Analyzing Students' Experience of Online Education during COVID-19: A Case Study of NUST, Pakistan

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Declaration

I, Muhammad Safi Ullah Khan confirm that this thesis titled "Analyzing Transformation of Education System in Pakistan During COVID-19: NUST as Case Study" presented for the degree of Master of Science in Systems Engineering, has been composed entirely by myself. This Thesis is based on exclusively the result of my own work. Present thesis has not submitted for any other degree or professional qualification.

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Dedication

This work is dedicated to my respectful grandparents (My Late Grand Father Dr. Abdul Jalil Khan and My Late Grand Mother Dr. Farath Khan) along with my parents (My Late Father Junaid Khan and My Mother Professor Fauzia Khan), My belove Khala Nusrat Jabeen Retired Principal of Elementary School and My beloved Uncle Dr. Sohail Khan First Deputy Secretary General of Shanghai Cooperation Organization (SCO) and formal Diplomate of Foreign Service of Pakistan. They always inspire me and support me in my ups and downs. At the same time, I also dedicated this thesis to my mentor Dr. Zamir Hussain under whose constant guidance I have completed this dissertation. He not only enlightened me with academic knowledge but also gave me valuable advice whenever I needed it the most.

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Abstract

The COVID-19 outbreak has had a massive global impact, leading to a shift towards embracing a virtual lifestyle. Pakistan, being a developing country, also experienced the effects of the COVID-19 outbreak. As a result, the government implemented smart lockdowns and enforced a work-from-home policy for organizations where maintaining social distance was not feasible. In particular, the educational sector was locked down to minimize the spread of the coronavirus. The education system in Pakistan transitioned from face-to-face (FTF) to distance learning (DL) mode, despite limited knowledge among teachers and students about e-learning.

Through a statistical analysis, considering NUST as a case study the thesis has examined various parameters introduced in e-learning, including how much students appreciated or criticized e-learning and the facilities provided by the concerned administration of the university. This pandemic opened a new chapter for the educational sector in Pakistan, prompting the adoption of modern technology to create a virtual educational environment capable of handling future pandemics. The study has investigated the perception of NUSTIANS (students at NUST) and their response to this transformation from FTF to DL mode during COVID-19. Moreover, this thesis has analyzed the user-friendliness of the DL mode as a new experience and assessed the level of satisfaction/dissatisfaction of students.

The research has used structured questionnaire to collect the information from the students. The questionnaire consists of twenty-four questions divided into six sections namely: educational management, parents' perception, resource social media, quality of services (overall), quality of services (classroom activities), and local/school-level administrative system. A sufficient sample of 318 NUSTIANS, supported by literature and statistical methods, from undergraduate, MS, and PhD programs, has been used in this thesis. Descriptive statistics and visualization techniques have been used to observe the trends and tendencies of various items of the questionnaire. Chi-

square statistics have been used to check the association between items of the questionnaire.

The results of the survey conducted on various aspects of the educational management system's shift from FTF to DL mode reveal a mixed perception among respondents. In the educational management section, a significant portion (45.91%) agreed with the transformation, while a notable proportion (33.96%) disagreed, and the remaining respondents (20.13%) remained neutral. Similarly, in the parents' perception section, a majority (61.01%) agreed that their parents accepted the shift, while a smaller percentage (18.24%) showed disagreement and the remaining respondents (20.75%) remained neutral. On the contrary, the resource social media section indicated that a considerable number of respondents (60.54%) disagreed that there was no technical burden in the transition to DL mode and that the quality of understanding improved. Moreover, in the sections quality of services (overall), quality of services (classroom activities) and the local/school-level administrative system received positive feedback , with overall respondents showing agreeing with the different academic services provided by NUST during pandemics as discussed in chapter 4.

The results of this survey will be useful for concerned administrations of schools, colleges, and universities for transitioning to e-learning mode during pandemics.

