Journal of Social & Organizational Matters
Vol 4 No 4 (2025): 66-87

Digital Pedagogies and Student Engagement in Higher Education: A Case Study of Pakistani Universities

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Keywords: *Digital Pedagogy, Student Engagement, Higher Education, Pakistan*

DOI No: https://doi.org/10.56976/jsom.v4i4.332

The issue of student engagement is becoming one of the most important in terms of the success of higher education. Founded in Pakistan, the fast digitization of universities has indicated both the possibilities and problems in the implementation of digital pedagogies, although there is little empirical information on the effects of its application. The research problem addressed in this study is whether digital pedagogical practices could be effective in promoting student engagement in Pakistani universities. Its purpose is to determine the extent to which teaching techniques based on technology can significantly improve participation, motivate and performance. The data were gathered using interview methods through the use of a quantitative case study design where students and university staff were surveyed and observed in the classroom setting of three major universities. The findings revealed that statistical procedures and tools including descriptive analysis, regression modeling and ANOVA were used to evaluate relationships between digital pedagogues and dimensions of student engagement. The results suggest that the use of digital tools, such as learning management system, interactive sites and multimedia tools, have a positive correlation with an increase in behavioral, emotional and cognitive engagement. Digital interactivity interaction and predictive value were found to have a significant effect on the participation of students, and access differences mediated the results of the regression analysis. The paper indicates the opportunities of digital pedagogies on facilitating online interaction in learning institutions, but the problem of infrastructures and training in this context should be taken into consideration. Institutional approaches to policy making and these findings are used to achieve improve quality learning in the course of Pakistan.

1. Introduction

Online pedagogies in higher education have transformed the learning and teaching landscape across the globe hence changing how institutions of higher education administer their course outline and the kind of interaction that they have with pupils and their respective societies. Engagement as a feature of behavioral, emotional, and cognitive engagement remains a determinable characteristic of higher education outcomes and there is vast evidence of engagement with academic outcomes, retention, and learning outcomes over time (Fredricks et al., 2019; Johnston et al., 2024). Over the last few years, the process of digitalization has gained pace not only due to the global technological transformations but also to the need and measures enforced by COVID-19 and altering the traditional teaching and learning methods (Zheng, 2025). So here the issue of the role of digital pedagogical innovations as the means of increasing student interest has become the matter of theoretical and empirical priority of modern scholarship.

1.1 The Global Rise of Digital Pedagogies

Digital pedagogies involve the application of technology enhanced tools, platforms and mechanisms that support and boost student learning and participation. Starting with learning management systems (LMSs) and moving on to artificial intelligence (AI)-mediated learning, such technologies have widened the range of opportunities to achieve individualized, customized, and interactive learning (Vehrer & Palfalusi, 2025). The introduction of immersive environment, augmented reality and artificial intelligence tutors also exemplify how digitalization may entail rather engaged experiences and generation Z attendants is typified by their high digital preferences (Ali, 2020; Ben Degen, 2025). However, the effectiveness of such pedagogies varies in context, both because of the institutional structures, teacher skills and because of socio-economic differences in access (Ibrahim & Kenwright, 2022).

New findings indicate how the digital platforms are advantageous in terms of accountability and collaboration, as well as transparency in higher education. Working examples include Rios-Muñoz et al. (2025) demonstrating the effectiveness of organized online spaces to enhance cooperation and the objectivity of assessment in biomedical engineering in the case of Johnston et al. (2024), which substantiates their claims that prediction of trends in student engagement through machine learning methods used on Moodle stream logs are feasible. The results confirm that digital pedagogy refers to the implementation of tools, but to the areas being integrated strategically and through pedagogical harmonization.

1.2 Student Engagement as a Pedagogical Imperative

Student engagement is not simply linear but multidimensional and can be present at the level of participation, emotional investment, and thinking (Fredricks et al., 2019). Participation in higher education has been found to mediate the learning outcomes, university retention, and acquisition of lifelong learning skills (Suraworachet et al., 2022). With the spread of digital pedagogies, the perceptions of their influence on the engagement are important. As an illustration, if human feedback is used together with analytics-based intervention in reflective writing

activities, students are much more likely to show continued interest in the process (Suraworachet et al., 2022). Equally, AI-based chatbots have been observed to facilitate real-time support of students, and in effect, respond to the challenges of internationalization and accessibility of higher education environments (Hsain and El Housni, 2024).

Despite these pros, there still are troubles. The outcomes of engagement are unequal, and often make light by other variables, such as digital literacy and the preparedness of the teacher and socio-economic inequality (Jin et al., 2025; Ibrahim & Kenwright, 2022). The effectiveness of digital pedagogies deserves more analytic examination in other contexts such as developing countries that are loosely structured due to lacks in infrastructural design.

1.3 The Pakistani Higher Education Context

The Covid-19 case has segregated the quality, accessibility, and effectiveness of e-adoption of online systems in rapid change-paced higher education in Pakistan, but with mixed results. Although the Higher Education Commission (HEC) has facilitated the digitalization efforts, the ongoing challenges of insufficiency of bandwidth, inequality of access, and inferior faculty readiness make the adoption of digital pedagogies difficult (Shah and Saeed, 2023). Empirical studies of the effects of such pedagogical changes are limited, especially when speaking of student engagement. Policy structures or institutional approaches commonly feature in the contemporary literature but fail to analyze the experiences of students with a grounded, data-driven approach (Malik and Anwar, 2022). It is this evidence gap that can be deemed particularly serious in light of increased awareness about the fact that engagement is not a homogeneous product but a context-dependent reality.

1.4 Research Problem and Gap

Even though the positive relationship between digital pedagogies and student activity is strongly supported by the extant scholarly literature, the contextual validation of the available data in relation to the Pakistani situation in higher education is underrepresented. The kind of research that is undertaken at higher sites might have harbored preconceived controlled technological infrastructure and routine instructional preparation (Vehrer & Palfalusi, 2025; Rios-Muñoz et al., 2025). In comparison, the Pakistani universities are also notable in the aspects of digital approach actualization, where the universities pursue disparity in the students, and grade. The absence of theoretical studies that may assess the importance of digital pedagogical approaches and the impact of the latter on the interest in the subject is one of the limitations of the present study. Such a gap must be bridged not only to enable the national changes in education, but also to support the discourse of digital equity and pedagogical innovation in the Global South in general.

