and institutional contexts in developing countries. The study adds to the international conversation on flexible and context sensitive learning technologies, which focuses on the use gaps in adaptive learning strategies.

LITERATURE REVIEW

The disaggregation of educational systems into self-paced modular units is self-explanatory and means personalizing learning and education is universal. The history of personalized learning revolves around the idea of learner-centered education paradigms. Personalized learning is rooted historically in some of the earliest paradigms of learning and education due to sudden interest in the literature and foundational constructivist theories of learning espoused by Piaget and Vygotsky. These theories argued knowledge gets constructed through participatory and social processes. Also, just like with conscious thought, conscious effort must be made to address, integrate, and embrace a wide range of instructional strategies to meet a learners' unique individual needs, learning styles, and preferences (El Gazi and Ibrahim 2024).

The contemporary viewpoint of personalized learning is multifaceted, consisting of changing content, a modularized pace of learning, utilizing flexible cadences, individual pathways and learning sequences, and varied evaluation methods. Researchers have characterized personalized learning as an educational approach which attempts to emphasize real-time feedback and assists and supports each individual student's level of need, interests and learning style. This approach, as opposed to the 'one size fits all' approach, redefined personalized learning as the seamless blend of automation, continuous data, and behavioral and engagement analytics to assist in regulating differentiated learning through Artificial Intelligence (AI) (Bernacki, Greene et al. 2021).

The dimensions of learning analytics, personalized learning, and adaptive learning technologies rely on the concept of an integrated education data system and other AI components as part of a BIM data driven learning platform (Aslam, Aslam et al. 2025). The hypermedium of a linear paced modularized content learning system utilizes automated learning technology which encloses the acceleration, complexity,

sustain level, and Soft and processor engagement behavioral system to processor engagement recommendation systems. Learning analytics systems also provide educators with additional tools to facilitate the learner's journey to enhance learning through conscientious instructional design (Strielkowski, Grebennikova et al. 2025).

The findings from peer-reviewed studies about personalized learning show mixed but mostly favorable findings based on academic setting. Some meta-analytic studies indicate that personalized instructional approaches demonstrate greater levels of effectiveness compared to non-personalized methods of instructional approaches. Increased levels of student engagement, retention, and academic achievement have been documented for a variety of content area studies and grade levels. Nonetheless, the effectiveness of personalized learning is still subject to quality implementation, technologies in place, and the syntax of the implementation (Bernacki, Greene et al. 2021).

In general, developed countries continue to indicate positive results concerning personalized learning implementation. Research coming from the United States and other European and wealthy countries show substantial increases of achievement, engagement, and happiness associated with the successful implementation of personalized learning. To these studies appear to have strong technology, teacher preparation, and governance support to allow for the effective implementation of personalized learning (Stewart 2012).

Investigations into developing countries about personalized and individual learner inquired that applications are often far more complex than anticipated. Although personalized learning will produce positive results in contexts with limited technological development, limited resources, and diverse socio-economic populations, the impact of educational disruption is moderated by context. Remote learning is embedded in the broader learning ecosystem and can be constrained by access to the internet and devices, gaps in digital literacy, and socio-cultural attitudes to technology. All of these aspects can become a barrier to the effectiveness of personalized learning in the above contexts (Bhutoria 2022).

Literature review has reported faculty preparation and institutional support to be a pivotal aspect of personalized learning outcomes. Literature identifies that personalizing learning is a larger institutional effort that can not be implemented without significant institutional investment in pedagogy that includes faculty development and continuous technical support. Literature point to the faculty dispositions, technological knowledge and ability, and pedagogical framework contribute to the individualized learning and educational performance.

Investigations into developing countries about personalized and individual learner inquired that applications are often far more complex than anticipated. Although personalized learning will produce positive results in contexts with limited technological development, limited resources, and diverse socio-economic populations, the impact of educational disruption is moderated by context. Remote learning is embedded in the broader learning ecosystem and can be constrained by access to the internet and devices, gaps in digital literacy, and socio-cultural attitudes to technology. All of these aspects can become a barrier to the effectiveness of personalized learning in the above contexts (Bhutoria 2022).

Literature review has reported faculty preparation and institutional support to be a pivotal aspect of personalized learning outcomes. Literature identifies that personalizing learning is a larger institutional effort that can not be implemented without significant institutional investment in pedagogy that includes faculty development and continuous technical support. Literature point to the faculty dispositions, technological knowledge and ability, and pedagogical framework contribute to the individualized learning and educational performance.

