

Students' Perspective on Digital Education Interventions During COVID-19 Pandemic and Academic Performance of University Students in Punjab

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Abstract



This study aimed to comprehensively assess university students' perspectives on digital education during the COVID-19 pandemic and its impact on academic performance. It focused on gauging satisfaction with digital learning, identifying challenges faced, and providing insights for future educational strategies. Sampling 1,309 students from Social Sciences, Humanities, and Arts departments across six public sector universities, the study revealed that female students exhibited greater awareness of online learning. While gender didn't affect computer skills or gadget availability, more females had reliable internet access (51%) compared to males (43%). Challenges included connectivity issues, time management, and power outages. Students expressed moderate satisfaction with study environments and support, signaling a need for improved online education solutions. Regional variations underscored the necessity for tailored strategies to address disparities in perceptions and experiences across different areas.

Keywords: Digital Education, Students Perspective, Students Satisfaction, Master Level Students, Higher Education

Introduction

The emergence of the COVID-19 pandemic brought about unparalleled global challenges, leading to the abrupt closure of educational institutions in over 203 countries and impacting over 1.3 billion students. In Pakistan, where digital resources were scarce, this closure further worsened pre-existing educational disparities. (UNESCO, 2020). The digital divide, coupled with issues such as electricity access and device availability, posed significant hurdles. Pakistan's response included initiatives like 'Teleschool,' combining television, radio, and SMS-based learning (Tabassum et al., 2020; Wilson et al., 2022). However, the impact varied, revealing disparities in engagement, particularly among more affluent households (Akmal et al., 2020). Challenges extended beyond infrastructure to factors like instructor presence, written communication time, mobility restrictions, and the absence of practical implementations (Iqbal et al., 2021). Despite these challenges, the importance of a comprehensive investigation into the effects of digital education during the pandemic in Pakistan is emphasized (Wilson et al., 2022). This examination is crucial for informing future educational strategies and policies, ensuring equitable access to quality education. The article also delves into the transformative landscape of education driven by technological advancements. Digital education, integrating tools and resources, addresses traditional constraints, offering increased access, engaging learning experiences, personalized learning, and inclusivity (Bates, 2019). The ability to transcend geographical barriers, coupled with interactive tools, gamification, and adaptability to individual needs, enhances comprehension and retention (Prensky, 2001; Mayer, 2001). Furthermore, digital education's capacity to provide personalized learning experiences caters to diverse learning styles, fostering a sense of ownership in students' learning journeys (Knewton, 2017). The inclusive nature of digital education, with features like screen readers and collaborative tools, ensures participation regardless of abilities, promoting an equitable learning environment (Burgstahler & Cronheim, 2001). In conclusion, the multifaceted rationale behind the adoption of digital education highlights its potential to transform traditional educational paradigms. As technology continues to advance, leveraging the benefits of digital education becomes imperative for creating a more accessible, engaging, and inclusive educational landscape.

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Problem Statement

The primary objective of this research study was to provide an in-depth analysis of the impact of digital education interventions on master's level students in the Punjab province of Pakistan, with a particular focus on their experiences during the COVID-19 pandemic. In the wake of the pandemic, educational institutions worldwide were compelled to adapt swiftly to remote and digital learning methods. This study aimed at shedding light on the effectiveness of these digital education interventions, with a comprehensive examination from multiple perspectives. One crucial aspect of this research is the assessment of master's level students' satisfaction with the digital education interventions implemented during the pandemic. Understanding the degree of satisfaction among students is vital as it provides insights into the extent to which digital education facilitated the continuity of their educational journey. Their experiences, feedback, and opinions regarding the effectiveness and usability of digital tools and resources were explored in detail. Furthermore, this study investigated the perspectives of students who were the main stakeholders in digital education intervention. The analysis focused on the students' satisfaction with the digital education. This included their experiences in transitioning to online teaching, the challenges they encountered, and the support they received in adapting to this new educational paradigm. In summary, this study investigated the perceived effects of digital education interventions on master's level students in Punjab, Pakistan, during the COVID-19 pandemic. By gathering and analyzing data from students, the research aimed to provide a comprehensive understanding of the challenges, opportunities, and overall effectiveness of digital education in the context of higher education in Pakistan. Through this exploration, the study seeks to contribute valuable insights that can inform future educational strategies and policies, enabling educational institutions to harness the full potential of digital education while addressing the specific needs and challenges faced by students, teachers, and departmental leadership.