Chapter 1

INTRODUCTION

The COVID-19 outbreak, originating from Wuhan, China, has engulfed the entire world, causing an unprecedented catastrophe. This virus has wreaked havoc globally without discrimination, disrupting the normality humans were accustomed to. The socio-economic and political dynamics of the world now present a bleak picture. Pakistan, like many other countries, has faced significant challenges during the pandemic, particularly due to strict lockdown measures that limited people's freedom to move and work. Both private and government sectors were required to adhere to work-from-home policies and regulations. The educational sector in Pakistan suffered greatly during the COVID-19 pandemic. With the implementation of smart lockdowns by the Government of Pakistan, face-to-face classes were halted, leading to the question of how to bridge the educational gaps for students and teachers. Since Pakistan is a developing country that had not previously adopted online education or e-learning, there was a significant concern and need for important steps to address this issue.

To tackle this challenge, Mr. Shafqat Mahmood, the former federal minister for education and professional training in Pakistan, intelligently decided to shift physical classes to e-learning mode in coordination with educational heads from all provinces. However, this decision raised concerns among the public, as parents faced additional economic burdens to provide smart mobile devices and expensive internet packages for their children to attend online classes. Educational institutes-initiated teacher training sessions in schools, colleges, and universities to address this issue. Educating students on how to use smartphones for e-learning became a major challenge for educational administrations. Due to mismanagement and a lack of awareness on how to train students at home for e-learning, many government schools, colleges, and universities in Pakistan suffered, particularly during the first wave of the pandemic.

However, some universities, like NUST, responded smartly by educating their students through online classes.

NUST, as one of the leading universities in Pakistan, handled this issue scientifically. They monitored the philosophy and psychology of students and teachers before transitioning to e-learning. NUST created tutorials to familiarize students with Microsoft Teams and its features, and teachers and staff members were trained in e-learning methods. During online classes, teachers provided introductory tutorials on using each option effectively, such as recording lectures, submitting assignments, participating in chat discussions, marking attendance, and facilitating two-way communication. NUST also introduced the Qalam App, which transformed their Campus Management System (CMS), providing user-friendly options for students and faculty. While NUST demonstrated effective measures, it was important to analyze if there were any areas that required improvement or direction.

To directly analyze the effectiveness of the steps taken by NUST administration during the pandemic, a survey was conducted among the most affected parameters: the students. This study was aimed to provide useful guidelines and help for universities in Pakistan as well as worldwide. During the pandemic, the study used existing literature and earlier surveys to determine the prevalence and frequency of protective behaviors, emotional well-being, and anxiety levels among the Turkish population. A quick online questionnaire with 3,040 individuals aged 18 to 30 was done from April 3 to April 9, 2020. The survey revealed that social isolation was the most common protective behavior during the COVID-19 outbreak. The collected data would serve as a valuable scientific reference for COVID-19 researchers studying behavioral characteristics.

The study was done to find out how instructional design, student happiness, and online stakeholder groups affected the quality of distant education during the pandemic outbreak. The intention was to determine how these components affected through remote learning's overall efficiently. The study concentrated on graduates of

an education college from KS University in Saudi Arabia. 210 people took part in the e-poll that was used to collect data from Facebook page and WhatsApp groups.

Mostly studies were conducted in Pakistan to investigate learn more about students' opinions and experiences with e-learning educational during the pandemic. The satisfaction levels of students with the help provided by their institutions administration and teachers, the home study environment, and the use of various communicating and assessing methods were all measured in these studies. The data was gathered in a cross-sectional survey utilizing online questionnaires and analyzed by using SPSS software. To improve the quality of virtual education, the studies emphasized the necessity for qualitative research including all major stakeholders, including students, teachers, administrators, and officials.

Another study was done at the levels of satisfaction of undergraduate students and the challenges they had faced because of the abrupt move to online education. Separate questionnaires were used for deducting pupils and instructors, with 1,280 pupils and 112 instructors taking part. Material quality, availability, instructors' engagement, and mode of course delivery was mostly considered. This study discovered that a lack of in-class contact was a big worry for pupils as well as instructors, and that the technique of delivered lectures was critical.

Furthermore, a study looked at undergraduate students' satisfaction with e-learning practices during the pandemics outbreak. Most pupils were disappointed with remote educational environment, stated concerns such as difficulty learning compared to regular schools, limited opportunities for internet-based learning, along with the need for face-to-face learning. The study was recommended to do more research on the advantages and disadvantages of online learning, the perspectives of teachers and students, the impact on learning outcomes, and the obstacles faced by mentors and learners.

