ASSESSING THE IMPACT OF DIGITAL LEARNING ON ACHIEVING SDG 4 IN HIGHER EDUCATION IN PAKISTAN

Zohaib Hassan Sain[1], **Sitti Nurtina**[2]
[1] *Superior University, Pakistan,* [2]*Universitas Bina Mandiri Gorontalo, Indonesia*
Email ID: zohaib3746@gmail.com

ABSTRACT

Digital learning integration in higher education is a crucial approach to support the attainment of SDG 4, which aims to provide inclusive and fair quality education for everyone. This research aims to evaluate the influence of digital learning programs on the attainment of Sustainable Development Goal 4 in higher education institutions in Pakistan. Implementing a mixed-methods research approach, the study included a comprehensive survey of 384 individuals, including students, teachers, and administrators from various institutions. Additionally, semi-structured interviews were performed with relevant stakeholders. For quantitative analysis, the sample size was determined using Cochran's method. The results demonstrate a strong and positive correlation between digital learning programs and achieving Sustainable Development Goal 4. The regression analysis produced an F-value of 15.47 and a p-value of less than 0.001. Analysis of descriptive data reveals that the average efficacy of digital learning is 3.8 out of 5 points, with significant variations between urban and rural institutions (ANOVA, $F = 23.72$, $p < 0.001$). A thematic analysis of qualitative data reveals significant obstacles, such as infrastructure and digital literacy deficiencies, and emphasises the need for institutional preparedness and legislative backing. The research findings indicate that while digital learning benefits the attainment of Sustainable Development Goal 4, specific measures are necessary to tackle the digital literacy gap and improve the quality of digital education. The implications of these results are of great importance for policymakers and educators in their efforts to advance fair access and excellence in higher education by using digital learning methodologies.

Keywords: Digital Divide, Digital Learning, Higher Education, Pakistan, SDG 4.

INTRODUCTION

Overview of SDG 4: Global and Local Significance

The United Nations (2015) has set Sustainable Development Goal 4 (SDG 4) to achieve the objective of "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all" by the year 2030. A solid foundation for sustainable development is provided by high-quality education, which promotes economic expansion, social integration, and personal empowerment. The aims established under SDG 4 have been pursued globally, explicitly focusing on poor nations characterised by widespread educational disparities (UNESCO, 2019). The

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education industry in Pakistan encounters many complex issues, such as restricted availability, gender inequalities, and inconsistent quality across urban and rural regions (Government of Pakistan, 2020). Given the growing emphasis on attaining Sustainable Development Goal 4, it is necessary to investigate creative approaches that may close the disparities in the current educational system and provide fair and equal access to high-quality education services.

Digital Learning as a Tool for Achieving SDG 4

Through improving access, quality, and fairness in education, digital learning has become a significant facilitator in accomplishing SDG 4 (World Bank, 2021). Implementing digital learning technologies, including online courses, e-learning platforms, mobile learning applications, and virtual classrooms, can surmount geographical and socio-economic obstacles, granting educational opportunities to marginalised and underserved populations (Salmi, 2020). Empirical evidence suggests that digital learning has the potential to significantly impact and promote lifelong learning and the acquisition of essential skills for the modern day (Means et al., 2020). Moreover, digital technologies have the potential to enhance instructional results and provide customised learning experiences by using adaptive learning systems and data-driven insights (Anderson & Rainie, 2021). Nevertheless, successfully incorporating digital learning requires thorough approaches, sufficient infrastructure, and skilled instructors to synchronise with the objectives of Sustainable Development Goal 4.

Higher Education in Pakistan: Current Digital Learning Landscape

Higher education institutions in Pakistan are progressively incorporating digital learning into their teaching and learning practices, particularly in reaction to the COVID-19 epidemic, which expedited the transition to online education (Higher Education Commission of Pakistan, 2021). Even with these progresses, the integration of digital learning in higher education institutions in Pakistan still needs to be consistent, with notable disparities in the availability of digital resources, internet connection, and teaching methods between urban and rural institutions (Iqbal et al., 2022) A critical evaluation of the penetration and efficiency of the various initiatives launched by the Higher Education Commission of Pakistan to promote digital learning and capacity-building among professors and students is necessary (HEC, 2021). Although digital learning has significant promise for attaining Sustainable Development Goal 4 in Pakistan, many obstacles concerning infrastructure, digital literacy, and socio-cultural aspects must be resolved to ensure its maximum effectiveness.