Objectives of the Study

The primary objective of this study was to assess how the shift to digital education during the pandemic affected the academic performance of university students. Specifically, it sought to understand the perspectives of students in Punjab, Pakistan, on the efficiency and effectiveness of online learning programs. Additionally, the study aimed to identify challenges students faced in navigating online distance learning and explore potential opportunities in this context. Furthermore, this study seeks to investigate whether there exists an association between these perceptions and the gender of the students. This research endeavors to provide a comprehensive understanding of the evolving educational landscape in the context of the pandemic and digital education, with a focus on its effects, challenges, and potential for improvement.

Specific objectives of this research were to:

1. Document the impact of digital education during the COVID-19 pandemic and its impacts on academic performance as perceived by the University Students.
2. Find out the perspective of university students related to efficiency and effectiveness of online learning programs implemented in the Punjab, Pakistan
3. Discover the challenges encountered and potential opportunities related to online distance learning programs from the university student's point of view in Punjab Pakistan
4. Investigate association between perception and gender of the students.

Research Questions

The study sought to answers the following research questions:

1. How do university students perceive the impact of digital education on their academic performance during the COVID-19 pandemic?
2. What are the perspectives of university students regarding the effectiveness of online learning programs in Punjab, Pakistan?
3. What challenges do university students face in online distance learning programs in Punjab, Pakistan, and what opportunities do they perceive in this educational approach?
4. Is there a significant association between the perception of digital education and the gender of university students?

Significance of the Study

Digital education, or online learning, has transformed traditional teaching by leveraging technology to offer accessible and flexible educational experiences globally. By breaking down geographical and

time barriers, it democratizes education, providing learners worldwide with high-quality resources. This approach incorporates interactive multimedia and personalized learning, catering to diverse learning styles and promoting lifelong learning. Not only benefiting learners, digital education also empowers educators to experiment with innovative teaching methods and enhance effectiveness through data-driven insights. As technology advances, the influence of digital education on knowledge dissemination and acquisition is expected to grow. Policymakers, faculty, and administrators can gain insights from research findings to optimize its integration in institutions, addressing challenges. Educational planners can use identified challenges when designing programs, ensuring effectiveness. Lastly, the study contributes to the broader education knowledge base, offering valuable insights for students and researchers in understanding and contributing to the evolving landscape of digital education.

Review of Related Literature

The COVID-19 pandemic triggered an unprecedented transformation in the field of education, with digital education emerging as a critical response to ensure continuity in learning. As educational institutions worldwide turned to online platforms, this shift exposed both the opportunities and challenges of digital education. While significant research has been conducted to understand its impact during the pandemic, there remain notable research gaps that require exploration and investigation. This section will delineate some of these research gaps to guide future studies in this dynamic and evolving field.

Sahu sheds light on a range of challenges associated with digital education during the pandemic. Notably, issues such as limited access to digital devices and the internet among students, particularly in rural and economically disadvantaged areas, are highlighted. In terms of academic performance, the paper investigates the impact of digital education on students' academic outcomes, considering variations linked to differences in technology access, home environments, and individual learning capacities. The author also explores the influence of assessment and evaluation methods in the digital education landscape. In conclusion, Sahu (2020) expects the potential long-term implications of the digital education shift beyond the pandemic. This involves an exploration of whether digital education will continue to play a substantial role in the education system and considerations on improvements or changes that enhance its effectiveness.

In the paper titled "Online Learning during the COVID-19 Pandemic," presented a comprehensive study examining the impact of online learning in higher education from an international perspective. Various dimensions, including academic performance, students' perspectives, and teachers' experiences during the unprecedented shift to online education prompted by the pandemic, were explored. The paper provided insights into the various strategies and approaches that educational institutions and instructors adopted to facilitate online learning. This involved discussions on the use of learning management systems, video conferencing tools, interactive platforms, and other digital resources that supported remote instruction. Innovative practices that emerged during this transition were also explored. The authors highlighted the challenges and limitations of online learning during the pandemic and provided recommendations for addressing these challenges, such as improving digital access and equity, enhancing teacher training for online pedagogy, and developing effective methods for remote assessment (Al Lily, 2020).