1.5 Significance of the Study

The proposed study fills the identified gap, as it will provide a systematic study of the way digital pedagogical methods will affect student engagement at Pakistani universities. Through a quantitative case study design, this study produces empirical evidence on the effectiveness of digital solutions like learning management systems, interactive platforms and multimedia

solutions - in terms of promoting behavioral, emotional, and cognitive experiences. This study is important due to three major contributions. First, it frames the world-wide discussions on digital pedagogy by putting them within the Pakistani higher education system, and thus solves the problem of digital equity and the limitation of infrastructure. Second, it educates policy and institutional strategies and approaches that would help improve the quality of teaching and learning by providing data-driven evidence to make decisions. Third, it also adds to the theoretical discourse on engagement in that it reflects on interaction between digital interactivity and socio-economic inequalities, thereby broadening the conceptual definition of engagement in various learning settings.

1.6 Research Aim

The proposed research problem is the need to explore whether digital pedagogical strategies are the keys to increased student engagement in Pakistani universities. In particular, the question that the research addresses is as follows: How effectively technology-based teaching practices enhance participation, motivation, and academic achievement in higher education Pakistani students? In answering this question, the study does not only adequately seal a much-needed empirical gap, but also facilitates the scholarly discourses relevant to the issue of the equitable and effective utilization of digital pedagogies in higher education.

This study has objectives that are crafted in regard to the identified research problem as well as the realities of Pakistani higher education. In particular, the study is aimed at:

1. Assess performance levels of digital pedagogical methods in terms of improving engagement with students, especially its behavioral, emotional, and cognitive levels in Pakistani universities.
2. Discuss how the institutional and infrastructural influences such as access differences, faculty readiness, and socio-economic differences affect the practice and success of digital pedagogies in as far as student engagement is concerned.

1.7 Research Questions

Based on the above objectives, the research questions that will drive this study are as follows:

1. What role do digital pedagogues strategies, including learning management, interactive, and multimedia tools, play in promoting behavioral, emotional and cognitive engagement in higher education students in Pakistan?
2. Which institutional and structural conditions, specifically inequality in digital access and instructor willingness, influence the connection between digital pedagogies and the result of student engagement?

2. Literature Review

2.1 Theoretical Frameworks of Digital Pedagogy and Student Engagement

The concept of student engagement has been a widely accepted multi-dimensional construct that is critical to the success of higher education. Fredricks, Filsecker, and Lawson (2019)

understand the concept of engagement as behavioral, emotional, and cognitive, and aligning these three aspects will encapsulate how students respond to their learning experiences. This threefold model has evolved to be a most referred model, which has affected future studies on the subject of an innovative pedagogical approach. A large portion of digital pedagogy also relies on the constructivist learning theory, which holds that learning is an active process, relying on interactions, reflections and collaboration between the student (and instructor). Online technologies complement these concepts by allowing customized, student-focused learning centers to expand beyond the conventional lecture-based style of delivery (Ibrahim & Kenwright, 2022).

Digital learning has also applied the Tinto student dialogue model of student persistence to education. Planned online and integrated pedagogies will create so-called communities of engagement that disseminate Tinto efforts on social and academic integration (Johnston et al., 2024). These models also stress that applying digital tools alone is insufficient, pedagogical integrity and institutional direction is necessary to foster meaningful interaction.

The other theory that is equally applicable is the socio-technical systems theory which emphasizes the process of human actors interplay with technology tools and organizational structures and schemes. This framework restates that the importance of the student in participating in online platforms is distant not merely through the affords of online platforms but also through the institutional capabilities, teacher proficiency and access in terms of socio-economic status (Nguyen & Nguyen, 2025). These theoretical foundations combine to suggest that digital pedagogy cannot be viewed as a set of tools such that technology and pedagogy exist as separate systems: it instead forms part of a broader system of education where technology, pedagogy and context evolve consensually.

2.2 The Global Evolution of Digital Pedagogies

The development of digital pedagogy has gone through a series of new evolutionary phases, starting with the issues of basic computer-assisted instruction in the 1980s to advanced e.g. AI-mediated systems today. With the development of learning management systems (LMS) early in the 2000s, centralized centers of course delivery, assessment and communication came into existence. In more recent times, with the COVID-19 pandemic, an online and hybrid learning transformation was suddenly realized, compelling most of the institutions to implement digital strategies in a large scale (Zheng, 2025). This shift revealed both what flexible digital tools can manage and how unequal access to technology may be dangerous.

The conceptualization of engagement is being re-defined by emerging technologies. VR and AR experiences can be immersive experiences, which are grounded on the principles of constructivist and experiential learning to enable students to learn through doing, in the context of simulation (Vehrer and Palfalusi, 2025). The adaptive learning systems and Socratic tutoring bots offer AI-based personalization in the real-time, which promotes in-depth reading and comprehension of challenging materials (Ben Degen, 2025). Meanwhile, analytics-based dashboards help institutions and organizations to track and forecast the engagement rates to implement the required interventions in time (Johnston et al., 2024).

However, it is still subject to conflicts over the pedagogical or technological imperatives of these advances. Criticism has been made that the use of technology has at times been pushed forward by institutions not in relation to its suitability to pedagogy but with relation to the innovativeness of the technology (Nguyen and Nguyen, 2025). This skirmish reflects broader debates in higher education about whether or not digital pedagogy should be essentially efficient, fair, or dedicated to transformative learning.

2.3 Study Interaction with student as Multidimensional Construct.

The significance of the interaction with learning results has given rise to academic inobiency. Behavioral engagement in terms of participation, attendance and full completion is often the most evident dimension. Distinct emotional engagement encompasses the commitment related to specific activities such as enthusiasm, interest, and sense of belonging among the students, and cognitive engagement entails the ability to see past the abstract and metacognitive application and continued working on challenging tasks (Fredricks et al., 2019).

This framework can be extended to the online worlds, as studies show recently. Specifically, Suraworachet et al. (2022) demonstrated improvement in consistency of stimulated engagement when the reflective writing task created using analytics-generated prompts was supplemented with human comments. Similarly, Hsain and El Housni (2024) showed that the assistance delivered by chatbots with AI proved appropriate and prompt, which facilitated emotional and behavioral interaction to the greatest extent in cases when international students needed to resort to work with new systems.