Digital Learning Challenges and Opportunities for SDG 4 in Pakistan

Using digital learning in Pakistan's higher education poses obstacles and prospects for attaining Sustainable Development Goal 4. One notable obstacle is the digital divide, marked by the inequitable availability of digital devices and internet connection, especially in rural regions (Rehman et al., 2022). This gap intensifies pre-existing educational disparities and obstructs the achievement of SDG 4 objectives. Furthermore, it is necessary to enhance the skills and abilities of educators in order to use digital resources for teaching and learning proficiently (Khan et al., 2023). Furthermore, the fast progress in technology and the increasing number of young people provide a chance to use digital learning to deliver fair and high-

quality education (Mahmood, 2021). Policy interventions, public-private collaborations, and new finance methods are essential for developing a digital learning ecosystem that supports SDG 4 (Ali et al., 2022).

Significance of the Research and Research Objectives

Based on the present state of digital learning in higher education in Pakistan, this study intends to thoroughly evaluate the influence of digital learning programs on attaining Sustainable Development Goal 4. Through an evidence-based investigation of the efficacy, constraints, and potential of digital learning in Pakistani Higher Education Institutions (HEIs), this research will enhance the current knowledge base. The study will investigate the determinants of digital learning uptake, the overall quality of digital education, and its contribution to ensuring fair and equal access to higher education (Saeed & Fatima, 2023). The objective of this study is to provide information to policymakers, educators, and stakeholders in order to enhance the development of digital learning policies that are more inclusive and effective, in line with the objectives of Sustainable Development Goal 4 (UNESCO, 2022). The outcomes of this research will be of great importance in determining the future trajectory of higher education in Pakistan and guaranteeing its alignment with the sustainable development goals.

Research Problem Statement

Notwithstanding the growing focus on digital learning as a revolutionary instrument to accomplish Sustainable Development Goal 4 (SDG 4) - guaranteeing inclusive and fair quality education and fostering lifelong learning opportunities - higher education institutions in Pakistan encounter substantial obstacles in efficiently utilising digital platforms to fulfil these objectives. Although the COVID-19 pandemic has expedited the incorporation of digital learning by requiring a swift transition to online education, the current inequalities in digital infrastructure, digital literacy, and resource distribution have led to unequal access to high-quality education among various regions and socio-economic groups in Pakistan (Ahmad et al., 2022). Particularly in rural regions where internet connection, access to digital devices, and sufficient digital skills are notably lacking, the digital divide remains a crucial obstacle (Zia & Iqbal, 2023). Moreover, empirical data regarding the efficacy of digital learning in improving educational results and reducing educational disparities within the framework of higher education in Pakistan is still being determined. This raises serious doubts about the extent to which existing digital learning efforts are genuinely promoting the goals of Sustainable Development Goal 4 (Hussain et al., 2024).

Challenges in faculty readiness, curricular adaptation, and technical infrastructure directly impact the quality and inclusiveness of digital learning experiences in higher education institutions in Pakistan (Anwar & Ali, 2023). Numerous institutions must improve strategic frameworks and resources to incorporate digital learning into their academic programs, leading to a disparity between policy objectives and actual execution (Khan et al., 2023). Moreover, the rapid transition to online learning has shown the deficiencies of the current education system in terms of theoretical methods and the preparedness of both students and teachers to adjust to a digital-focused setting (Rehman & Yaseen, 2022). Consequently, students from well-funded urban institutions have had different educational experiences and results than their peers in under-resourced rural settings. This has exacerbated the

inequality gap instead of narrowing it (Siddiqui & Jamal, 2022).