One of the most glaring research gaps in the realm of digital education during the pandemic pertains to digital equity and inclusivity, as highlighted by DiMaggio. The sudden shift to online learning unveiled disparities in access to technology and the internet among students. Marginalized communities, economically disadvantaged households, and remote regions faced barriers to participation, hindering their educational progress. Research is needed to investigate deeper into the root causes of these disparities, explore effective strategies to bridge the digital divide, and ensure that digital education is accessible to all, regardless of socio-economic status, geographic location, or special needs (DiMaggio, 2004).

The rapid transition to digital education prompted educators to adapt their pedagogical methods to the online environment, as concluded by Allen and Seaman (2011). However, there is a pressing need for research that examines the effectiveness of various pedagogical approaches in the digital context. Questions related to the efficacy of synchronous vs. asynchronous learning, the impact of multimedia and interactive content on student engagement, and the role of teacher training

in delivering effective online instruction require in-depth investigation. Identifying best practices for online teaching and learning will be crucial in enhancing the quality of digital education (Allen & Seaman, 2011).

Another significant research gap in the digital education landscape centers around the mental health and well-being of students and educators, as highlighted by Son, Hegde, Smith, Wang, and Sasangohar (2020). The prolonged use of digital devices, social isolation, and the blurring of boundaries between work and personal life have raised concerns about the psychological impact of online learning. Research should focus on understanding the mental health challenges faced by students and educators, identifying support mechanisms, and developing strategies to mitigate the adverse effects of prolonged screen time and remote learning environments (Son et al., 2020).

Research Methodology

In our study covering the diverse population of the north, central, and south regions of Punjab, we employed a stratified random sampling technique. This method, based on geographical region and gender strata, ensures adequate representation of each subgroup in the sample, enhancing accuracy and reliability and providing insights into regional variations. This study used a mixed-methods approach, combining quantitative and qualitative methods to thoroughly investigate the research questions, following Creswell's recommendation (2009) for a more holistic understanding. The study employed the Concurrent Triangulation Strategy (QUAN+QUAL), as suggested by Santos (2017), to simultaneously collect quantitative and qualitative data for robust comparison and uncovering patterns and perspectives. The mixed-methods approach allowed for a comprehensive examination of the research topic, leveraging both quantitative and qualitative strengths to enhance the depth and breadth of the findings. The Punjab province has a total of 80 universities, comprising 49 public and 31 private institutions (Punjab Higher Education Commission, 2022). This study includes six universities, two from each of the northern (Rawalpindi and Gujrat), central (Lahore and Faisalabad), and southern (Multan and Bahawalpur) regions. The study encompasses a diverse population, including male and female students of Social Sciences, Humanities, and Arts departments. The appropriate sample size, typically expressed as a percentage of the population, is determined based on the specific research objectives, desired level of confidence, margin of error, and the characteristics of the population we are studying. Keeping in view the large target population for students and resources and time constraints, 30% sample size is selected for students. Given the estimated target student population of 3,765 in the specified disciplines, a sample size of 1,318 (30%) was chosen. This selection of a relatively smaller sample size is primarily driven by the large size of the target population, along with limitations in available time and resources. Considering the substantial target population residing in the central region of Punjab province across the chosen disciplines, the sample size allocated to this area is proportionately larger. Out of the total sample size of 1,318, the central region accounts for 452 samples, constituting 34% of the total. Similarly, sample size of 436 and 431 was drawn proportionate to their target populations from north and south regions respectively. To ensure reliability, we conducted a pilot test of our questionnaires, gauging their consistency and dependability. Feedback from this phase played a pivotal role in fine-tuning the data collection tools for precision and reliability before the full-scale survey administration.

Data Analysis

Table 01: Level of Significance among Male and Female Students on Readiness for Online Learning

S #	Statements	Respondent	Responses	
			Yes	No
1	I knew online learning before COVID-19 pandemic	Male	225 (49%)	231 (51%)
		Female	494 (58%)	359 (42%)
2	I had already basic skills to use a computer.	Male	358 (79%)	98 (21%)
		Female	678 (80%)	174 (20%)
3	I had all the required gadgets to undertake online classes.	Male	388 (85%)	68 (15%)
		Female	719 (84%)	134 (16%)
4	My computer was able to download videos and presentations (quality of gadgets)	Male	268 (59%)	188 (41%)
		Female	513 (60%)	340 (40%)

The results unveiled a noteworthy correlation between gender and the awareness of online learning, indicating that awareness about online education is influenced by gender. Specifically, female students exhibited significantly higher awareness levels compared to their male counterparts.