In the meantime, the measure of engagement has shifted. Over the past few years, the application of log data, clickstream analytics, and predictive modeling to operationalize engagement in the context of digital environments receives increasingly more tooling, enabling scientists to follow a novel approach to data collection (Johnston et al., 2024). Though such methods are scalable, it is feared that engagement may be inferable to measurable cues to give online activity, because such means may fail to obtain additional levels of information, emotion and cognition that play vital roles in deep learning.

2.4 Digital Pedagogies and Engagement: International Evidence

The different societies of application of digital pedagogy show the diversity of the effects of digital pedagogies. The study results showed that biomedical engineering students who went through organized gamification in their courses enhanced teamwork, responsibility, and evaluation equity, which directly increased motivation (Rios-Muñoz et al., 2025). These results are consistent with the constructivist theories that provide emphasis on active learning.

The next innovation is AI-based tutoring systems. Ben Degen (2025) remarked on Socratic AI tutors as a tool to help students formulate research questions, and showed that interactive digital technologies would help scaffold high-level thinking. In the same measure, adaptive platforms of learning, where content is suit to the performance value, have additionally been found to boost

cognitive benefits and the learning legacy within sizeable, amplify classrooms (Nguyen & Nguyen, 2025).

Nevertheless, these pedagogies are still situation-specific. Latief, Khuluq, and Rinaldhi (2025) also pointed out that teacher pedagogical competence rates are key towards developing favorable digital settings. In the absence of proper training and encouragement, the implementation of new tools may run the risk to become counterdigestive, which is why the idea that technology should be pedagogically justified and anthropologically inclined should be contended.

2.5 Challenges and Equity in Digital Learning

However, with growing interest, concerns about equity and inclusion in digital pedagogy have long existed. There is some literature that suggests that digital learning habitats varies between students based on socio economic disparities. In fact, Jin et al. (2025) express that digital opportunities (digital divide) in form of bandwidth, device and digital literacies access can amplify inequalities in educational attainment. These disparities are more likely to mirror social adoptions of the dominant classes in society that present significant concerns about equality in tertiary education.

Preparation of the faculty is another noisy aspect. Ibrahim and Kenwright (2022) display that it is not incidental that many instructors have been failing at adopting the introduction of the Internet of Things (IoT) technologies, due to their digital competence and the current system of institutional backing. Considerably, Nguyen and Nguyen (2025) highlight that national-scale efforts of digital transformation must be oriented on the enhancement of teacher capacity-building to ensure that the engagement of students is not threatened.

Ethical concerns also accompany the birth of AI and learning analytics. Despite the possible benefits of predictive models of engagement, which can be used to begin preemptive responses, they introduce issues of surveillance, privacy and bias. In order to encourage data-driven pedagogy, institutions should balance the benefits associated with the practice, along with installing safeguards such as maintaining a safe environment in which students may exercise their autonomy and trust (Johnston et al., 2024). These combined matters reflected that the embrace of digital is not a guarantee of the engagement but it is mediated with more inclusive structural, ethical, and cultural units.

2.6 The Pakistani Higher Education Context

The global tendencies as well as demands of the COVID-19 pandemic have motivated the rate of digital pedagogies integration in Pakistan. The Higher Education Commission (HEC) is leading efforts yet only bringing marginal positive results to digital transformation given the structural and socio-economic challenges posed. Shah and Saeed (2023) reported that the limitations of bandwidth access and poor availability of electricity and fair access were severe barriers to the online learning experience during the pandemic. Malik and Anwar (2022) also emphasized the disconnect between lofty policy ambitions and realities on the ground, where

faculty themselves are often not digitally literate and therefore are not able to implement the ambitious policy adequately.

Whereas global scholarship has heavily provided documentation on the association between digital pedagogy and student engagement, little localized research on the same is available in Pakistan. Available literature tends to focus on either policy or institutional solutions, but not on the empirical analysis of the experiences of student engagement. This leaves a gap of knowledge on the interaction between digital tools on the behavioral, emotional, and cognitive aspects of engagements in resource-limited settings.

In addition, there exist cultural determinants of the use of digital pedagogies. In a society where the tradition of teacher-based pedagogies is well established, adopting student-based interactive types of digital based approaches necessitates expansion of more than just infrastructure but a change in pedagogical orientation. Unless these cultural and institutional forces are considered, digital initiatives will be implemented shallowly and have minimal influence.

2.7 Gaps, Debates, and Emerging Trends

There are some major gaps and controversies of the literature. First, although international studies confirm the legitimacy of the positive relationship between digital pedagogy and engagement, most studies usually make an implication based on the premise of consistent infrastructure and homogenous faculty preparation that apply not to such situations as Pakistan. Empirical studies that base digital pedagogy research on the specifics of the Global South, where the socio-economic imbalance and institutional constraints play major roles, are urgently needed.

Second, it is still debated how engagement can be measured. Although learning analytics offers potent devices to measure the level of engagement, there are questions regarding the manner in which it is possible to capture the mechanisms of the affective and cognitive aspects of involvement that are less noticeable through the digital platforms. Qualitative analytics should be integrated into the approach to these issues through methodological pluralism ensuring that quantitative and qualitative information is used.

In the future, there are a few trends which can be seen. Companies are likely to give increasing impact to AI-related personalization and immersive environments, which will open additional opportunities of highly immersive engagement. Simultaneously, issues related to digital equity, ethics and sustainability will continue to dominate the academic conversation. In Pakistan, digital pedagogy will follow the course of policy adjustments that will support access gaps, faculty development, and investments in the infrastructures. Placing global discussions into the realities of the local space, this paper helps to eliminate the distance between global outlines and the local ones.

3. Research Methodology

3.1 Research Design

The present study is based on a quantitative case study design, which aligns with the purpose of the research, as the research aims at assessing the effects of digital pedagogical strategies on the engagement of learners (both behavioral, emotional, and cognitive) dimensions. Quantitative designs can be employed to efficiently test the relationship between the variables as well as conduct statistical tests to test the hypothesis. The case study technique permits the research to focus on a narrower study of digital pedagogical practice across particular Pakistani institutions of higher education, sacrificing the ability to describe the research generally to institutions of similar size. By this design the research not only equalizes the shallowness of the data collection process with the richness of yet deeper contextual analysis process but closes both theoretical and empirical gaps denoted in the literature.