The pandemic outbreak triggered substantial changes in a variety of industries, highlighting weaknesses as well as possibilities through technology exchange. The goal of the research done in Romanian universities was to present a survey of the

online learning educational process as seen by students and course instructors. Data was obtained from 844 students from different fields of study, revealing that their capacity moving in traditional to distance learning classes was distressed for many students. The study emphasized the need for financial investments for teacher training and acquiring rights to create digital animations or simulations. The retaining student involvement, cutting-edge teaching strategies for discussions and brainstorming in each sessions were advocated, particularly in online environments.

To address the hurdles faced during future pandemics, a scientific analysis of NUST students' experiences with the online education system was conducted. Questionnaires were used to gather information on various aspects, including educational management, parental perceptions, resources, social media usage, quality of services, and satisfaction with the Qalam App. Data was collected from the NUST University Main Office H-12 Campus, with a target sample size of 316, but 332 samples were successfully achieved. The results of this research will provide valuable insights and guidance to educational stakeholders and decision-makers for utilizing e-learning during future epidemics and pandemics. By conducting authentic surveys, the educational system in Pakistan can better prepare for crises, ensuring students' education and investments are not compromised. NUST University sets a benchmark for other universities in Pakistan to meet similar standards in implementing e-learning.

1.1 Motivation:

The motivation behind this research is to secure and safeguard the education system of Pakistan with the slogan "Education for All." By implementing progressive changes in the online education system, we aim to make the infrastructure more effective and efficient for students. This transformation provides a pathway to address the critical and practical needs of students and teachers regarding educational concerns, offering a quality and cost-effective solution. It can serve as an alternative during pandemics, epidemics, and situations like natural disasters, lockdowns, long

marches, and dharnas in Pakistan. For example, the heavy floods during the 2022 epidemic crisis in Pakistan were due to climate change.

1.2 Problem Statement:

The problem statement revolves around the online educational concerns of Pakistani students during the transition from Face to Face (FTF) mode to Distance Learning (DL) mode during pandemics. We have targeted to assess the impact on students' satisfaction or dissatisfaction when interacting with e-learning features and services. To achieve this, we will use NUST as a case study.

1.3 Proposed Solutions:

This study have investigated a statistical insight to evaluate the satisfaction and dissatisfaction of students based on various parameters, addressing their identified issues while using the DL mode considering NUST as a case study.

1.4 Objectives of The Study:

The objectives of this research are as follows:

1. Analyze the experience of NUST students during the transition from FTF mode to DL mode.
2. Identify limitations or shortcomings of the system and propose improvements for future planning.

1.5 Relevance to National Needs:

This research plays a significant role not only for NUST but also for the overall education sector of Pakistan in the coming years. NUST serves as a representative sample that reflects the entire student population of Pakistan due to its extensive infrastructure and diverse range of undergraduate, MS, and Ph.D. programs. The goal is to evaluate the perception of NUST students regarding the DL mode during the pandemic. The findings will help shape our future requirements and provide guidance for teacher training in the event of any future pandemics.

Chapter 2

REVIEW OF LITERATURE

After the outbreak of the Coronavirus pandemic from Wuhan China, it brought massive disruption in all fields of activities. As the high risk of COVID-19 spread, all institutions had to close physical activities, and this impacted largely students' education. Meanwhile, educational systems globally adopted e-learning platforms, to continue the process of teaching. Likewise, Pakistan's educational sector was also affected during the pandemic due to smart lockdowns imposed by Government. Hence, Pakistan's educational system shifted from Face to Face (FTF) classes to Distance Learning (DL) mode. With limited knowledge regarding e-learning among teachers and students in Pakistan, still, the online education system was adopted during pandemics in schools, colleges, and universities.

Therefore, we are surveying NUST as a case study. The focal point of this study is to investigate the level of satisfaction and dissatisfaction among NUSTIANS regarding DL mode by collecting their responses through online questionnaires to analyze the strengths and weaknesses of the educational system of Pakistan during pandemics. Through this scientific study, we will be able to propose solutions. A few similar studies conducted in different parts of the world are summarized below.