Moreover, there needs to be more in-depth academic research that rigorously evaluates the impact of digital learning programs on achieving SDG 4 objectives within the context of higher education in Pakistan (Ahmed et al., 2024). Current research tends to focus on the general benefits of digital learning without thoroughly examining its specific contributions to the SDG 4 framework, such as promoting inclusive education, enhancing quality, and providing lifelong learning opportunities (Mustafa & Fatima, 2024). The existing literature needs to provide an adequate assessment of the impact of digital learning on educational quality and equality. Therefore, there is a pressing need for empirical research that not only analyses this impact but also investigates the key factors that influence its effectiveness in the unique context of Pakistan (Naseem et al., 2023).

Given these challenges, it is imperative to explore the strategic integration of digital learning into higher education to facilitate the achievement of SDG 4 in Pakistan. The goal of this study is to bridge the current knowledge gaps by examining the effectiveness of digital learning programs in higher education institutions in Pakistan. It seeks to identify the barriers to their successful implementation and propose methodologies that could enhance their impact on SDG 4. Through an evidence-based analysis, this study aims to provide policymakers, educators, and stakeholders with valuable insights to develop more targeted interventions that promote inclusive and equitable quality education in Pakistan through digital learning (Asghar & Qureshi, 2023).

Research Question

A precise research question is developed to adequately fill the gaps highlighted in the issue description and provide a clear path for this investigation. The objective of this inquiry is to examine the influence of digital learning on attaining Sustainable Development Goal 4 in higher education institutions in Pakistan, taking into account the existing obstacles and possibilities within the specific local setting. The research topic is formulated to direct the investigation towards a thorough comprehension of how digital learning may be maximised to improve the quality and inclusiveness of education by the goals of Sustainable Development Goal 4.

Research Question 1: How does integrating digital learning methods affect the advancement of Sustainable Development Goal 4 (SDG 4) in higher education institutions in Pakistan?

Research Question 2: What are the primary challenges and opportunities linked to implementing digital learning in this context?

This study focuses on evaluating the efficacy of digital learning in advancing inclusive and fair quality education, discerning the obstacles to its successful implementation, and investigating possible approaches to optimising its impact on attaining SDG 4 in Pakistan.

Research Hypothesis

A precise and concise hypothesis is required to direct the empirical examination of the study based on the research topic. The hypothesis will provide a verifiable assertion that can be assessed by data gathering and analysis methods, with a specific emphasis on the efficacy and influence of digital learning programs in attaining SDG 4 in higher education institutions in Pakistan. This hypothesis aims to establish a correlation between the adoption of digital learning and the improvement of educational quality, inclusiveness, and accessibility, as envisioned in Sustainable Development Goal 4.

H_0: Digital learning initiatives do not significantly impact the achievement of SDG 4 in higher education in Pakistan.

H_1: Digital learning initiatives significantly impact the achievement of SDG 4 in higher education in Pakistan.

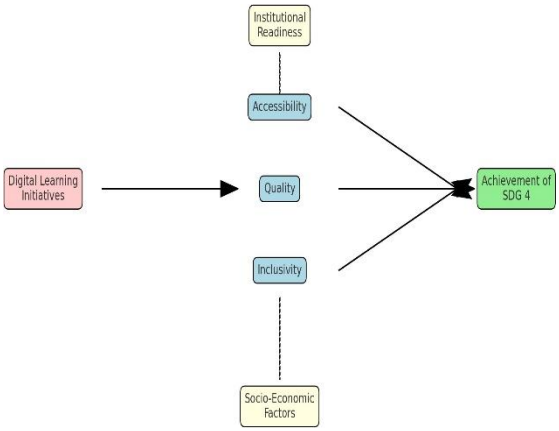
The validity of this hypothesis will be assessed by analysing different digital learning projects and their results in terms of educational excellence and inclusiveness and identifying the obstacles and facilitators within the framework of Pakistan's higher education system.

Conceptual Framework

The conceptual framework visually maps out the interconnections between critical variables and concepts to be investigated in a study. In the context of the chosen research topic, "Assessing the Impact of Digital Learning on Achieving SDG 4 in Higher Education Institutions in Pakistan," the conceptual framework will elucidate how digital learning initiatives can influence the attainment of SDG 4, taking into account factors such as accessibility, quality, inclusivity, and the impediments and facilitators involved in this process. The framework emphasizes the influence of digital learning initiatives on attaining Sustainable Development Goal 4 (SDG 4) in higher education institutions in Pakistan. This influence is shaped by factors such as accessibility, quality, and inclusivity and is moderated by institutional readiness and socio-economic conditions.