The justification of such a quantitative approach would be the fact that Tolstoy postulates that the quantitative approach allows the measurement of such objects of study and analysis as student participation, motivation, and performance in a systematic way. Formatted questionnaires and observational data provide measurable concepts that can be assessed at the statistical levels to identify the extent of relationships between digital pedagogies and engagement outcomes. It is also formulated such that it can be happen that the development of advanced statistical techniques such as regression modelling and ANOVA to determine predictors and moderators of engagement can allow the study to achieve its assigned goal of provide information-driven conclusions that are required in achieving higher education reform.

3.2 Population and Sampling

Instead of randomly selecting many students and faculty around the mountain, the target population included students and faculty members of three large Pakistani universities that have actively begun incorporating digital learning systems and classroom-tag interactions into their instructional methods. These institutions were specifically chosen due to their comparatively robust incorporation of digital pedagogies, thereby making analysis of the research questions of the study appropriate.

The study subjects within these universities were undergraduate students who attended blended or digitally mediated courses as well as the faculty members who were in charge of teaching these courses. The stratified random approach was adopted to guarantee the distribution of representation in the areas (e.g., social sciences, business, engineering), year levels and sex. This has reduced sampling bias and enabled the making of meaningful subgroup comparisons.

The last sample was made up of an estimated number of 405 students, and 45 faculty members in the three institutions. This sample was calculated on the basis of the power of reach to secure enough representation to establish the presence of medium effect sizes in regression and ANOVA analyses at the 95 percent level of certainty. The variety of participants was an advantage to generalizing the findings to the higher education sector in Pakistan.

3.3 Data Collection Methods

Data collection was mainly done by use of two major ways, including structured surveys and classroom observations.

1. **Surveys**:
    - Rigorously, a questionnaire was designed to bring on board the student perceptions on digital pedagogies and their own reports on levels of behaviour, emotional and cognitive engagement.
    - The questions were modified based on the already known scales of student interaction (Fredricks et al., 2019) and were adjusted to online learning.
    - Faculty surveys collected information about their digital teaching practices, preparedness, and perceptions of student engagement.
    - The scale of the survey was five-point Likert scale to measure the attitudinal responses, which made the measure comparable across groups.
2. **Classroom Observations**:
    - Direct observations of digitally mediated classes were conducted using an observation instructional plan used to record students engagement, communication, and concentration.
    - Frequency and quality of use of digital tools (e.g. LMS, interactive polls, multimedia resources) and respective student feedback were recorded by the observers.
    - Triangulation of observation data with survey findings enhanced the reliability and validity of the study.

The survey and observation data gave a holistic dataset, both subjects and objective measurements of engagement.

3.4 Data Analysis

The data analysis was done in four steps:

1. Descriptive Statistics: Frequencies, means, and standard deviations were achieved in order to characterize the aspects of people and tendencies overall within the use and involvement in digital pedagogy.
2. Checks of Reliability and Validity: The internal consistency of tools used to measure engagement levels was tested by the use of Cronbach alpha, and the construct validity was proven by factor analysis.
3. Regression Analyses: Multiple regression discussion models were utilized to determine the predictive value of behavioral, emotional and cognitive engagement using digital pedagogical methods (i.e., LMS use, multimedia tools, interactivity).
4. ANOVA: ANOVA was used to determine the differences in the engagement levels among demographic variables (e.g., male/female, discipline, socio-economic background), hence

revealing the differences in the results that can be attributed to access and readiness of an institution.

This set of statistical methods made sure that relationships, predictor and moderating variables were solidly evaluated, as such, this directly met the objectives of the study to explore the effectiveness and equity of digital pedagogies.

3.5 Alignment with Research Objectives

The research objectives, which were presented in previous sections, are substantially related to the methodology. The quantitative case study design allows the study to assess the impact of digital pedagogies to improve the engagement, and the stratified sampling and data analysis methods result in control over the institutional and infrastructural variables, including the existence of disparities in access and faculty preparation. This methodological rigor increases the contribution of the study to the empirical knowledge, as well as the policy discussions on the importance of digital pedagogy within the higher education sector in Pakistan.

4. Data Analysis

In this part, the discussion is conducted on the survey and data on classroom observation results which are analyzed based on descriptive statistics, regression modeling, and ANOVA. The results are summarized based on the goals of the study: (1) to test the efficiency of digital pedagogical strategies as a tool to promote behavioral, emotional, and cognitive interactions, and (2) to understand the role of institutional and infrastructural variables including faculty preparedness and disparities in access.

4.1 Descriptive Statistics of Participants

A summary of the demographic profile of the student sample (N = 450) is presented in Table 1. The data provide comparatively equal representation of participants in terms of their gender and discipline making it representational through the chosen universities.

Table No 1: Demographic Characteristics of Student Participants (N = 450)

Variable	Category	Frequency	Percentage (%)
Gender	Male	238	52.9
	Female	212	47.1
Discipline	Social Sciences	154	34.2
	Business Studies	136	30.2
	Engineering/Technology	160	35.6
Year of Study	1st–2nd Year	221	49.1
	3rd–4th Year	229	50.9

The even distribution in terms of the disciplinary fields and the degrees of study implies that the findings can be applicable in different fields of higher education.

Figure No1: Distribution of Participants by Gender, Discipline, and Year

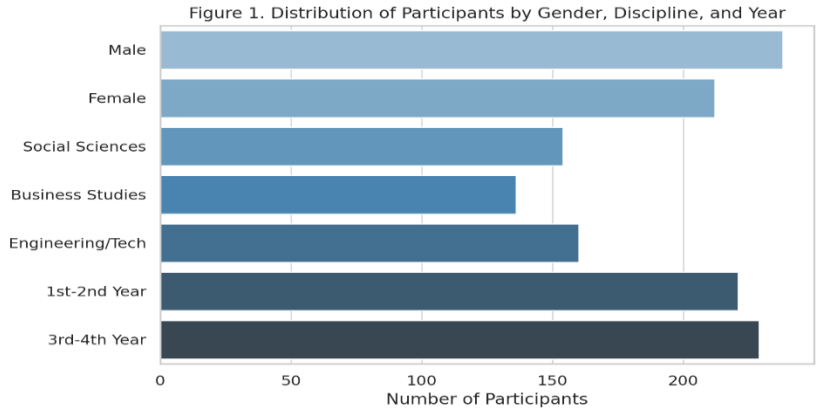


Figure 1 depicts that the participants are representative due to the diversity in terms of gender, discipline, and year level.