However, when it comes to basic computer skills, the availability of necessary gadgets, and the quality of these gadgets, there was no distinction between male and female students in terms of basic computer skills, gadget availability, or gadget quality.

Table 02: Association Between Internet Availability and Gender.

Statements	Respondents		Total
	Male	Female	
Regular and Reliable	198 (43%)	432 (51%)	630 (48%)
Somewhat Regular	215 (47%)	360 (42%)	575 (44%)
Rarely accessible	43 (10%)	61 (7%)	104 (8%)

It was revealed that 51% of female students enjoyed regular and reliable access to the internet, in contrast to 43% of their male counterparts who reported the same level of accessibility. Remaining did not respond to this question.

Table 03: Association Between Gender and Perception about Online Learning.

S#	Statements	Gender	Responses		Ch square	df.	Sig.
			Yes	No			
1	Both online and in person approaches require similar efforts for learning	Male	225 (49%)	231 (51%)	8.818	1	.003
		Female	494 (58%)	359 (42%)			
2	I feel more comfortable in classroom face to face teaching as compared to online classes	Male	382 (29%)	74 (6%)	3.385	1	.066
		Female	746 (87%)	107 (13%)			
3	I am comfortable with online modes of communication including email, chats and discussion boards & social media.	Male	298 (65%)	158 (35%)	3.891	1	.049
		Female	510 (60%)	343 (40%)			
4	Online education develops an interest in teaching and learning process	Male	319 (70%)	137 (30%)	.063	1	.802
		Female	591 (69%)	262 (31%)			
5	Online education has positive effect on the medium of instruction	Male	330 (72%)	126 (28%)	.123	1	.726
		Female	625 (73%)	228 (27%)			
6	For online classes it is important to have knowledge of computer hardware, windows and software	Male	156 (84%)	30 (16%)	.214	1	.643
		Female	212 (85%)	36 (15%)			
7	Online classes are a better option than formal learning	Male	243 (53%)	213 (47%)	.760	1	.383
		Female	433 (51%)	420 (49%)			
8	Online education stimulated my Creativity	Male	340 (75%)	116 (25%)	.535	1	.464
		Female	620 (73%)	233 (27%)			
9	E-learning is different from other forms of learning & very helpful	Male	376 (82%)	80 (18%)	1.201	1	.273
		Female	682 (80%)	171 (20%)			

The results of the Chi-Square test unveiled a noteworthy connection between gender and the perception that both online and in-person approaches to learning require similar levels of effort. This implies that the belief in the equivalence of effort between online and in-person learning is influenced by one's gender. Specifically, female students were found to hold this belief significantly more than their male counterparts. The Chi-Square test didn't yield significant results for various aspects, including student comfort levels with classroom-based teaching versus online classes, online communication methods, the impact of online education on interest and instruction, computer knowledge importance, preference for online classes, creativity stimulation, and E-learning benefits. No significant gender-based differences were found in these indicators among surveyed students.

Table 04: Students' Responses on Home Study Environment for Online Learning

S #	Statements	Responses*					Mean
		1	2	3	4	5	
1	The level of in-house support and facilitation from family/friends/roommates etc. to concentrate	141	297	422	371	78	2.96
		11%	23%	32%	28%	6%	
2	The quality of outside/surrounding environment (background sounds, noises, unnecessary disruption etc.)	184	472	424	175	54	2.57
		14%	36%	32%	13%	4%	
3	The quality of internet connection]	351	423	289	179	67	2.38
		27%	32%	22%	14%	5%	
4	The availability of power supply (electricity) in your area	394	421	248	183	63	2.31
		30%	32%	19%	14%	5%	
5	The availability of required devices and facilities	190	446	356	227	90	2.68

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(computer/tablet, cellphone, printer, study table, etc.)	15%	34%	27%	17%	7%
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*1=Not at all satisfied, 2= Slightly satisfied, 3= Moderately Satisfied, 4= Very Satisfied, 5= Extremely satisfied

The mean responses for the five statements consistently ranged from 2 to 3, indicating that students' satisfaction with their home study environments for online learning was generally moderate but not notably positive, as the range remained below 3 on the satisfaction scale. The data reveals that students were moderately satisfied with their home study conditions for online learning, but there is room for improvement. This highlights the importance of enhancing these environments to create more positive online learning experiences.