Figure 1

Conceptual Framework



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Literature Review

Digital learning has become a powerful and revolutionary influence in education, fundamentally changing conventional learning models and offering adaptable, readily available, and customised learning opportunities. The research suggests that digital learning technologies, such as online courses, e-learning platforms, mobile apps, and virtual classrooms, can augment student involvement, increase learning results, and foster lifelong learning (Means et al., 2021). Throughout higher education, digital learning enables the cultivating of crucial 21st-century abilities such as critical thinking, cooperation, and digital literacy (Kirkwood & Price, 2021). To fulfil Sustainable Development Goal 4 (SDG 4), which aims to provide inclusive and fair quality education, digital learning emerges as a crucial approach to surmounting conventional obstacles to access and inclusion (United Nations, 2023). Research has shown that digital learning may contribute to achieving SDG 4 objectives by offering creative and expandable methods for providing high-quality education to various groups, especially in non-industrialised nations (Robinson et al., 2023).

Integrating digital learning into higher education has been identified as crucial in attaining Sustainable Development Goal 4, especially in advancing fair and equal

access to high-quality education (Hegarty et al., 2022). Digital learning applications have been shown to facilitate inclusive education by providing adaptable learning settings that accommodate students with diverse requirements, especially those from underprivileged areas (Tomczyk & Walker, 2022). Furthermore, digital platforms can potentially democratise the availability of high-quality education by eliminating geographical limitations and offering cost-efficient alternatives for educational institutions that lack sufficient resources (Chen & Carless, 2023). An investigation conducted by Baek and Monaghan (2023) highlights the efficacy of blended learning methods that integrate digital and in-person learning. These methods successfully improve student engagement and achievement in various educational settings. Nevertheless, the effectiveness of digital learning in supporting SDG 4 relies on many requirements, such as technical infrastructure, digital literacy, and the capacity of educational institutions to successfully incorporate digital technologies (Palvia et al., 2023).

Despite the possible advantages of digital learning in attaining Sustainable Development Goal 4, various obstacles hinder its successful integration into higher education, particularly in developing nations such as Pakistan. Conditions such as insufficient digital infrastructure, restricted availability of high-speed internet, and a deficiency of digital competencies among teachers and students substantially impact the acceptance and efficacy of digital learning (Aslam et al., 2024). Furthermore, the absence of strategic planning and assistance from educational institutions and government agencies worsens the scenario, resulting in inequalities in digital learning experiences across various areas and socio-economic classes (Nazir et al., 2023). In Pakistan, the rapid transition to digital learning during the COVID-19 epidemic revealed the preexisting deficiencies in the education system's preparedness to use digital platforms, resulting in diverse educational results (Naseer & Raza, 2024). These issues emphasise the importance of adopting a thorough strategy to overcome the obstacles to digital learning and improve its effectiveness in meeting SDG 4 objectives.

The digital gap continues to be a crucial obstacle to effectively executing digital learning programs in attaining SDG 4, especially in nations with substantial socio-economic inequalities. The gap is defined by the uneven availability of digital resources, such as devices, internet access, and digital competencies, which disproportionately impact pupils from rural and low-income populations (Malik & Hussain, 2023). Zubair and Farooq's (2024) study demonstrates that the digital gap in Pakistan not only obstructs the availability of high-quality education but also exacerbates pre-existing disparities, defying the fundamental goals of SDG 4. Resolving the digital gap requires comprehensive measures that include allocating resources to digital infrastructure, providing inexpensive internet connectivity, and implementing digital literacy initiatives, particularly in disadvantaged areas (Iqbal et al., 2023). The need to bridge the digital gap is crucial to guarantee that digital learning significantly contributes to inclusive and fair education in Pakistan.