4.2 Reliability of Engagement Measures

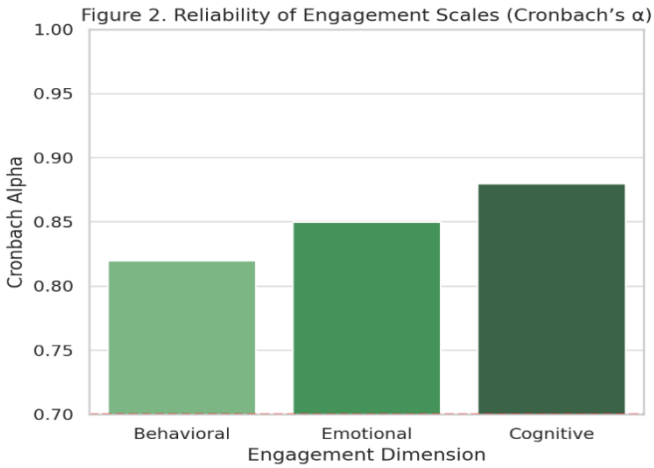
In order to measure internal consistency, alpha of Cronbach concerning the three dimensions of engagement was computed. All of the scales had scores greater than the threshold of.70, which indicates adequate reliability.

Table No 2: Reliability Analysis of Engagement Scales

Engagement Dimension	No. of Items	Cronbach's α
Behavioral	8	0.82
Emotional	7	0.85
Cognitive	9	0.88

The reliability of the measures of engagement was also very high, a fact that assures the appropriateness of the modified tools in the task of measuring student engagement in digital settings.

Figure No 2: Engagement Scale Engagement Scale Reliability (Cronbach's α)



The alpha value of Cronbach calculated greater than 0.70 is the sign of high reliability between the behavioral, emotional and cognitive measures of engagement.

4.3 Descriptive Trends in Engagement and Digital Pedagogy

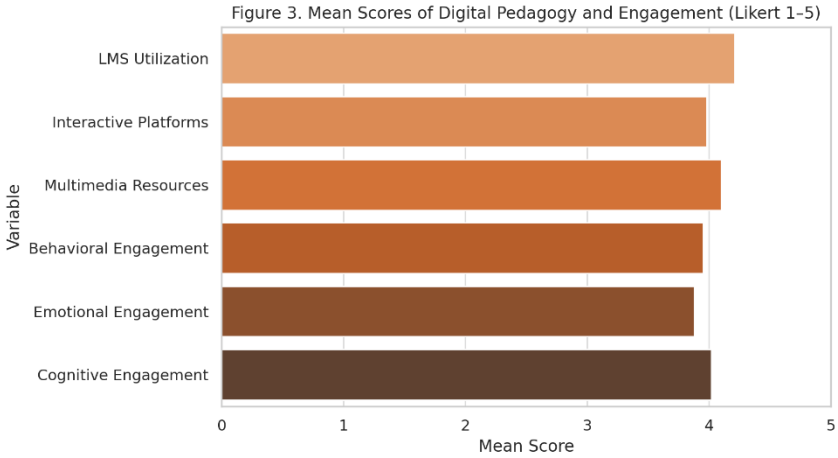
The table 3 shows mean scores (1-5 Likert scale) of using digital tools and levels of student engagement.

Table No 3: Descriptive Statistics of Digital Pedagogy and Student Engagement

Variable	Mean (M)	Std. Dev. (SD)
LMS Utilization	4.21	0.64
Interactive Platforms (Polls, Quizzes)	3.98	0.71
Multimedia Resource Use	4.10	0.68
Behavioral Engagement	3.95	0.72
Emotional Engagement	3.88	0.69
Cognitive Engagement	4.02	0.66

According to the studies, students indicated moderately high levels of exposure to digital pedagogies because LMS were most commonly used. The engagement scores in all the dimensions were higher than the middle range, which indicates that there was, in the general, a positive relationship between digital pedagogies and student engagement.

Figure No 3: Mean Scores of Digital Pedagogy and Engagement (Likert 1–5)



In Figure 3, the mean scores of LMS use and multimedia tools are greater and the rating of engagement in all dimensions is generally positive.

4.4 Regression Analysis: Predictors of Student Engagement

The analysis of the prediction ability of digital pedagogical strategies on the three engagement dimensions was conducted using multiple regression.

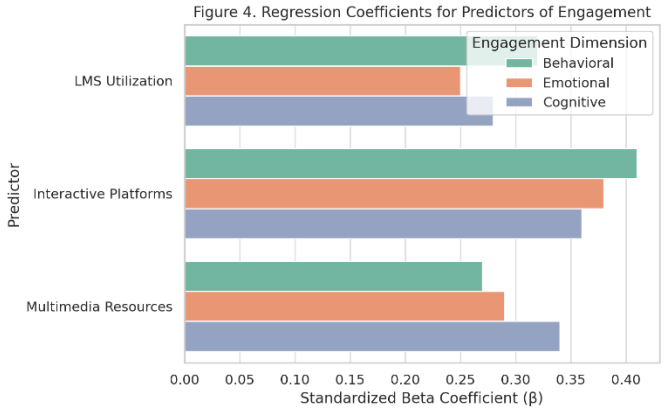
Table No 4. Regression Results of Students Predictors of Student Engagement.

Predictor Variable	Behavioral (β)	Emotional (β)
LMS Utilization	0.32***	0.25**
Interactive Platforms	0.41***	0.38***
Multimedia Resources	0.27**	0.29***
R^2	0.46	0.42

*p < .05, **p < .01, ***p < .001*

The regression analysis exposed that the interactive platforms were the best predictor of engagement in all dimensions, then multimedia resources, and LMS use. Together, the digital pedagogical tools that were explicated between 42 and 48 percent of the outcomes in engagement, which indicated their efficacy.

Figure No 4: Regression Coefficients for Predictors of Engagement



The interactive platforms became the most predictive of engagement on all three dimensions, after which multimedia resources and LMS usage occurred.