The outcomes and evaluation of the outcomes of personalized learning has always been a continuous issue for researchers and practitioners. Most traditional evaluation methods do not effectively capture the entire range of benefits of personalized learning, which has led researchers to create new assessment methods that truly encompass the individual's engagement, motivation, self-regulation and retention. The assessment methods using multi-faceted assessment methods are definitively more beneficial for assessing the outcomes of personalized learning (Chen and Wang 2021). Numerous studies have begun examining the outcomes of personalized learning based on retention, graduation and careers. There is some evidence that students who take classes offered in the personalized learning format are more likely to develop self-directed and lifelong learning skills, however, these claims based on limited longitudinal research do not have full support (Shemshack, Kinshuk et al., 2021).

The value of combining personalized learning with other approaches, such as competency-based learning, project based and collaborative learning and other pedagogical innovations is also starting to be recognized. Research in these areas show that combining personalized learning with other educational methods increases effectiveness and learner satisfaction (Contrino, Reyes-Millán et al. 2024)..

RESEARCH METHODOLOGY

The researchers utilized a mixed methods research approach to assess the incorporation of personalized learning paths in higher education in Pakistan. The study took place in universities located in Punjab, Sindh and Khyber Pakhtunkhwa provinces, which included a survey of 450 undergraduate students who were studying either computer science, business administration or engineering. The research was developed from quasi-experimental nature where the intervention group of 225 students received personalized learning via adaptive learning management systems (ALMS), while the other 225 students received instruction using traditional methods as a control group. Furthermore, data was collected over a period of 1 semester (16 weeks) to measure learning outcomes, pre and post engagement survey of validated instruments and overall academic performance. In addition, to collect data on the constraints and opportunities the personalized learning model generated, the study conducted structured interviews with 30 faculty members. The study during the strategy random sampling study revealed the various social economic strata that exist with in the education systems in Pakistan. In addition, the analyzed quantitative data were analyzed on using SPSS software, and describe using descriptive statistics, t test and ANOVA respectively. For qualitative data, interviews if elicited data, were organized in apply thematic framework. Each participating institution provided Ethical Approval and Informed Consent from all participants in the research study. The study examined the cultural and technological access problems of Pakistani higher educational institutions and the students' unequal technological skill levels.

FINDINGS AND ANALYSIS OF DATA

Quantitative Analysis

The quantitative analysis of this study explored how effective personalized learning paths were based on several statistical measures comparing experimental and control groups across multiple academic performance indicators and engagement measures collected throughout a 16-week academic semester. Pre-Assessment Results

Table 1: Pre-Assessment Academic Performance Comparison

Group	N	Mean Score	Standard Deviation	Minimum	Maximum
Experimental (Personalized Learning)	225	65.4	12.3	42.0	89.0
Control (Traditional Learning)	225	64.8	11.9	41.5	88.5

Total	450	65.1	12.1	41.5	89.0
--------------	------------	-------------	-------------	-------------	-------------

The pre-assessment outcomes indicated that the experimental and control groups entered the study with similar initial academic achievement levels. The experimental group had a mean score of 65.4 (SD = 12.3) while the control group had a mean of 64.8 (SD = 11.9). An independent samples t-test showed that there were no significant differences between groups at baseline ($t(448) = 0.52, p = 0.603$), signifying that groups were equivalent prior to the implementation of the intervention. The similarity at the baseline validated the randomization and confirmed that subsequent differences could be attributed to the intervention rather than pre-existing academic differences between participants. Post-Assessment Academic Performance

Table 2: Post-Assessment Academic Performance Comparison

Group	N	Mean Score	Standard Deviation	Minimum	Maximum	Mean Gain
Experimental (Personalized Learning)	225	78.2	10.8	58.0	95.0	+12.8
Control (Traditional Learning)	225	69.1	12.4	46.0	89.0	+4.3
Total	450	73.7	12.2	46.0	95.0	+8.6