Table 05: Students' Responses on University's Support for Online Learning

S #	Statements	Responses*					Mean	SD
		1	2	3	4	5		
1	Clear guidelines on shifting from traditional to the online mode of education	132 10%	351 27%	548 42%	238 18%	40 3%	2.77	.96
2	Guidance on the access and use of online education	90 7%	524 40%	437 33%	218 17%	40 3%	2.69	.93
3	Availability of learning material for course completion	157 12%	344 26%	522 40%	234 18%	52 4%	2.76	1.01
4	Technical support to overcome any technical difficulties of power supply (electricity) in your area	168 13%	503 38%	414 32%	186 14%	38 3%	2.56	.98
5	Provision for registering any grievances or Complaints	182 14%	454 35%	426 33%	199 15%	48 4%	2.60	1.02

*1=Not at all satisfied, 2= Slightly satisfied, 3= Moderately Satisfied, 4= Very Satisfied, 5= Extremely satisfied

Mean responses for the five statements consistently ranged from 2 to 3, indicating students' satisfaction with university support for online learning was moderate but not notably positive, staying below the 3 on the satisfaction scale. Overall, students expressed room for improvement in the university's online learning support systems. These findings highlight the importance of enhancing support services to create a more conducive online learning environment and meet students' needs and expectations for academic success.

Table 06: Responses of Faculty for Imparting Online Learning

S #	Statements	Responses*					Mean	SD
		1	2	3	4	5		
1	The overall Quality of Course Content	101 8%	350 27%	524 40%	288 22%	46 4%	2.87	.96
2	In-time delivery of course content	93 7%	478 37%	454 35%	237 18%	47 4%	2.75	.95
3	Appropriate pace of lectures	134 10%	417 32%	467 36%	251 19%	40 3%	2.73	.98
4	Opportunities given to ask questions	169 13%	393 30%	425 33%	251 19%	71 5%	2.74	1.08
5	Clear guidelines about assignments and assessments	180 14%	403 31%	390 30%	262 20%	74 6%	2.73	1.10
6	Flexibility in following assignment deadlines	126 10%	453 35%	433 33%	243 19%	54 4%	2.73	1.00
7	Convenient exam schedules	132 10%	428 33%	418 32%	262 20%	69 5%	2.78	1.05
8	Timely and continuous feedback on class progress	115 9%	468 36%	413 32%	247 19%	66 5%	2.76	1.02
9	Follow-up and motivation to improve class progress	126 10%	459 35%	400 31%	253 19%	71 5%	2.76	1.04
10	Availability for consultation and guidance after class timing (WhatsApp, Messages, E-mails, etc.)	97 7%	392 30%	462 35%	281 22%	77 6%	2.88	1.02

*1=Not at all satisfied, 2= Slightly satisfied, 3= Moderately Satisfied, 4= Very Satisfied, 5= Extremely satisfied

The mean responses for all five statements ranged from 2 to 3, indicating moderate but not

high satisfaction among students regarding the faculty's role in online learning. Since these mean responses were below the midpoint (3) on the satisfaction scale, it suggests a moderate sentiment rather than strong endorsement. Students, in general, didn't express highly positive views about the faculty's impact on their online learning experiences. Further investigation and potential improvements may be necessary to enhance satisfaction levels and overall online learning experiences.