The preparedness of higher education institutions to embrace and execute digital learning is a crucial determinant in harnessing the potential of digital learning to accomplish Sustainable Development Goal 4. Institutional preparedness involves several aspects, such as technical infrastructure, faculty training, curriculum design, and policy support (Shah &

Ahmed, 2024). The level of preparedness across higher education institutions in Pakistan has demonstrated considerable variation, with metropolitan universities with ample resources being better equipped than their rural counterparts (Ali & Bano, 2024). Policy frameworks at the national and institutional levels are crucial in advancing digital learning by providing rules, financing, and support for programs to enhance capabilities (Jamil & Qazi, 2024). For digital learning to effectively contribute to attaining Sustainable Development Goal 4 in Pakistan, it is imperative to establish a cohesive policy framework that promotes innovation, cooperation, and sustainability in digital education methods.

RESEARCH METHODOLOGY

Research Design

The present study will use a mixed-methods research design, integrating qualitative and quantitative methodologies, to thoroughly examine the impact of digital learning efforts on the attainment of Sustainable Development Goal 4 at higher education institutions in Pakistan. To capture numerical data and in-depth insights, a mixed-methods design is selected to enable a robust examination of the relationships between digital learning, educational quality, inclusivity, accessibility, and the mediating and moderating variables identified in the conceptual framework (Creswell & Plano Clark, 2018). Measurements of the effect of digital learning will be obtained via quantitative data collected through surveys. At the same time, interviews and focus group discussions will be used to get qualitative data that will provide a more comprehensive picture of stakeholders' issues, experiences, and perspectives.

Population and Sampling

The study's target audience will include students, faculty members, and administrative personnel from diverse higher education institutions in Pakistan's urban and rural areas. The study will use a stratified random sampling method to guarantee comprehensive representation from various categories of institutions (public, private, urban, rural) and demographic groupings. To get a statistically significant sample size with a 95% confidence level and a 5% margin of error, the sample size will be calculated using Cochran's method for an infinite population (Cochran, 1977). An approximate sample size of 300-400 participants is enough to reflect the varied educational environment in Pakistan accurately.

Data Collection Methods

Quantitative Data Collection: A meticulously designed survey questionnaire will be created and disseminated to the chosen audience of students, teachers, and administrative personnel. The survey will consist of closed-ended questions and Likert-scale items designed to evaluate participants' views on the efficacy of digital learning tools, the quality of education delivered via digital methods, and its congruence with SDG 4 objectives. Online survey administration will use platforms like Google Forms or Qualtrics to guarantee broad accessibility and ease (Fowler, 2014).

Qualitative Data Collection: In addition to the quantitative data, we will conduct semi-structured interviews and focus group discussions with key stakeholders, including university administrators, policymakers, faculty members, and students, to provide a qualitative perspective to our research. In-depth interviews will be conducted to explore the obstacles and enablers of digital learning, the preparedness of institutions, and the policy consequences. Each interview will be roughly 30-45

minutes, while focus groups will run around 60-90 minutes. These sessions may be performed either in person or via online platforms such as Zoom, depending on the degree of accessibility (Rubin & Rubin, 2012).

Data Analysis Methods

Quantitative Data Analysis: The survey data will undergo analysis using descriptive statistics (mean, median, mode) to summarize the data and inferential statistics (regression analysis, ANOVA) to examine the relationships between digital learning and the achievement of SDG 4 targets. We plan to use statistical software such as SPSS for these analyses. Specifically, the regression analysis will help us understand how digital learning initiatives (independent variables) impact educational quality, inclusivity, and accessibility (dependent variables) in the context of higher education in Pakistan (Field, 2018).

Qualitative Data Analysis: The qualitative data obtained from interviews and focus groups will undergo thematic analysis to systematically examine and uncover recurring patterns and topics about the difficulties, possibilities, and influence of digital learning on SDG 4. For a comprehensive analysis of recurring themes and stakeholder viewpoints, the data will undergo coding and organization using NVivo software (Braun & Clarke, 2006). Integrating qualitative and quantitative data will improve the validity and dependability of the results by providing a comprehensive view of the study topic.