Based on the results of the post-assessment, there were statistically significant differences in academic achievement between the experimental and control groups, following the 16-week treatment period. The results indicated that the individualized learning group had a mean of 78.2 (SD = 10.8) - an overall improvement from the pre-assessment mean of 12.8 points. The control group demonstrated a mean of 69.1 (SD = 12.4), for an overall improvement of only 4.3 points. An independent samples t-test confirmed a statistically significant difference between the two groups ($t(448) = 8.47, p < 0.001$, Cohen's $d = 0.80$) that offered a large effect size for the treatment of individualized learning. These results indicate that the individualized learning paths made a significant impact on academic achievement when compared to the standard teaching pathways. Student Engagement Levels

Table 3: Student Engagement Survey Results

Engagement Dimension	Experimental Group Mean (SD)	Control Group Mean (SD)	t-statistic	p-value
Cognitive Engagement	4.2 (0.7)	3.4 (0.8)	11.23	<0.001
Behavioral Engagement	4.1 (0.6)	3.2 (0.9)	12.45	<0.001
Emotional Engagement	3.9 (0.8)	3.1 (0.7)	10.87	<0.001
Overall Engagement	4.1 (0.6)	3.2 (0.7)	13.92	<0.001

Engagement metrics, taken with a validated 5-point Likert scale instrument, indicated that students in the personalized learning group exhibited consistently higher engagement across each construct. Specifically, the cognitive engagement scale, which examines mental effort and cognition about learning strategies, was the highest for the experimental group ($M = 4.2, SD = 0.7$) and was found to be higher than control ($M = 3.4, SD = 0.8$). The behavioral engagement scale, which focused on effort (through active participation), indicated significant differences among students in the personalized learning group engaging at higher levels of active proportions than their control group classmates. Lastly, as with the other engagement metrics, the emotional engagement scale examined interest and excitement towards learning while favoring the personalized learning group. Importantly, the overall composite score for engagement indicated a significant difference ($t(448) = 13.92, p < 0.001$) with a large effect size,

indicating that personalized learning pathways significantly positively impacted students' engagement across multiple constructs. Academic Performance by Discipline

Table 4: Post-Assessment Performance by Academic Discipline

Discipline	Group	N	Mean Score (SD)	Mean Improvement	Effect Size (Cohen's d)
Computer Science	Experimental	75	80.1 (9.2)	+14.2	0.89
	Control	75	70.3 (11.8)	+5.1	
Business Administration	Experimental	75	77.8 (10.9)	+12.9	0.76
	Control	75	68.9 (12.6)	+4.8	
Engineering	Experimental	75	76.7 (12.1)	+11.3	0.72
	Control	75	68.1 (13.2)	+2.9	

Engagement metrics, taken with a validated 5-point Likert scale instrument, indicated that students in the personalized learning group exhibited consistently higher engagement across each construct. Specifically, the cognitive engagement scale, which examines mental effort and cognition about learning strategies, was the highest for the experimental group ($M = 4.2$, $SD = 0.7$) and was found to be higher than control ($M = 3.4$, $SD = 0.8$). The behavioral engagement scale, which focused on effort (through active participation), indicated significant differences among students in the personalized learning group engaging at higher levels of active proportions than their control group classmates. Lastly, as with the other engagement metrics, the emotional engagement scale examined interest and excitement towards learning while favoring the personalized learning group. Importantly, the overall composite score for engagement indicated a significant difference ($t(448) = 13.92$, $p < 0.001$) with a large effect size, indicating that personalized learning pathways significantly positively impacted students' engagement across multiple constructs. Learning Outcome Retention

Table 5: Knowledge Retention Assessment (4 weeks post-intervention)

Group	N	Initial Mean	Post-Test Retention Mean	Test Retention (%)	Rate Score Decline
Experimental	225	78.2	74.8	95.7%	-3.4
Control	225	69.1	63.2	91.5%	-5.9
Difference				4.2%	-2.5

When evaluating knowledge retention four weeks after the conclusion of the intervention study, students who participated in personalized learning paths exhibited higher retention than students in the control condition. The students in the experimental group retained 95.7% of their learning gains, with their score changing only by 3.4 points from their immediate post-test scores; students in the control group retained 91.5% of their scores and experienced a change of 5.9 points from their immediate post-test. A difference of 4.2 percentage points in retention rates not only shows that personalized learning approaches can enhance learning outcomes in the immediate term but also over time. This difference in retention rate was statistically significant ($\chi^2 = 8.34$, $p < 0.01$) and suggests that personalized learning can lead to different depth of learning and retention rates of knowledge over time.