Table 07: Students' Feeling and Experience about Academic Performance Through Online Learning

S #	Statements	Responses*					Mean	SD
		1	2	3	4	5		
1	I was able to maintain motivation and enthusiasm while taking online classes.	111 9%	39 3%	484 37%	459 35%	67 5%	3.29	.98
2	I was able to manage my time effectively in completing assignments	72 6%	179 14%	454 35%	515 39%	89 7%	3.28	.97
3	I found online learning to be more convenient and flexible	99 8%	194 15%	448 34%	489 37%	79 6%	3.19	1.01
4	I was quite successful in using the relevant software and required tools	81 6%	155 12%	440 34%	531 41%	1 0%	3.32	.99
5	I was able to cut down transportation costs.	74 6%	159 12%	392 30%	535 41%	149 11%	3.40	1.03
6	I was able to focus on additional things (part-time job, hobbies etc.)	89 7%	156 12%	419 32%	509 39%	135 10%	3.34	1.04
7	My command in using the relevant software and required tools have increased	58 4%	148 11%	415 32%	540 41%	58 4%	3.44	.98
8	My ability to practice self-responsibility has increased	70 5%	139 11%	426 33%	548 42%	126 10%	3.40	.98
9	My ability to practice self-discipline has increased	69 5%	146 11%	402 31%	566 43%	125 10%	3.41	.99
10	My time-management skills have increased.	74 6%	147 11%	398 30%	566 43%	124 10%	3.40	1.00

*1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

The mean responses for the five statements ranged from 3 to 3.40, suggesting that students' sentiments fell within a range of mild satisfaction to agreement, indicating neither strong dissatisfaction nor complete indifference. However, their satisfaction levels did not reach the "agree" level (4) on the scale of personal feelings related to online learning. Overall, students held positive sentiments and experiences in online learning, leaning towards a favorable view. This highlights the importance of understanding students' perspectives for ongoing improvement in online learning platforms and education.

Table 08: Comparison of male and female students' perspective on different aspects of online learning.

S #	Dependent Variable	Grouping Variable	N	Mean	SD	t-value	Sig,
1	Home Study Environment for Academic performance	Male	456	2.4803	.83840	-3.117	.002
		Female	853	2.6354	.89323		
2	University Support and Environment for academic performance	Male	456	2.6333	.77688	-1.393	.158
		Female	853	2.6982	.81699		
3	Role of Faculty for ensuring students' academic performance	Male	456	2.7899	.81854	.559	.572
		Female	853	2.7627	.84942		
4	Personal feeling and experience about academic performance	Male	456	3.3623	.89911	.772	.461
		Female	853	3.3257	.77207		

The t-test comparing male and female students' mean scores on the home study environment showed a significant difference, with females rating their home study environment more favorably. However, no significant gender differences were found in university support, the academic environment, or the faculty's role in shaping academic performance. These results highlight the importance of addressing gender-related disparities in students' perceptions, particularly regarding the home study environment. In contrast, there seems to be gender equity in how students view university support, the academic environment, and faculty roles, which can guide efforts to create inclusive and supportive learning environments.

Table 09: Modes of Communication in Between the Students and their Teachers.

Sr #	Statement	Respondents	%age	Ranking
1	Social Media apps (WhatsApp/Facebook, etc.)	335	26%	1
2	E-mail Correspondence	307	23%	3
3	Online Lectures/Video Conferencing (Google hangouts, Zoom, Skype, etc.)	315	24%	2
4	Recorded Lectures	121	9%	5
5	Course Websites	128	10%	4
6	Other website links (for reading material)	103	8%	6
Total		1,309	100	

The research showed that WhatsApp groups were the prime communication method for 26% of students, promoting real-time discussions and sharing course materials. Video conferencing platforms like Zoom, Skype, and Microsoft Teams were the second choice at 24%, enabling virtual classrooms and face-to-face interactions. Email remained significant at 23%, serving for formal announcements and feedback. These findings highlighted diverse communication modes and the adaptability of students and educators in using technology for effective teaching and learning in online education. They emphasized the importance of digital tools in modern pedagogy.

Table 10: Major Problems Faced by Students During Online Learning

S #	Issue	Number	%age
1	Internet and connectivity issues	377	29%
2	Time management	346	26%
3	Load shedding	233	18%
4	Lack of gadgets	176	13%
5	Lack of interaction	112	09%
6	Technical issues	65	05%
Total		1,309	100%

The table 10 provides insights into significant challenges faced by students in online learning. Notably, 29% cited internet connectivity issues as a major hindrance, emphasizing its crucial role. Time management ranked second at 26%, underscoring its importance for students juggling various commitments. Additionally, 18% identified power outages as a disruptive factor. Addressing these issues, including improving internet access, offering time management support, and implementing backup solutions for power outages, is vital for enhancing online education's effectiveness and accessibility.

