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The Impact of Online Learning on Academic Performance Post-COVID-19: A Comparative Study of Student Engagement, Learning Outcomes, and Educational Inequality

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ABSTRACT

Background: The COVID-19 pandemic has changed the global education system significantly, forcing a rapid transition from traditional classroom education to online learning.

Objective: This paper explores how online learning has been affected in the post–COVID-19 era with regard to students' engagement, attainment, and educational inequity.

Methods: The research was conducted as a comparative study between urban and rural settings, and public and private institutions in Pakistan, using a mixed-method approach involving survey data and qualitative feedback from secondary and higher education students.

Results: Students from urban areas and private institutions adapted better to online teaching, experienced higher engagement, and showed more stable academic performance. In contrast, students from rural areas and public schools faced challenges such as poor internet connectivity, limited device ownership, inadequate institutional support, lower academic outcomes, and reduced participation.

Conclusion: Due to digital inequality, the study highlights a widening educational gap that necessitates urgent policy reforms, improved technological infrastructure, and inclusive teaching strategies. While online education presents opportunities for innovation, its success depends on equitable access and support for all learners.

INTRODUCTION

Unprecedented disruption of global education systems due to the COVID-19 pandemic had a rapid shift from face-to-face traditional instruction to online learning (Adedoyin & Soykan, 2023; Tilak & Kumar, 2022). While this transition was necessary to maintain the continuity in education, it has considerably changed the style of getting and delivering knowledge. Following the COVID era, online learning has assumed a substantive role in education in the new age yet researchers, educators and policy makers are required to ascertain the long term impact on scholastic performance, student engagement and even education gap (Yang & Xin, 2022; Sato et al., 2023).

Online education was often seen as something separate or supplementary to it, widely used for higher education and professional development before the pandemic (Stojan et al., 2022; Svihus, 2024). But the global lockdown resulted due to which institutions ranging from primary schools to universities were made to shift on to digital learning platforms overnight (Tilak & Kumar, 2022; Jarvis & Mishra, 2024). While innovative, this sudden digital transformation revealed long standing disparities in access to technology, internet connectivity and digital literacy. With the end of the immediate crisis of COVID-19, there is now a need to look at how this transition has impacted the students academically and socially in terms of engagement, outcome and equality (Matsieli and Mutula, 2024; Tulaskar and Turunen, 2022).

The impact on student engagement is one of the central concerns in the discourse on online learning (Bergdahl, 2022). Engagement is the level of attention, curiosity, interest and passion that students show when learning something. Engagement is facilitated in the physical classrooms by direct interaction with the teachers and other peers, structured learning environment and instantaneous feedback (Alam & Mohanty, 2022; Lasekan et al., 2024). However, dynamic elements such as students' motivation, participation and information retained, often lack in online learning which raises the questions (Tandiono, 2024). However, research shows, that while some students thrive at working in self paced and largely digital environments, others struggle with distractions or lack of motivation and become isolated.

Another area of investigation is the effect that online learning has on academic performance. Mixed results come from a variety of studies done during and after the pandemic. Others find that students have performed as well as or better than, their counterparts in traditional classrooms because of the flexibility and accessibility of digital content (Eduljee et al., 2024; Chen et al., 2023). However, some emphasize decreased comprehension, retention and test scores especially among younger and under resourced populations. Given this variation, it was necessary to compare differences in the outcomes and factors that lead to success or failure academically to learn how they vary while exploring online learning environments.

The transition to online learning has only further exasperated an issue of education inequality that was already at a critical stage

HIGHLIGHTS	
Research insights	The study reveals significant digital disparities in Pakistan's education system post–COVID-19, highlighting unequal adaptation, engagement, and performance between urban-private and rural-public students.
Practical insights	Improving online learning effectiveness requires enhanced internet infrastructure, affordable digital devices, teacher training, and inclusive teaching methods to bridge rural–urban and public–private educational gaps.
Industry insights	EdTech companies can leverage these findings to design affordable, accessible digital platforms and localized learning solutions that address connectivity and engagement challenges in underserved regions.

before the pandemic (Golden et al., 2023). Low income families, students from rural areas and marginalized communities are often denied access to dependable internet, digital devices and peaceful learning space (Mathrani et al., 2023). In addition, unjust differences in parental support and digital literacy further hinder smooth online learning. These inequalities are widening the achievement gap which is also threatening to undo decades of progress in educational equity. On the contrary, students from well showered households enjoyed better tools, one on one support and individualized learning environments which provided a definite advantage (Robertson, Nguyen and Salehi, 2022).

In view of these issues, this study offers an overall assessment of post-COVID online learning landscape. This work is intended to determine those key questions: what has been the impact of online learning on student engagement across different age groups and levels of education? How do we quantify the measurable impacts over academic performance compared to pre pandemic in person learning? To what extent has the digital divide exacerbated educational inequality and how can these effects be minimised?