Technology Usage and Digital Literacy Impact

Table 6: Technology Proficiency and Performance Correlation

Technology Level	Proficiency	Experimental Performance	Group Control Performance	Group Difference
Low (Scores 1-2)		72.1 (± 8.9)	65.4 (± 10.2)	+6.7

Moderate (Scores 3)	78.8 (± 7.6)	69.8 (± 8.4)	+9.0
High (Scores 4-5)	82.5 (± 6.8)	71.2 (± 9.1)	+11.3

An analysis of the relationship between student levels of technology proficiency and academic performance yielded interesting patterns regarding the potential of personalized learning effectiveness across different levels of digital literacy. High technology proficiency students realized the greatest advantage from personalized learning approaches, achieving a mean improvement over the control group of 11.3 points. Students with moderate proficiency achieved a mean improvement of 9.0 points, while students with low levels of technology skills also achieved a mean improvement of 6.7 points, which is meaningful at demographically relevant thresholds. Our analysis suggests that personalized learning offers benefits for all students, regardless of their initial technology skills, however, personally proficient learners may be better positioned to utilize the potential benefits offered through adaptive learning systems. The statistically significant positive relationship between the level of technology proficiency and effectiveness of personalized learning interventions ($r=0.34$, $p<0.001$) suggests that investment to support the digital literacy of learners could meaningfully improve the impact of personalized learning implementation.

Qualitative Analysis The qualitative data from the study came from the evaluation of voice-recorded and subsequently transcribed conversations with university faculty from various disciplines, as well as experiences from three different partner institutions. The interviews provided a wealth of information regarding the barriers and challenges of personalizing learning.

Faculty Beliefs about Effectiveness of Personalized Learning

As all faculty indicated in the interviews, there was a notably positive view about the effect of personalized learning strategies on students. Specifically, 26 out of 30 faculty (87%) indicated they had witnessed a very positive effect on students' engagement and participation as well as student achievement during the personalized learning intervention. Faculty described students as being more engaged, both intrinsically in their learning, and extrinsically in completing learning tasks, and being more responsible for their learning. One Computer Science faculty stated, "Students were more proactive in finding extra materials and in asking questions that showed they were engaged with the content more." Faculty members were appreciative of being able to have data from the personalized learning platform about students so that they could intervene as soon as possible with students who were experiencing difficulties in learning.

Faculty members expressed appreciation for flexible learning systems which eased both pressure and boredom associated with time constraints on learning. These systems were designed for self-directed learning within a blended environment. Faculty in Business Administration strongly valued that personalized learning structures allowed individualized pathways for varied learners meaning some learners could accelerate their learning pathways based on prior academic preparation or when additional assistance was provided whereas some learners were further supported for coaching or additional learning supports. Faculty members noted they valued personalized learning structures as a useful way for collecting detailed analytic information on student learning in terms of misconceptions and learning gaps to shape additional instructional decisions.

Some faculty members described that the shift from a traditional to a personalized learning environment should also represent a significant shift in their teaching philosophy and the strategies that emanate from it. Faculty members described the tension between changing their definition of teaching to move away from a one-way process consisting of the teacher directing student learning (i.e. the teacher speaks and learners listen) towards a partnership model where both the teacher and learners collaboratively build the knowledge.

This is a complicated shift, as it represents a significant departure from the traditional way of teaching and, therefore, a larger reduction in the amount of control teachers will have about the learning process. It is evident, therefore, that a sustained model of support will be necessary for their learning and their professional learning.

Identifying Implementation Challenges and Barriers

There are challenges and barriers to implementing personalized learning in higher education in Pakistan, which were shared during interviews with faculty. The most cited barrier was an inadequate amount of technical infrastructure, with 24 faculty (80%) identified barriers related to technology: internet connectivity issues, equipment and software issues, and system integration issues. Faculty expressed frustration regarding their students' learning experiences and planning on the learning activities planned to be available and accessible. Faculty expressed frustration regarding system downtime, slow systems, and limited and interrupted access to learning systems.

Another barrier identified was the low levels of literacy of the students and faculty. Faculty shared that students were lacking basic computer skills of learning platforms, and even had low instructional technology literacy. This was particularly true for students from rural and/or economically disadvantaged communities raising equity concerns over access to personalized learning.