Table 11: Issues to be Addressed for the Successful Conduct of the Online Learning

S #	Issue	Number	%age
1	Provision of uninterrupted internet	383	29%
2	Time management	293	22%
3	Load shedding	231	18%
4	Lack of Interaction	187	14%
5	Lack of gadgets	146	11%
6	Technical issues	69	06%
Total		1,309	100%

In this research, insights from participants revealed key aspects of online education. Firstly, 29% emphasized the necessity of a stable internet connection for uninterrupted learning. Secondly, 22% highlighted the importance of time management skills in online classes. Lastly, 20% expressed concerns about power outages, emphasizing the need for backup solutions. In summary, these findings underscore the significance of reliable internet access, time management, and addressing power outage challenges in improving online education.

Table 12: Summary of One Way ANOVA on Students Responses

Statements	Groups	Sum of Squares	Df	Mean Square	F	Sig.
Home Study Environment factors	Between Groups	99.788	2	49.894	71.847	.000
	Within Groups	906.957	1306	.694		
	Total	1006.745	1308			
University Study environment factors	Between Groups	48.639	2	24.319	39.905	.000
	Within Groups	795.914	1306	.609		
	Total	844.553	1308			

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Faculty role to ensure academic performance	Between Groups	54.057	2	27.028	40.773
	Within Groups	865.751	1306	.663	.000
	Total	919.808	1308		
Personal Feeling and experience	Between Groups	33.317	2	16.658	25.814
	Within Groups	842.781	1306	.645	.000
Total		876.098	1309		

Summary of ANOVA shows that F values are significant at 0.05 level of significance, which means that students from at least one region have different mean value of their perception than that of students from other regions. Post Hoc analysis was run to find out significantly different means.

Table 13: Post Hoc analysis

Dependent Variable	I	J	Mean Difference (I-J)	Std. Error	Sig.
Home Study Environment factors	Central region	North region	.52044*	.05603	.000
		South region	.63165*	.05655	.000
University Study environment factors	Central region	North region	.34752*	.05248	.000
		South region	.44930*	.05298	.000
Faculty role to ensure academic Performance	Central region	North region	.41733*	.05474	.000
		South region	.44020*	.05526	.000
Personal Feeling and experience	North region	Central region	.36884*	.05401	.000
		South region	.29141*	.05467	.000

Post-hoc analyses revealed that mean value for perceptions of students about online learning from central region for home study environment was significantly higher than that of means of students from north and south regions. Hence students from central region had better perception for their home study environment. Similarly mean of students from central region for university study environment was significantly higher than that of students from north and south regions. It can be concluded that students from central region i.e. students from UE and GCWU Faisalabad had better perception for their university study environment as compared to others. Students from central region had significantly greater mean for Faculty role to ensure academic performance than that of students from north and south regions. It can be concluded that students from central region i.e. students from UE and GCWU Faisalabad had better perception for their university Faculty role to ensure academic performance as compared to others. Post-hoc analyses also revealed that perceptions of students from north region about online learning were significantly better than that of others for their Personal Feeling and experience, as mean value of students for personal feelings and experience was significantly greater than that of means of students from other regions.

Discussion

The COVID-19 pandemic prompted an abrupt closure of higher education institutions, necessitating a shift to online digital education for continuity. Concerning the impact of digital education on the academic performance of students during COVID-19 pandemic, students utilized diverse communication methods in online learning, reflecting the transformative potential of digital tools. While regarding the effectiveness of the online learning programmes, the pandemic accelerated the digital transformation of society, emphasizing the importance of equipping higher education students with digital literacy for future success (Selwyn, 2020). Online education played a critical role in maintaining educational access during the pandemic, overcoming physical distance and financial constraints, and fostering inclusivity (UNESCO, 2020). Students expressed moderate satisfaction with their home study environments, highlighting room for improvement to create more positive online learning experiences. Similarly, students' satisfaction with university support for online learning was moderate, emphasizing the need to enhance support services. Students were moderately satisfied with the faculty's role in online learning, suggesting room for improvement in faculty engagement and effectiveness. While students generally held positive sentiments and experiences in online learning, their satisfaction levels didn't reach a highly enthusiastic level.