Using a comparative framework, this research uses data from a variety of public and private educational institutions while utilizing the academic and demographic workforce pertaining to various students in urban and rural environments. Qualitative and quantitative methods will be employed: surveys, analysis of academic performance and interviews with students, teachers and parents. The intention is to present a balanced and evidence led view on the effects of online learning post the pandemic.

And in conclusion, online learning is offering new possibilities for education innovation but have also created major problems that need to be solved. The more digital education becomes embedded into our academic systems, the more important it is to understand how it affects us in the long term so that we can build an inclusive, effective and equitable education future. This study contributes to the development of such policies and practices by understanding student engagement, learning outcomes and inequality in online learning. These findings not only will inform education strategies in Pakistan, they will also provide a reference point for global discussion on digital transformation of education.

METHODOLOGY

This chapter describes the research design, sample population, method of data collection, instruments and methods of data analysis used in investigating the effects of online learning on academic performance, student engagement and educational inequality after COVID-19.

Research Design

Hence, a mixed-methods comparative research design was adopted in order to give a full account of how online learning has affected students academically and socially. This mixed methods approach enables both a quantitative and qualitative form of data collection and analysis, permitting comparative numerical measurements as well as a more in depth analysis of student experience.

Academic performance metrics and survey responses were utilized as quantitative data and interviews were conducted as well as open ended survey questions to gain qualitative data to understand student engagement and perceptions of educational inequality.

Study Population and Sample

Secondary school and undergraduate students from Pakistan's urban and rural areas, who experienced online learning during and in the case of continuing students, after the COVID-19 lockdowns, were the study population. Finally, in determining sample size, a total of 400 students were sampled through the use of stratified random sampling in order to have the representation across:

There were 500 students studied, divided into urban (population 200) and rural areas (population 200), public (population 200) and private institutions (population 200), as well as gender balance (approximately 50% among male, 50% female).

Moreover, 20 educators and 20 parents were interviewed as a supplement to findings and in broader context.

Inclusion and Exclusion Criteria

This study considers students who had studied at least one entire academic term under remote learning setup due to the COVID-19 pandemic and who are currently enrolled in a secondary or undergraduate program. The opposite case, however, left students out who did not participate in online classes during the pandemic and students with known learning disabilities to control for potential variability in academic performance.

Data Collection Instruments

Quantitative and qualitative tools were used to collect comprehensive data. The quantitative tools included a structured questionnaire that asked about Likert scale questions concerning student engagement, GPA and exam scores as a measure of academic performance and the availability of digital devices, quality of the internet and parental support for the students for access to educational resources. Academic records when available were obtained to substantiate student performance before and after the switch to online learning. On the qualitative side, semi structured interviews with students, teachers and parents were conducted to investigate students' experiences and parents' and teachers' perceptions of online education. Themes like motivation, student teacher interaction, learning challenges and equity in access were covered in these interviews. In addition, focus groups of 6 to 8 students were conducted twice; one in an urban setting and one in a rural setting—with special focus being attuned to eliciting common experiences and strategies to support the online learning in the post–COVID world.

Data Collection Procedure

To guarantee the reliability and clarity of research instruments, 20 students pilot tested the research instruments prior to collecting the full data. For the students in areas with scarce internet access, we gave them questionnaires printed out, but for the more modern students with stable internet access we also distributed them through Google Forms. The interviews were carried out via Zoom, phone call or inperson as preferred by each intervener and per COVID-19 safety protocols. The entire process for data collection takes the full two months, from February till March 2025 so that the data can be comprehensively taken and the data precisely gathered.

Ethical Considerations

The study was conducted in strict ethical considerations. Participants gave informed consent and in the case of minors, their guardians provided written or verbal consent also. All of the data collected was anonymized and securely stored and strict confidentiality was maintained to ensure privacy. The respondents opted in voluntarily and were explicitly told they could withdraw at any time with no consequences. In addition, the research protocol was approved ethically by the appropriate Institutional Review Board (IRB) to maintain alignment with current academic and ethical requirements.

Data Analysis

In this study, data analysis was approached using both quantitative and qualitative methods to achieve a complete understanding of the influence of online learning. Survey data were analyzed using SPSS version 25 for the quantitative analysis. The data was summarized through descriptive statistics using means, standard deviations and frequencies. t-tests and ANOVA were utilized to infer with regard to academic performance differences between different groups of students such as rural/urban and public/private school. Further, correlation and regression analyses were carried out to analyze the relationships between student engagement in online learning and academic performance outcomes. Interview transcripts and responses to open ended survey questions were examined using thematic analysis for the qualitative analysis. It entailed finding recurring themes regarding engagement, challenges, benefits and educational inequality. The qualitative data was organized, coded

and interpreted using NVivo software to increase rigor and depth of analysis.