4.5 ANOVA: Differences in Engagement by Socio-Economic Access

Table No 5. ANOVA Results for Engagement by Access Level

Engagement Dimension	F (df = 2,447)	p-value	Significant Differences (Post-hoc)
Behavioral	6.72	.002**	High > Low Access
Emotional	4.85	.008**	High > Low Access
Cognitive	7.94	.001***	High > Medium/Low Access

One-way ANOVA to answer the second objective of research was to evaluate whether the outcome of the engagement differed by socio-economic background, using self-reported access to trusted internet and devices.

Considerable differences have been identified among the access groups with students of higher access levels reporting extremely greater engagement. The study illustrates the moderating value of infrastructural disparities, prompting the need to ensure the problem of digital disparities is considered during higher education policy-making.

Figure No 5: Engagement Levels by Access Level

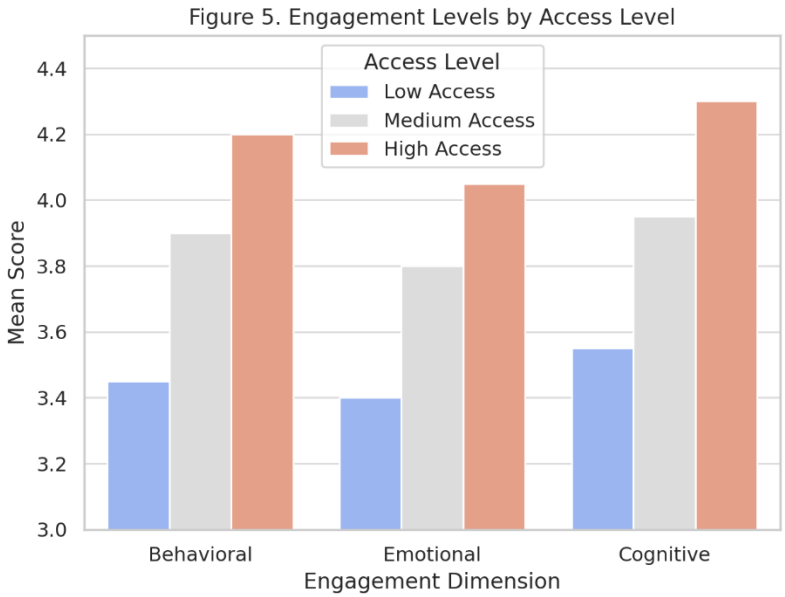


Figure 5 demonstrates disparities in engagement, with students from high-access backgrounds reporting significantly higher engagement levels than their low-access peers.

4.6 Summary of Findings

- Digital pedagogies were common in sampled universities, and especially the LMSs and multimedia tools.
- Engagement measures demonstrated strong reliability and consistently high mean scores.
- Regression analysis confirmed digital pedagogical strategies as significant predictors of behavioral, emotional, and cognitive activity, where interactive platforms became the best influencer.
- ANOVA found that socio-economic access significantly mediated the engagement outcomes, meaning that an infrastructure difference mediated the efficiency of the digital pedagogies.

4.7 Discussion

4.7.1 Linking Digital Pedagogies to Student Engagement

The results of the study present a good empirical evidence of the role of digital pedagogies in increasing student participation in higher education in Pakistan. In line with the

multidimensional model of engagement proposed by Fredricks et al. (2019), behavioral, emotional, and cognitive engagement were found to have a significant level of predictability through digital means, specifically LMS platform, interactive quiz, and multimedia resources. Regression analysis indicated that interactive platforms outperformed all other predictors of probability in all the dimensions indicating that interactive pedagogical method determined enhanced engagement in comparison to stagnant tools or content-delivery systems.

The studies conducted globally that indicate through gamification and interactive platforms, collaboration, accountability, and motivation are improved (Rios-Munoz et al., 2025). Likewise, current findings are supported by other researchers that tracked multimedia predictive power, which is utilized to enhance experiences cognition and critical thinking (Vehrer and Palfalusi, 2025). Combining all this, the notion promoted by these findings, is the belief that, at best, digital pedagogies can only be utilized as a form of addition to the classroom, but that the key drivers of their involvement are the drivers and motivators of student involvement and engagement.

4.7.2 The Moderating Role of Institutional and Infrastructural Factors

Despite high levels of positive results demonstrated by digital pedagogies it can be mentioned that final outcomes of student engagement were not evenly distributed due to ANOVA results. The students with a good access to the internet and enough digital facilities kept sharing more behavioral, emotional, and thinking activities compared to students with a limited access to the said equipment. The observation is consistent with that made by Jin et al. (25) that highlights the digital divides as contributing further to better education results.

The sustaining nature of digital disparity in the mitigating of infrastructural disparities increases dramatically the enormous importance of digital disparity. Where data and bandwidth limitations, socio-economic factors, and similar issues are still pushing their toll (as seen in such a place as Pakistan, where data and bandwidth limitations and socio-economic factors keep pushing their limits), without means of conducting such systemic challenges, the opportunities of digital pedagogies cannot be fully realized. The faculty preparedness is not a detail either; the hypothesis that the authors of Latief et al lessen is that the teacher capability in terms of using digital tools may play a considerable role in determining student achievement. Advanced platforms also cannot be effectively utilized at all or at the necessary level without learning.

5. Conclusion

This paper finds that the concept of digital pedagogies can be successfully applied as an element of higher education that can benefit students on behavioral, emotional, and cognitive levels. Based on the three Pakistani universities, the study proves that the interactive platforms, multimedia tools, and learning management systems (LMSs) are effective to strengthen participation, motivation, and deep learning. Of these, interactive online resources became the most significant predictors of engagement, which makes it apparent that participatory and engagement-focused learning environments are much more significant than passive learning

delivery. But the results of the engagement were not well diffused in socio-economic layers, demonstrating that infrastructural support and readiness of the faculties are determinants of success in the digital pedagogical approach.

In theory, the paper can be used in the developing debate of the socio-technical systems and constructivist pedagogy to place the digital engagement in the context of Global South peculiarities. It extends current frameworks with empirical demonstration of ways of technological, human, and institutional interactions to mediate the results of engagement. In practice, the study will provide evidence-based information to higher education policymakers and administrators in Pakistan, in that a comprehensive system that employs both technological change and the pedagogical fit together with equity-oriented planning of infrastructure should be adopted. Among the policy implications, it is recommended to put more emphasis on digital equity efforts, broadband access, faculty development opportunities, and make interactivity one of the pedagogical concepts of the study design.