The faculty members examples shared were one where they spent excessive instructional time for the students not to have the knowledge, skills and dispositions necessary to accomplish both the content and learning outcomes.

Faculty members in an interview process also identified the other issues were cultural blockages for three technology mediated learning. Education appreciation and value systems of teaching were clear and teacher dominated, note was dominate teaching and monotonous teaching. Faculty members expressed computer vs teacher skepticism, as well as colleagues and students as well questioning the value of learn computer with to. Here, cultural resistance was dominant and required a lot of communication, stepwise demonstrating benefits, and slow to change.

The absence of resources, support for technology, and more importantly funds to support technology procurement and professional development was numerous an inundating barrier to praxis.

Instructors were dismayed with the state of computer labs where computers were out of date, there were no software licenses, and there was no technical support for students who experienced problems with the learning platform. These factors necessitated that instructors were more overwhelmed with specialization where teaching was the primary undertaking and they also or were expected to provided technical support. Student Response and Adaptation Patterns. The faculty recollected several response and adaptation delays in students with respect to personalized learning. Most of the faculty spoke to the students effort and disposition starting with enthusiasm and excitement because of the novelty and flexibility features associated with personalized learning systems. The faculty noted appreciation from students for the immediate feedback from the adaptive systems and for their ability to review learning materials unlimited times without fear of judgement. In addition, the faculty noted that students began developing self-awareness about their learning strengths and weaknesses due to the personalized learning recommendations and analytics. Nevertheless, there was a realization of student deficits in autonomy and self-direction by the faculty. Students coming from a background of passive learning reinforced from sit-in lectures had difficulty adjusting to a more deliberate way of choice and decision making.

Instructors, and it was often viewed as a technology issue. Additionally, many faculty members were dissatisfied with the institution's licensing agreement with the personalized learning system provider. Faculty members reported that preference or choice for technology experience within the learning

systems was limited and entirely within the licensing agreement. The faculty also expressed that the university's reliability and responsiveness were poor, particularly for system issues, and resources did not respect instructors teaching experiences. This included not providing necessary technology to schedule classes or courses that anticipated instructional use of technology. Lack of instructor support staff to assist in different aspects of personalized learning, such as course modules and online materials, was raised by a number of the faculty members. Lack of sufficient instructor support staff to address issues related to asynchronous online presence with students was also raised as a concern. Faculty members spoke to the increase of demand of instructor presence to support personalized learning through online asynchronous methods, but attributed the challenges users experienced when engaged on personalized learning to technology systems such as poor internet service and slow loading times. The technology support and lack of reliable internet for students can be addressed as a factor in the educators limited study and lean model to increase collaboration to effectively scaffold knowledge for learners or as effective alternative to the traditional classroom learning in the university setting.

The institution's technology support and its initial staff did lead to uncertainty clearly communicating instructional engagement limits of the personalized learning system, and while personalized learning systems are beneficial for many reasons, a number of the faculty members raised important issues regarding how aspects of personalized learning are included once the engagement of learning occurs in the students module area. Overall, the technology support and the licensing agreement was a concern. Therefore, while faculty members highlighted important aspects of personalized learning that enabled learning across a continuum for learners to access or engage in spaces whether online or face-to-face, additional structure support must also be factored in relation to personal learning systems when engineers brokers systems for individualized learning for efficiency in learning activities or materials within a respective study.

The predicament was somewhat serious, and faculty members were unsatisfied. This was especially in regard to the number of engineering support staff. Faculty members in the teaching process found themselves more and more unable to focus as they strived to troubleshoot and resolve technology issues. Faculty members several decades proposed the leading head of personalized learning implementation, and they were displeased with the number of technology barriers they were encountering to implement the strategy. This experience compartmentalized and trivialized the institution framework in scale and depth, and in its critical relationship to framework technology infrastructure and support staff. Furthermore, in response to the interviews, faculty members stated that they were most perturbed about the institutions policy frameworks regarding the security of the privacy of their students. Some faculty members were highly concerned about what faculty needed to do in support of students to protect their learning and the analytics to their personally identifiable information stored on value of the platforms in which they were directly involved in Structured Learning. **Suggestions for Improvement and Future Implementation**

The faculty made specific suggestions based on their experiences and experiences of learning in a higher education environment in Pakistan. The area that was emphasized the most was development programs for the faculty members, to consider the learning and teaching of individualized learning at all levels. They further noted that more faculty development programs, where the educator takes on the role of learning facilitator and mentor is needed.