Limitations of the Study

- Self-reported data may introduce bias or inaccuracies.
- Limited access to verified institutional academic records for all participants.
- The digital divide in rural areas may have restricted participation from the most marginalized students.

This robust and multi layered methodology was aimed to make sure findings are not only trust worthy but are indeed representative of diverse student experiences from across Pakistan and can initiate a meaningful discussion about the changing academic reality in digital era.

RESULTS

A data collected from 400 students in urban and rural areas and public and private institutions had been used in this chapter to present the findings of the studies. Based on the results, the findings are grouped in three main sections: student engagement, academic performance and educational inequality.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency (n=400)	Percentage (%)
Gender	Male	204	51.0
	Female	196	49.0
Location	Urban	200	50.0
	Rural	200	50.0
Institution Type	Public	200	50.0
	Private	200	50.0

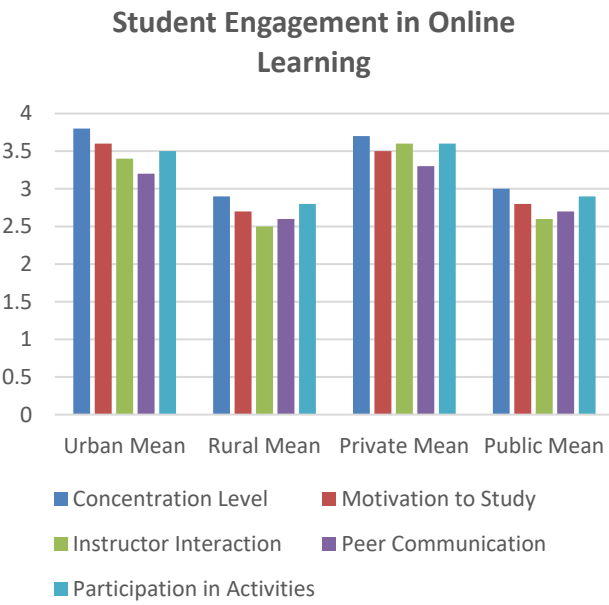
Student Engagement in Online Learning

A Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was used to measure key indicators of student engagement like concentration, motivation, interaction and participation with instructors.

Table: 2

Engagement Indicator	Urban Mean	Rural Mean	Private Mean	Public Mean
Concentration Level	3.8	2.9	3.7	3.0
Motivation to Study	3.6	2.7	3.5	2.8
Instructor Interaction	3.4	2.5	3.6	2.6
Peer Communication	3.2	2.6	3.3	2.7
Participation in Activities	3.5	2.8	3.6	2.9

Figure: 1



Findings: Urban and private school students reported significantly higher engagement levels than rural and public-school students.

Academic Performance Pre- and Post-Online Learning

Academic performance was measured using self-reported GPA or grade percentage before and after the shift to online learning.

Table: 3

Group	Pre-COVID GPA	Post-COVID GPA	Mean Difference	p-value (Paired t-test)
Urban Students	3.4	3.2	-0.2	0.041*
Rural Students	3.2	2.7	-0.5	0.001**
Private Schools	3.5	3.3	-0.2	0.034*
Public Schools	3.1	2.6	-0.5	0.001**

*Significant at $p < 0.05$, **Highly significant at $p < 0.01$**

Findings: There was a statistically significant decline in GPA after the introduction of online learning, especially among rural and public-school students.

Table 4: Access to Online Learning Resources

Resource Accessed	Urban (%)	Rural (%)	Private (%)	Public (%)
Smartphone/Device Access	94.5	65.0	92.0	68.0
Reliable Internet Access	90.0	52.0	91.5	56.0
Quiet Study Space	75.0	40.0	80.0	45.0
Parental Support	68.0	55.0	70.5	52.5

Findings: A digital divide was observed. Rural and public-school students had significantly less access to essential online learning resources, contributing to learning gaps.