About the challenges, the selected six universities faced similar challenges, including issues with internet connectivity, time management, and power outages, highlighting the imperative to enhance the effectiveness and accessibility of online education (UNESCO, 2020). Despite faculty efforts, challenges persisted, emphasizing the need for solutions. The adaptability of online education facilitated the higher education sector's adjustment to the pandemic-induced changes, allowing for

innovative teaching approaches (Hodges et al., 2020). While online education brought positive experiences, challenges such as the digital divide and the need for ongoing teacher training must be addressed to sustain its long-term benefits (Schleicher, 2020). The pandemic underscored online digital education's vital role in adapting to change, ensuring educational access, and preparing students for a digitally connected future in higher education.

This study found that female students exhibited higher awareness of online learning compared to their male counterparts. However, there were no significant gender-based differences in basic computer skills, gadget availability, or gadget quality. Gender played a role in determining internet accessibility, with 51% of female students reporting regular and reliable internet access compared to 43% of male students. Female students were more likely to perceive equivalent effort levels in online and in-person learning. However, no significant gender-based differences were found in other aspects of online education.

Gender disparities were noted in students' perceptions of home study environments, emphasizing the importance of addressing gender-related disparities. Students used diverse communication methods in online learning, including WhatsApp groups, video conferencing, and email. Major challenges in online classes included internet connectivity issues, time management, and power outages, underscoring the need for solutions to enhance online education's effectiveness and accessibility. The importance of reliable internet access, time management skills, and addressing power outages was highlighted to enhance the quality of online education.

Regional variations in students' perceptions showed differences in home study environments, university environments, faculty roles, and personal experiences, indicating the need for tailored strategies to address regional disparities in online education.

Conclusion

The study found that gender differences were not significant in various aspects of online education, emphasizing the influence of individual preferences and institutional support. Students expressed moderate satisfaction with their online learning experiences, indicating room for improvement. Diverse communication methods were employed, reflecting the adaptability of online education. Significant challenges in online education, such as internet connectivity and time management, underscore the importance of robust infrastructure and support. Regional variations in students' perceptions highlighted the need for tailored strategies to address disparities. Overall, the findings suggest that addressing specific concerns and enhancing infrastructure, faculty development, and technical support are essential to improve the effectiveness and accessibility of online education across student perspectives.

Female students displayed higher awareness of online learning compared to male students. Gender influenced internet accessibility, with more female students reporting reliable access. Female students tended to perceive equivalent effort levels in online and in-person learning, but no significant gender differences were observed in various other aspects of online education. Students expressed moderate satisfaction with their home study environments and university support for online learning, indicating room for improvement in both areas. Students were moderately satisfied with the faculty's role in online learning, suggesting potential for enhancement. Overall, students generally held positive sentiments and experiences in online learning, with room for improvement in online learning platforms.

Gender disparities were notable in how students rated their home study environments, emphasizing the need to address gender-related disparities. WhatsApp groups were the primary mode of communication for online learning, reflecting the diversity in communication methods used in online education. Major challenges in online classes included internet connectivity issues, time management, and power outages, underscoring the importance of addressing these challenges. The research findings highlighted the significance of a stable internet connection, time management skills, and addressing power outage challenges to enhance the quality of online education. Regional variations in students' perceptions indicated differences in home study environments, university environments, faculty roles, and personal experiences, emphasizing the need for tailored strategies to address regional disparities.

Recommendations

The study recommends that universities should implement gender-specific initiatives to address the awareness gap in online learning. Collaborating with the government, universities can launch

programs to enhance basic computer skills and digital literacy for all students, regardless of gender. Ensuring equal access to necessary equipment, the government should invest in improving gadget availability and quality. Efforts should also focus on expanding reliable internet access to eliminate gender-based discrepancies. To enhance the online learning environment, universities should continuously provide resources, guidance, and technical support for students' home study setups. Optimizing support services, universities can better meet evolving student needs and promote faculty engagement in online teaching for a high-quality education experience. Joint strategies between universities and the government should address common challenges in online classes, including region-specific disparities in home study environments, faculty roles, and personal experiences. The government should invest in a robust digital infrastructure, establish a dedicated technical support system, and maintain gender equity in gadget accessibility and online class comprehension. Future university research can delve deeper into gender-based disparities in online education to develop targeted strategies for improving awareness, digital skills, and equal access to resources.

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