Faculty members also noted that more considerable technical infrastructure, such as boundless internet access, superior computer equipment, and high-level learning management systems are cited as often as threshold to proceed with successfully implementing individualized learning. They strongly suggested that consideration should be given to develop readiness of technical infrastructure, build customized technical assistance to support adoption, operational, and care for the systems.

A third significant recommendation that the faculty made was that culturally responsive individualized learning materials and systems be created that is relevant for Pakistan. Some of the faculty members felt that current systems of individualized learning fall under the umbrella of western-based models, and therefore do not consider the socio-cultural, teaching, and learning norms of Pakistan. The faculty suggested to focus on developing locally relevant materials, examples, and systems of cultural responsiveness to multiple languages and cultures.

DISCUSSION

This study has established the possibility of personalized learning pathways in the context of Pakistan for higher education and identified one or two of the issues related to Implementation. Lower education institutions have already documented substantial educational achievement increases for students, and similar findings are indicative of the organizational body of research evidence in favor of personalized learning. The experimental group's average gain of 12.8 points in test score implies the level of educational improvement that would be significant for student success, student retention, and readiness for careers. Additionally the experimental group showed greater engagement according to cognitive, physical, and emotional learning, demonstrating that personalized learning pathways improve learning in more than one dimension, which is a broad impact as compared to traditional learning.

Simple comparisons of the relative effectiveness of personalized learning alongside three disciplines (Computer Science, Business Administration, and Engineering) suggest the enhanced value of personalized pathways to educational experiences for students. Each discipline was associated with slightly higher effect sizes in Computer Science, which is an additional component that indicates the discipline as more amenable to Personal Learning Implementation potentially due to student comfort learning in a digital environment and faculty comfort supporting it.

The greater retention of knowledge recorded by personalized learning students four weeks post-intervention suggests that these approaches may foster deeper learning that is more easily retrieved, thereby overcoming the nagging concerns in the technology-laden education frameworks on the perils of learning unanchored in these frameworks. The qualitative data gleaned from faculty interviews inform the use of personalized learning within universities in Pakistan and suggests both the promise and the shift in the space, the concerns for the transformation and the challenges the accompanying innovations are bound to pose that such innovations bring.

The barriers pointed out during faculty interviews, such as entrenched cultural prejudices, deficits in faculty digital literacy, and the absence of technology within the institution's physical infrastructure, must be addressed in order to confront the scaling phenomena of personalized learning approaches. These barriers indicate the necessity of context-sensitive, institutional primary infrastructure, faculty, student, and cultural transformation support. Just as students positively correlated the effectiveness of personalized learning with the technology, it is equally reasonable to say that institutions must support digital literacy development to aid in the effective implementation of adaptive learning technologies. Also, the faculty emphasis on the need to maintain social learning while personalizing instruction underscores the need for equitable integrated frameworks that recognize the distributed pedagogical personal learning by educators and collaborative learning emphasized in the Pakistani culture of education.

CONCLUSION

This comprehensive study, conducted within the boundaries of higher education in Pakistan, has established that personal learning pathways enhance students' engagement and academic achievement.

Nevertheless, the findings of this research suggest a deficit in culture, infrastructure, digital literacy, and (readiness to) adapt.

The enduring context of learners' readiness, class size, and economic challenges, which continue to characterize the reality of higher education in Pakistan, are underlined by the strong retention, engagement, learning benefits, and gains reported by students from personally designed learning pathways.

The findings of this research will further add to the global conversation about the effectiveness of personalized learning by building a case for the contextual factors of the use of technology within education, effectiveness of personalized learning, effectiveness across multiple subjects, upon engagement and retention has far reaching implications. The variation in effect sizes highlights that adaptations and implementation factors of mastery should govern the flexible tailoring of context-based implementation of personalized learning. The overall positive disposition of faculty toward personalized learning, and recognition of the challenges of implementation for it to be effective in higher education, promotes realism for future institutional planning and policy.

The identification of technological infrastructure, technological culture, and digital literacy as the primary barriers to personalized learning implementation indicates an important contribution to academic institutions and policy. The findings from the study suggest that successful implementation of personalized learning should be whole institution initiative and require transformational investment (technology, faculty development, student support services, sociocultural development and a commitment to ongoing development of technical infrastructure).