2.1 Level of Research Done

Our first evaluated study was a survey conducted during the pandemic to assess the dissemination and frequency of protective behaviors, as well as emotional and anxiety status among the Turkish population. An online questionnaire was distributed to 3,040 respondents aged 18-30, and a cross-sectional survey was conducted between April 2 and April 8, 2020. During the COVID-19 outbreak, social seclusion was the most common protective behavior reaction. Previous research indicates that respondents were unaware that COVID-19 may be spread via droplets, potentially reducing the

need for some preventative measures. As a result, the public's accurate understanding and good attitudes towards the coronavirus disease outbreak have risen. According to the study, it is critical to provide easy and recurrent health information via social media in order to encourage protective behaviors. The findings found a substantial relationship between computer or cell phone usage and sleep habits. University students who are knowledgeable about COVID-19 may be able to lessen adverse feelings and deal with the hazards of an infectious outbreak in a more positive manner. The study could have ramifications for young people's public health during infectious disease outbreaks, such as improved protective behavior. Following the COVID-19 epidemic, investigations on psychological and behavioral repercussions of the pandemic can be done. The information gained in behavioral dimensions will be a valuable scientific reference for other COVID-19 investigators in this vital and critical procedure and beyond [1].

Another survey was conducted to investigate how Instructional Design, Student Satisfaction, and Online Stakeholder Groups impacted the quality of distant learning during the COVID-19 epidemic. The target group included KS University students. They all attended the college for teachers. As undergraduate programs, they are followed by programs in Educational Administration, Administration Policies, Arts, Educational Technology, Educational Psychology Islamic Studies, Special Education, and Early Childhood. Data was gathered through WhatsApp and Facebook groups using an online questionnaire. There were 50 female responses (23.81%) and 210 overall responses to the questionnaire, with 160 men (76.19%) responding. Four experts from different fields looked at the scale's content validity. A Likert scale with four points was used to evaluate the importance of each item. The twenty items were determined to be minimal or extremely relevant. I-CVI = 0.90, an item-level content validity index, was computed. All the construct values were greater than the advised cutoff point of 0.60, indicating convergent validity for the instrument. .The actual values ranged from 0.666 to 0.843. As a result, the tool showed high levels of validity, regularity, and reliability. In how it handled factors like Educational Design, online groups of stakeholders, and satisfaction among students as predictors of remote

learning during the COVID-19 epidemic, it was a unique study. In conclusion, online groups of stakeholders, curriculum development, and student happiness are likely to be crucial mechanisms that contribute to a rise in QDE during critical circumstances like the Corona epidemic. The combined effects of online groups of stakeholders, instructional design, and satisfaction among students were shown to account for 43.5% of the overall variance in students' QDE. F(3, 206) = 28.962; P 0.01; the F-ratio value was significant. These aspects had to be taken into account when developing e-learning for students in higher education. This investigation is useful in practice because the current scenario has forced colleges around the world to adapt to distant education [2].

Our third resurrected study investigated students' perceptions and experiences with different aspects of online education while studying at Pakistani Higher Education Institutes (HEIs) and educational institutions that switched to online methods of instruction during the COVID-19 pandemic. The purpose of this study was to determine students' levels of satisfaction with the support offered by their institutes and teachers; the usage of various channels for communication along with evaluation methods; and their home study environment. This study used a web questionnaire-based cross-sectional survey design. The SPSS program was used to analyze data received from 707 respondents from various Pakistani higher education institutions and universities. Overall, the majority of students said they would not take online classes again once the pandemic has ended. Even though most students reported living in three or more-bed apartments/houses (39%), and one or two-bed apartments/houses (35%), only 36% had a separate room for studying [3].

Our fourth evaluated study sought to identify the challenges faced by students and educators in this sudden transformation. Furthermore, it investigates undergraduate students' satisfaction with online education practices during the COVID-19 outbreak. The study used a survey approach was conducted using two separate questionnaires for students as well as educators. A total of 1280 pupils completed the student questionnaire, while 112 teachers completed the teacher questionnaire. The predicted

variables for student satisfaction were Content Mode of Lecture Delivery (MLD), Teacher Interaction (TI), Content Availability (CA), and Quality (CQ). Regression results demonstrated that the total model with all four indicators was significantly more predictive of satisfaction among students. According to the findings of this study, 87.6% of respondents said that providing online content, such as video lectures, presentations, notes, assignments, and exam papers, is more difficult. However, 63.5% believe that understanding new technologies has been an added burden that demands a greater amount of effort and time. The poll was conducted at a time when online programs were in full swing at most Pakistan's higher education institutions. The findings of this research could lead to more efficient paradigm shifts in this epidemic. [4].