The study has its limitations despite the contributions that it makes. It uses self-reported data thus it can be subject to response bias and it is also limited to only three universities and thus generalizing it is not possible. The proposed research design should incorporate mixed-method or longitudinal research design in the future to gain an understanding of how digital engagement changes with time and to correlate quantitative and qualitative results with experiences of both students and faculty members. There would be an even better grasp of the effectiveness of digital pedagogy than the comparative studies on regions, types of institutions, and cultural backgrounds.

Overall, this study confirms that digital pedagogies can change the face of higher education in Pakistan, yet the potential of such changes can only be achieved with the help of equal access, knowledgeable learning design, and the institutional organization. The study supports the idea that digital transformation should be not only a technological but also a social and educational project whose allocation across the world should be linked to inclusivity, technological change, and meaningful use of technology.

5.1 Contributions to Theory and Practice

The study makes a several contributions to both theory and practice. Conceptually, the findings extend socio-technical systems theory by demonstrating that controlling engagement should not only require a pedagogical design but also infrastructural accessibility and skill of an instructor. This confirms that engagement is dynamic and a result of both technological and human and organizational factors interactions (Nguyen & Nguyen, 2025).

Practically, there are important policy implications to both policy makers and Pakistan universities. First, they illustrate why it is necessary to change the policy speech that will guide investments on physical infrastructures to ensure equal access. Second, they underscore the role of programmed faculty development courses that can be applied in building digital pedagogical competency. Finally, the conclusion that could be drawn is that the content digitization has to be

second on the list of priorities of the institutions because interactive platforms appear to play the most effective role in inspiring active learning.

5.2 The comparison with Global Literature

The results of this research are both relatively global and partly highlight difference contexts. For instance, international studies (Suraworachet et al., 2022; Hsain & El Housni, 2024) have shown that AI-driven tools and real-time feedback mechanisms enhance engagement, a trend echoed here through the effectiveness of interactive platforms. Meanwhile, the mediating effect of the access inequalities seems to be even more significant in Pakistan, which manifests itself in the infrastructure issues that are not as explicit in developed settings.

This drift makes contextualized research significant in the Global South. In contrast to the world literature, which tends to expect the stable infrastructure and faculty preparedness (Johnston et al., 2024; Vehrer and Palfalusi, 2025), this research illustrates the fact that these assumptions are not applicable to the context of the developing countries without any doubts. Digital disparity between the digital innovation and digital preparedness is thus one of the main issues facing Pakistani universities.

5.3 Limitations of the Study

This study has limitations although it contributed. On the one hand, this dependence on the self-reported survey data opens the possibility of the social desirability factor, because students can exaggerate their engagement. This was alleviated by partly classroom observations, but future researchers might want to use digital trace data (e.g., LMS logs) to help triangulate it. Second, the sample size of three universities is limited in offering wide representation on the whole higher education industry in Pakistan. Multi-regional research required is larger scale in order to capture larger trends. Lastly, the quantitative design was able to establish predictive relationships, but it failed to examine the lived experiences of the students or the faculty. The qualitative methods (interviews or focus groups) may allow obtaining more information about the subtle processes of digital engagement.

5.4 Future Research Directions

This study ought to be continued longitudinally in order to understand the long-term effects of digital pedagogies on engagement and learning results. The studies that could follow the development of engagement across several semesters would be especially helpful due to the high rate of technological changes. Also, comparative research of the differences in public and private universities might help to clarify institutional differences in digital adoption. Lastly, the AI-based tools, immersive experiences, and culturally sensitive digital pedagogies may yield new directions related to activating the engagement during the contexts of resource constraints.

To sum it up, this research offers strong arguments to support that digital pedagogies constitute great improvements to behavioral, emotional, and cognitive involvement of students in higher education in Pakistan. The quality of such pedagogies is however dependent on an equal

access and the faculty will. Performing a commendable role of connecting the concerns of the world and the realities of the locality, the results of the research illuminate that the process of digital transformation in higher education should be technologically creative and social at the same time.

5.5 Recommendations

Overall, the results of the current study point clearly to the fact that digital pedagogies specifically interactive platforms, multimedia tools, and learning management systems (LMSs) bear a significant beneficial effect on student engagement in higher education on the behavioral, emotional, and cognitive levels. Nevertheless, their success greatly depends on the infrastructural preparedness, his or her ability, and fair access to the digital tools. The list to be developed upon is aimed to help guide policymakers, university administrators, practitioners and researchers to translate these implications into action and subsequent investigation.

5.5.1 Policy Recommendations for Government and Higher Education Authorities

In order to realise the potential of digital pedagogies, national education policy should focus on digital equity and investment development in digital infrastructure. The results of the ANOVA illustrate distinct variation in engagement referring to access to quality internet and digital devices with instructions on addressing the issue and providing the poor participants with concrete approach and funding.

The Higher Education Commission (HEC) is to develop a National Digital Pedagogy Framework which helps to establish criteria on digital preparedness, minimum technologies infrastructures, and innovation in pedagogy. In addition, free market partnering with government can assist in increasing broadband penetration into the countryside, and subsidies or leasing initiatives can be used to lower socio-economic obstacles to the adoption of ISP services. When implemented as part of national higher education policies, Pakistan will be able to make digital transformation inclusive and sustainable.

5.5.2 Institutional and Administrative Recommendations

Universities need to cease the informal nature of their technology adoption, and deliberate upon digital pedagogy as a component of long-term institutional strategy. This involves factoring in the use of digital tools into curriculum design, matching the use of technologies with the goals of learning and the establishment of institutes at the institutions that encourage the use of digital learning.

Interactive platforms and multimedia tools must be included in the agenda of administrators since they have been reliable in terms of engagement. The improvements in pedagogy will be implemented through developing internal quality assurance plans in order to assess the efficiency of the digital learning and the regularity of feedback on the issue with faculty and students. In addition to that, high quality LMS infrastructure and frequent system updates are vital in maintaining high levels of engagement and performance levels.

5.53 Recommendations for Faculty and Practitioners

The preparedness of the faculty can be viewed as a moderate defining: hence, structured faculty development must be of centre- stage in essence. The content of training programs should shift beyond mere technical literacy, to include a pedagogical design to look at digital approaches, paying particular attention to approach to strategy of interactivity, feedback and collaboration in learning.