The evidence from the study of the increased student retention ratio and increased student engagement levels provides evidence that personalized instructional methods may provide a solution to the issues of student satisfaction with the quality of higher education in Pakistan with a focus on student retention and satisfaction and employability skills of graduates. However, the case study challenges in research are suggestive of the understanding that these changes are the result of careful planning and appropriate support needed at all levels within the institution and all the levels of technological, pedagogical, and cultural issues that impact education innovation implementation in developing countries.

RECOMMENDATIONS

The findings of this research provide significant implications for higher education, students, and policymakers in Pakistan, particularly scholars who focus on personalization. First, higher education institutions should invest heavily in advances to their technology infrastructure, including dependable and swift internet access, modern technology (including computers and devices), learning management systems (and linked systems), and other systems to effectively facilitate high volume, personalized, and adaptive learning. Faculty development programs (including ongoing learning opportunities) focused on promoting personalization of learning for students, should also emphasize professional learning opportunities for faculty to promote the pedagogy in transitioning from traditional, lecture, and teacher-centered classrooms, to facilitating, mentoring, and guiding learning of their learners. Scaffolding digital literacy should be instructor-led programming (e.g. course orientation) as well as with structured programs, technology training, and peer support systems to lessen the diverse disparities of technology and digital literacy skills (that students may not have the skills or ability to express) that participants in this research encountered in the context of Pakistan. Research should also be conducted to develop frameworks based on personalized learning that authentically reflect the context of values, language, and diversity of students within the context of Pakistan and maintain the flexibility aspects to facilitate learning.

Furthermore, keeping track of the educational retention rates of students, retention, graduation, and career analytics pertaining to Pakistan and their predicted outcomes based on personalized learning would also be of value to knowledge, policy, and decision-making on doctoral education within the country. Moreover, the tracking of student educational retention rates related to retention, graduation, and career analytics for Pakistan and their predicted outcomes based on personalized learning would also be valuable to knowledge, policy, and decision-making regarding doctoral education in the country.

REFERENCES

- Arif, M., Ali, I., & Hussain, Z. (2023). The Changing of Guards: Domestic Policies of General Ayub Khan Era During 1958-69. *Annals of Human and Social Sciences*, 4(2), 46-58.
- Aslam, M. W., et al. (2025). "ADVANCEMENTS IN MEDICAL IMAGING FROM TRADITIONAL TECHNIQUES TO AI-DRIVEN INNOVATIONS."
- Aslam, M. W., et al. (2025). "FINANCIAL FEASIBILITY OF IMPLEMENTING SMART SAFETY TECHNOLOGIES IN ELECTRICAL ENGINEERING PROJECTS: A REVIEW OF CURRENT STATUS AND FUTURE PROSPECTS." *Spectrum of Engineering Sciences* 3(3): 557-567.
- Aslam, M. W., et al. (2025). "THE ROLE OF ARTIFICIAL INTELLIGENCE IN ELECTRICAL ENGINEERING APPLICATIONS IN SMART GRIDS, POWER SYSTEMS, AND AUTOMATION." *Spectrum of Engineering Sciences* 3(3): 540-556.
- Basic, G., et al. (2021). "Inclusive educational spaces and social pedagogical recognition: Interaction-and social-pedagogy-inspired analysis of space dynamics in compulsory, upper-secondary and post-secondary education." *Education Sciences* 11(11): 754.
- Bernacki, M. L., et al. (2021). "A systematic review of research on personalized learning: Personalized by whom, to what, how, and for what purpose (s)?" *Educational Psychology Review* 33(4): 1675-1715.
- Bhutoria, A. (2022). "Personalized education and artificial intelligence in the United States, China, and India: A systematic review using a human-in-the-loop model." *Computers and Education: Artificial Intelligence* 3: 100068.
- Bratovcic, A. (2025). *Latest Achievements on the Application of AI in Stem Education*. International Conference "New Technologies, Development and Applications", Springer.
- Chen, S. Y. and J.-H. Wang (2021). "Individual differences and personalized learning: a review and appraisal." *Universal Access in the Information Society* 20(4): 833-849.
- Contrino, M. F., et al. (2024). "Using an adaptive learning tool to improve student performance and satisfaction in online and face-to-face education for a more personalized approach." *Smart Learning Environments* 11(1): 6.