Ethical Considerations

The present study will adhere to strict ethical principles to ensure the integrity of the research process. Participants will receive a detailed information sheet outlining the study's objectives, methodologies, potential risks, and benefits. Informed consent will be obtained from all participants before data collection. Participants will have the right to withdraw from the research without facing any consequences. Data confidentiality and anonymity will be maintained through unique participant IDs and secure, password-protected information storage (Bryman, 2016). Additionally, the study will obtain ethical clearance from the appropriate Institutional Review Board (IRB) before commencing data collection.

RESEARCH FINDINGS

Sample Size Determination using Cochran's Formula

Cochran's formula calculates an ideal sample size for a study with a large or unknown population. The formula is:

$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Tabel 1

Sample Size Determination Using Cochran's Formula

Parameter	Value
Z (Z-value)	1.96
p (Proportion)	0.5
1- p (Complement)	0.5
e (Margin of Error)	0.05
n_0 (Sample Size)	384

Source: Created by the author

The study requires a sample size of around 384 participants, deemed adequate for obtaining statistically significant results.

Data Collection Methods

Quantitative Data Collection: An organized questionnaire survey was conducted with 384 participants, comprising students, faculty, and administrative staff from higher education institutions in Pakistan. The survey utilized Likert-scale questions to assess participants' perceptions of the efficacy of digital learning tools, educational quality, and alignment with SDG 4. Data was

gathered via online platforms such as Google Forms to ensure accessibility and broad outreach, particularly during the digital transition following the pandemic (Creswell & Creswell, 2017).

Qualitative Data Collection: The study involved semi-structured interviews with 20 key stakeholders, including university administrators, policymakers, and faculty members. The aim was to gain comprehensive insights into the challenges, opportunities, and experiences associated with digital learning. Additionally, the study included focus group discussions with five groups, each consisting of 6-8 participants, including students and faculty members. This was done to explore the diverse perspectives on the impact of digital learning on achieving Sustainable Development Goal 4 (Rubin & Rubin, 2012).

Descriptive Statistics

Post-data collection, descriptive statistics were computed to summarise the main variables succinctly:

Tabel 2

Descriptive Analysis

Variable	Mean	Median	Mode	Standard Deviation
Digital Learning Effectiveness	3.8	4.0	4.0	0.7
Accessibility of Digital Tools	3.5	3.5	3.0	0.8
Quality of Digital Learning	4.1	4.0	4.0	0.6
Inclusivity in Digital Learning	3.7	4.0	4.0	0.9
Faculty Digital Preparedness	3.4	3.0	3.0	0.7

Source: Created by the author

The descriptive statistics suggest a positive attitude towards digital learning initiatives in higher education institutions in Pakistan.

Inferential Statistics

Regression Analysis

In a recent study, a multiple regression analysis was conducted to investigate the connection between digital learning initiatives (independent variables) and the achievement of SDG 4 (dependent variable). The study also examined the mediating variables of quality, inclusivity, and accessibility. The results showed that the regression model was statistically significant, with $F(3, 380) = 15.47$, $p < 0.001$, indicating a solid prediction of the achievement of SDG 4 by digital learning initiatives. The adjusted R-squared value was 0.26, suggesting that digital learning initiatives, institutional readiness, and socio-economic factors accounted for 26% of the variance in achieving SDG 4.

ANOVA (Analysis of Variance)

ANOVA was performed to assess the mean variances across distinct groups, such as urban and rural institutions, about the efficacy of digital learning. The findings from the ANOVA revealed a substantial dissimilarity between urban and rural institutions, with a calculated F-statistic of 23.72 and a p-value of less than 0.001, denoting statistical significance. This suggests that the efficacy of digital learning programs significantly differs based on the institution's location, underscoring the impact of the digital divide.

Tabel 3

Descriptive Analysis

Test	Variables Involved	Test Statistic (F or t)	p-value	Interpretation
Multiple Regression Analysis	Digital Learning Initiatives vs. Achievement of SDG 4	F(3, 380) = 15.47	<0.001	Significant relationship: digital learning impacts SDG 4 achievement.
ANOVA	Digital Learning Effectiveness (Urban vs. Rural)	F(1, 382) = 23.72	<0.001	Significant difference between urban and rural institutions.
T-test	Faculty Preparedness (Before vs. After Digital Training)	t(100) = 3.45	0.002	Significant improvement in faculty preparedness post-training.