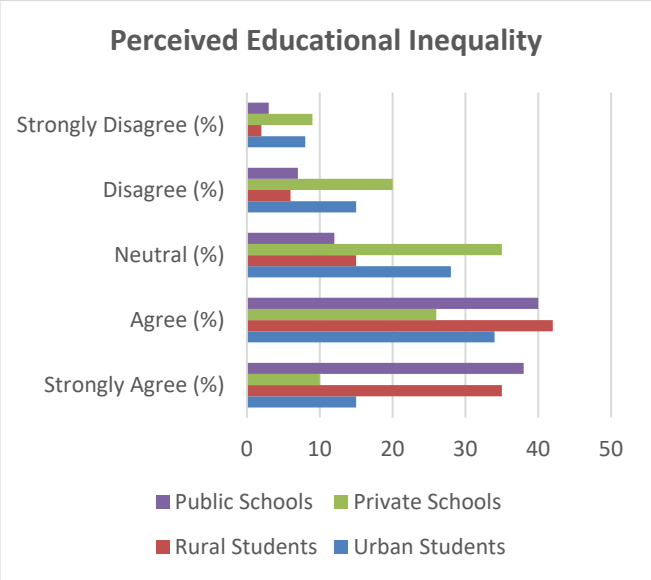
Perceived Educational Inequality

Students were asked to rate their agreement with the statement: *"Online learning has increased educational inequality"*.

Table: 5

Group	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Urban Students	15	34	28	15	8
Rural Students	35	42	15	6	2
Private Schools	10	26	35	20	9
Public Schools	38	40	12	7	3

Figure: 2



Findings: A significantly higher proportion of rural and public-school students perceived that online learning increased educational inequality compared to their urban and private school counterparts.

Summary of Key Findings

- **Engagement** was lower among rural and public-school students.
- **Academic performance** declined significantly post-COVID, especially among disadvantaged groups.
- **Resource access** disparities were major contributors to educational inequality.
- Students in rural areas **strongly perceived** online learning as increasing inequality.

DISCUSSION

The findings of this study reveal a multifaceted impact of online learning on students' academic experiences in the post-COVID-19 era, especially highlighting discrepancies between urban and rural students, as well as those enrolled in private versus public institutions. While online learning became a necessary response to the educational disruption caused by the pandemic, its implementation and outcomes varied significantly based on socioeconomic and geographic factors.

The data indicate a clear disparity in student engagement levels, with urban and private school students reporting higher levels of motivation, participation, and interaction with instructors compared to their rural and public-school counterparts. These results support previous research suggesting that technological literacy, home environments, and school support systems heavily influence the ability of students to remain engaged during remote learning. In contrast, rural students often faced challenges such as unreliable internet connections, lack of personal devices, and minimal parental or institutional support, all of which hindered their ability to engage effectively.

There was a highly significant decline in academic performance post COVID-19 as measured by change in self reported GPA, particularly in rural and public schools. In addition to connectivity issues, these students had fewer real time interactions and fewer opportunities for teacher feedback. This provides support for the argument that while online learning is flexible, there is something lacking in its immediacy and accountability, things that are often present in the traditional in person setting. The lower levels of performance decline among private and urban students also suggests that educational institutions with more resources and availability of infrastructure fared better in the transition.

The most striking finding is that these advances further deepen already existing educational inequalities. It was clear that the digital divide grew as rural and economically disadvantaged students reported lack of internet reliability, access to personal learning devices and adequate home learning environments. Furthermore, these groups significantly perceived increased educational inequality. This is consistent with global reports from UNESCO and the World Bank which cited studies showing that the pandemic has been disproportionately felt by marginalized student populations.

Technology and learning resources were of paramount importance for online learning. Those who had personal access to devices, reliable internet connections and quiet, private learning environments fared better both in engagement and academically. Moreover, the amount of parental and institutional support did matter, with private school students tending to have more structured schedules, regular assessments and personalized feedback.

Results suggest that online learning is not going away but only in some form and its effective use goes beyond digital access. And systemic reforms are needed to ensure equitable outcomes, from disparities in technological access, pedagogical support and learning environments. The fact that it may ever widen if there aren't interventions to support online learning is another one.

CONCLUSION

This study provides a comprehensive assessment of the extent to which online learning has affected student engagement, academic performance and educational inequalities in the post COVID-19 era. That it has provided a lifeline of sorts for continued education during crisis times is true, but that it has not yielded uniform outcomes across various student populations is evident.

The findings indicate that: Urban and private school students adapted more effectively to online learning due to better access to resources and support systems. Rural and public-school students experienced significant declines in academic performance and engagement. Educational inequality has been amplified due to systemic disparities in access to technology, infrastructure, and academic support.

Finally, if it is to continue as a model of education, then online learning should embrace inclusivity, access and support in the future. Investments in digital infrastructure, teacher training and equitable access by policymakers and educators will be critical to avoid further widening inequities and ensure that online education

is a bridge to opportunity and not a barrier. To address the shortcomings identified in this study, hybrid learning models, improved digital tools and focused efforts to give disadvantageous communities could be expedient.

Ethical Considerations

The study was conducted in accordance with ethical guidelines, with informed consent obtained from all participants and confidentiality strictly maintained.

Data Availability

Available from corresponding author on request.

Author Contributions

Zainab Afridi: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing Original Draft Preparation. Writing, Review & Editing.

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Conflict of Interest

None.

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