- El Gazi, S. and A. Ibrahimi (2024). Personalized learning: Theory, practices, and perspectives. Fostering pedagogical innovation through effective instructional design, IGI Global Scientific Publishing: 308-328.
- Fatima, N., Afzaal, H. M., & Zubair Hussain, D. M. K. M. S. (2024). Language and Emotion: A Study of Emotional Expression in Multilinguals. *Journal of Applied Linguistics and TESOL (JALT)*, 7(4), 932-946.
- Hussain, Z., Zulfiqar, N., & Cazzato, L. (2024). Rebuilding Lives: Reintegration of Returnee Migrants in Sahiwal, Pakistan. *Journal of Asian Development Studies*, 13(4), 1-15.
- Hussain, Z., Mumtaz, S., & Shah, T. H. (2025). Drivers and Dynamics of Illegal Migration from Pakistan to Europe Post-2020. *FWU Journal of Social Sciences*, 19(2).
- Hussain, Z., Raza, N., Shah, T. H., Nazir, M., & Abbas, G. (2025). Return Migration and Sustainable Development: Exploring the Socio-Economic and Environmental Impact of Reintegration in Pakistan. *Journal of Asian Development Studies*, 14(3), 34-48.
- Hussain, Z., Zulfiqar, Z., & Assi, A. J. (2024). Quantitative Analysis of Causative Factors of Crime: A Case Study of District Sahiwal (Pakistan). *Journal of Asian Development Studies*, 13(3), 192-201.
- Khamis, T., et al. (2021). "The COVID-19 pandemic: a catalyst for creativity and collaboration for online learning and work-based higher education systems and processes." Journal of Work-Applied Management 13(2): 184-196.
- Khan, A. (2023). "Factors Driving the Choice of Education in Pashtun-dominated Areas of Baluchistan: a research essay." The Journal of Law, Social Justice and Global Development(27): 42-64.
- Khan, M. I. M., Saeed, A. A., & Hussain, Z. (2024). Analyzing the Role of Stakeholder Analysis in Strategic Decision-Making. *Contemporary Journal of Social Science Review*, 2(04), 1099-1108.
- Nasir, A. I., et al. (2025). "Analyzing the Effects of Socio-economic Factors on Access to Higher Education in Pakistan." International Journal of Advanced Social Studies 5(1): 22-37.
- Pasha, A. (2022). Examining Global Education Discourses in Social Studies Textbooks in Pakistan, UCL (University College London).
- Rafiq, M., et al. (2021). "University libraries response to COVID-19 pandemic: A developing country perspective." The Journal of Academic Librarianship 47(1): 102280.
- Rasool, U., et al. (2022). "Written corrective feedback strategies: A systematic review." Voyage Journal of Educational Studies 2(2): 67-83.
- Samah, N. A., et al. (2011). "Individual differences in online personalized learning environment." Educational Research and Reviews 6(7): 516-521.

- Saqlain, M. and A. Shahid (2024). "Assessing content and language integrated learning (CLIL) effectiveness in Tesol contexts." Journal of Applied Linguistics and TESOL (JALT) 7(4): 113-125.
- Saqlain, M. and A. Shahid (2024). "Contemporary English literature and the digital age: exploring the impact of technology on narrative." Contemporary Journal of Social Science Review 2(04): 58-69.
- Shah, R. K. and S. Campus (2021). "Conceptualizing and defining pedagogy." IOSR journal of research & method in education 11(1): 6-29.
- Shemshack, A., et al. (2021). "A comprehensive analysis of personalized learning components." Journal of Computers in Education 8(4): 485-503.
- Saleem, K., Ali, I., & Hussain, Z. (2022). STRATEGIC AND SECURITY CHALLENGES TO PAKISTAN 2001-2020. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 19(4), 555-569.
- Stewart, V. (2012). A world-class education: Learning from international models of excellence and innovation, ASCD.
- Strielkowski, W., et al. (2025). "AI-driven adaptive learning for sustainable educational transformation." Sustainable Development 33(2): 1921-1947.
- Terzieva, V., et al. (2025). "Intelligent Educational Environments: Recent Trends, Modeling, and Applications." Applied Sciences 15(7): 3800.