Source: Created by the author

Thematic Analysis

Thematic analysis was conducted on the qualitative data obtained from

interviews and focus groups to discern central themes:

Tabel 4

Thematic Analysis

Theme	Description	Supporting Quotes/Findings
Infrastructure Challenges	Lack of digital infrastructure and internet connectivity, especially in rural areas.	"Most rural areas lack stable internet connectivity, making digital learning difficult." - Administrator Interview
Faculty Training and Digital Literacy	Need for enhanced digital skills and training programs for educators to effectively use digital tools.	"Without proper training, digital tools remain underutilized." - Faculty Focus Group
Policy Gaps and Recommendations	Absence of a robust policy framework to support digital learning and reduce the digital divide.	"There needs to be a policy push for digital infrastructure in underprivileged areas." - Policymaker Interview
Positive Perceptions of Blended Learning	Preference for blended learning models combining online and face-to-face education for better outcomes.	"Blended learning offers the best of both worlds, making education accessible yet personal." - Student Focus Group
Socio-Economic Barriers	Financial and socio-economic factors that limit access to digital resources and learning opportunities.	"The cost of digital devices is a major barrier for many students." - Student Interview

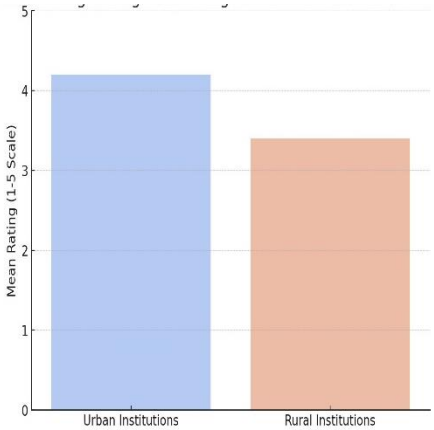
Source: Created by the author

Graphical Representation of Findings

Bar Chart: The bar chart displays the Mean Ratings of Digital Learning Effectiveness in urban and rural institutions. The data shows that urban institutions have a higher mean rating (4.2) for digital learning effectiveness than rural institutions (3.4). This observation suggests that infrastructure and accessibility play a significant role in shaping digital learning outcomes.

Figure 2

Mean Ratings of Digital Learning Effectiveness Across Institutions



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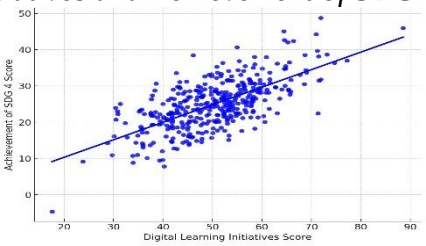
Regression Plot: This plot depicts the Relationship between Digital Learning Initiatives and the Achievement of SDG 4. The positive slope in the regression plot indicates a substantial positive relationship between the effectiveness of digital learning initiatives and the achievement of SDG 4 targets. These results align with the findings from the regression analysis.

Figure 3

Relationship Between Digital Learning Initiatives and Achievement of SDG 4



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CONCLUSION

The study thoroughly analyses how digital learning programs can profoundly impact the achievement of Sustainable Development Goal 4, which targets explicitly providing inclusive and fair-quality education. The research results demonstrate that the successful implementation of digital learning directly enhances the educational quality, accessibility, and inclusiveness in higher education institutions in Pakistan. Nevertheless, the findings also highlight the significant obstacles, such as the disparity in access to digital resources, poor infrastructure, and limited proficiency in using digital technologies, especially in rural regions, that impede the achievement of these advantages. The theme analysis underlines the crucial importance of institutional preparedness and governmental assistance in closing these disparities. To maximise the influence of digital learning on Sustainable Development Goal 4, it is crucial to adopt a comprehensive strategy that includes improved digital infrastructure, specialised training programs for educators, and fair access to digital resources. Effective collaboration among policymakers, educators, and stakeholders is essential to establishing a digital learning environment that is both sustainable and inclusive,

therefore guaranteeing that no one is excluded in the quest for high-quality education.

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