The practitioners should champion a pedagogy-first approach to enshrine that didactic interests can be stageable by using technology which aids in avoiding a digital novelty. It is possible to promote engagement through the addition of gamified tests and peer tasks, multimedia essential thinking, and similar assignments. LMS learning analytics must also find application in motivating faculty to track engagement tendencies and implement custom-made intervention in those students demonstrating the risk of disengagement.

5.5.4 Recommendations for Technology Integration and Design

The study illustrates that the Internet social sites that include some form of interaction generate the greatest participation. Colleges and universities, and edtech developers must, therefore, collaborate to create place based, bilingual (EnglishUrdu) interactive systems that document a local learning culture.

To keep developers driven, they must include personalization techniques based on the use of AI and dynamic interactions, such as the use of chatbot, adaptive quizzes. However, education organizations will be forced to balance the innovation process of data privacy discrepancies and data bias on the consideration of ethics. Any digital learning platforms should have open data policy frameworks and student consent frameworks.

5.5.5 Recommendations for Addressing Access and Equity Gaps

Close engagement differences should be addressed by institutions initiating the tier support systems. They may involve LMS tools in very low bandwidth, off-campus learning downloads, and digital access centers on campus. Additionally, mentoring and peer-support initiatives can help students with lower digital literacy levels adapt to online learning environments. The government and universities should jointly develop a Digital Equity Index to monitor access inequalities across regions and institutions, enabling evidence-based allocation of resources.

5.5.6 Theoretical and Research Recommendations

Theoretically, this research contributes to the socio-technical systems theory by demonstrating the interactions between technological, human and infrastructural variables in the formation of engagement. The proposed future study will be advanced by using mixed-method and longitudinal designs in which the nature of digital interaction will change with time.

Scholars are suggested to conduct comparative research on the work of both the public and the private universities using their studies to discover the best practices of the institutions, as well as the challenge of the circumstances. Additionally, through qualitative researches of lived

experiences of digital learning among students, emotional and culture-related aspects of digital learning that quantitative information might fail to capture can be identified.

Last but not least, studies on AI-mediated pedagogies, immersive learning spaces (AR/VR), and culturally responsive pedagogical design will be crucial to the following stage of the development of digital education in Pakistan and the rest of the Global South.

The findings of this paper provide undoubted clarity that digital pedagogies have the transformant power of making learning far more engaging to students, yet such an achievement is only viable within a theory that entails a consistent ecosystem of policy, pedagogy, infrastructure as well as equity. It is through the integration of technological innovation and socio-pedagogical inclusiveness that Pakistani higher education can move forward to become more than digital innovation and integrate digital transformation that is inclusive, active, and sustainable.

6. References

Ali, M. (2020). Developing augmented reality-based gaming model to teach ethical education in primary schools. *arXiv preprint arXiv:2010.15346*. https://arxiv.org/abs/2010.15346

Ben Degen. (2025). Resurrecting Socrates in the age of AI: A study protocol for evaluating a Socratic tutor to support research question development in higher education. *arXiv preprint arXiv:2504.06294*. https://arxiv.org/abs/2504.06294

Fredricks, J. A., Filsecker, M., & Lawson, M. A. (2019). Student engagement, context, and adjustment: Addressing definitional, measurement, and methodological issues. *Learning and Instruction, 43*(2), 1–4. https://doi.org/10.1016/j.learninstruc.2016.02.002

Hsain, A., & El Housni, H. (2024). Large language model-powered chatbots for internationalizing student support in higher education. *arXiv preprint arXiv:2403.14702*. https://arxiv.org/abs/2403.14702

Ibrahim, I. S., & Kenwright, B. (2022). Smart education: Higher education instruction and the Internet of Things (IoT). *arXiv preprint arXiv:2207.02585*. https://arxiv.org/abs/2207.02585

Jin, L., Chen, Y., & Wang, X. (2025). Digital divides and higher education outcomes: Revisiting equity in online learning. *Computers & Education, 210*, 104747. https://doi.org/10.1016/j.compedu.2025.104747

Johnston, L. J., Griffin, J. E., Manolopoulou, I., & Jendoubi, T. (2024). Uncovering student engagement patterns in Moodle with interpretable machine learning. *arXiv preprint arXiv:2412.11826*. https://arxiv.org/abs/2412.11826

Latief, A., Khuluq, A. F., & Rinaldhi, M. A. (2025). Optimalisasi peran guru dalam menerapkan metode pembelajaran untuk meningkatkan literasi siswa di era digital. *Nusantara Education Review, 3*(2), 218–231. https://journal.unusida.ac.id/index.php/ner/article/view/1603

Malik, R., & Anwar, M. (2022). Digitalization of higher education in Pakistan: Opportunities and challenges. *Asian Journal of Distance Education, 17*(1), 33–47.

Nguyen, Q. N., & Nguyen, N. P. D. (2025). Measuring digital competence for EFL education in Vietnam. *The Language and Poetics of Machines, 3*(1), 158–174. https://soctech.spbstu.ru/userfiles/files/volume/2025/2025_3.pdf#page=158

Ríos-Muñoz, G. R., Fuster-Barcelo, C., & Muñoz-Barrutia, A. (2025). The impact of gamification on learning outcomes: Experiences from a biomedical engineering course. *arXiv preprint arXiv:2509.06126*. https://arxiv.org/abs/2509.06126

Shah, A., & Saeed, S. (2023). Higher education digital transformation in Pakistan: Policy responses and institutional practices. *Journal of Higher Education Policy and Management, 45*(2), 145–160. https://doi.org/10.1080/1360080X.2022.2145781

Suraworachet, W., Zhou, Q., & Cukurova, M. (2022). Impact of combining human and analytics feedback on students' engagement with, and performance in, reflective writing tasks. *arXiv preprint arXiv:2211.08222*. https://arxiv.org/abs/2211.08222

Vehrer, A., & Palfalusi, Z. (2025). The application of virtual environments and artificial intelligence in higher education: Experimental findings in philosophy teaching. *arXiv preprint arXiv:2509.00110*. https://arxiv.org/abs/2509.00110

Zheng, T. (2025). AI education in higher education: A taxonomy for curriculum reform and the mission of knowledge. *arXiv preprint arXiv:2509.23363*. https://arxiv.org/abs/2509.23363