The fifth reviewed study focused on investigating student satisfaction with distance education. The findings revealed that a significant majority of students expressed dissatisfaction with online education in comparison to traditional classroom learning. The reasons cited included difficulties in effectively learning through online platforms, limited access to internet-based learning due to a lack of computers or smartphones, student preferences leaning towards non-web-based learning, and a perception that online learning did not provide the same level of engagement as the traditional classroom method. According to the research carried out by Sokout and Usagawa (2018) at Kabul Polytechnic University in Afghanistan, researchers noted continuous issues faced by the nation in terms of internet access, electricity availability, ICTs centers, and service quality. The survey recommended more research be done to examine the benefits and drawbacks of online education, as well as to look into how students and teachers view it, how it affects their academic performance, and what difficulties both students and teachers face when using the internet to learn. It was noticed that pupils' ability to learn independently was not adequately encouraged by online instruction. However, the study found that students were somewhat satisfied with the involvement of teachers, who helped facilitate the e-learning process [5].

In our sixth evaluated study, they wanted to show how the COVID-19 pandemic had brought about significant changes across the board, emphasized numerous technologically based potential as well as vulnerabilities. In order, to give readers a comprehensive picture of the virtual educational process, this study will examine it from the viewpoints of both students and teachers from Romanian universities. Without respect to the students' fields of study, data were gathered from 844 students attending Romanian universities. In-depth interviews and surveys were employed in this study, which was primarily focused on quantitative methodologies. SPSS statistical software was used to handle the data. The findings of this study show how the opinions of two distinct parties that play a role in the university process of learning differ. Even when the pandemic is over, the educational system should continue to successfully incorporate technological advancements, which this pandemic served as an important beginning point for. This study also emphasizes the necessity of spending money on both teacher training and the purchase of licenses for the creation of simulations or virtual animations. Research also shows that instructors should implement cutting-edge teaching techniques like discussions and brainstorming sessions to keep students' interest in class, particularly online [6].

In our seventh reviewed study, the focus was on examining the awareness of children regarding the COVID-19 situation, which had both positive and negative effects. While some children appeared unaware of the pandemic and were not bothered by the changes happening around them, others expressed frustration, as mentioned earlier. It was noteworthy that in families where children faced difficulties at school and felt safest at home, positive emotions were frequently observed. For these children, practices such as social distancing and self-isolation provided a period of calm and respite, leading to a more relaxed environment for them and their families. Compared to their peers without problems, the kids with disabilities were under higher stress. In this study, it was found that, on lockdown days, families that have kids with disabilities feel 44% more stress as well as 12% more anxiety than their typically developing children, who suffer 25% and 5% stress and anxiety correspondingly [7].

Our eighth reviewed study focused on the potential educational crisis that could arise in Pakistan if alternative educational options are not provided for students from impoverished backgrounds, who often lack access to technology. The effectiveness of virtual education is a topic of debate among scholars. Some argue that virtual education produces outcomes equivalent to traditional pedagogical approaches, while critics argue that there is insufficient empirical evidence to support the outcomes of virtual education. However, it has been observed that outcomes tend to improve when the provision of virtual education is overseen by school districts.

To effectively address the impact of the Covid-19 pandemic on Pakistan's public education sector through virtual education, significant investments need to be prioritized to bridge the digital divide and meet the learning needs of the 47 million out-of-school children. However, the absence of public discourse on ensuring continuous educational provision for children in public schools during the pandemic-induced shutdown indicates that such investments are unlikely to be made in the short term. Instead, the focus is currently on ensuring the basic survival of the country's impoverished populations, who heavily rely on daily wage income in the informal economy, which has been severely affected. [8].

The teachers were reluctant to accept the change because they were accustomed to educating students Face-To-Face (FTF). The teaching community was forced to adopt online distant teaching and learning because of the pandemic issue, nevertheless. Additionally, this epidemic had taught pupils that they needed to have certain specific abilities in addition to their academic training, such as problem-solving, survival, and critical thinking. The curriculum must be created in a way that fosters resilience to certify and priorities the use of these skills [9].

In Pakistan, the epidemic had a negative impact on the continuity of schooling. Nearly 40,000 students from primary school to upper secondary education were directly impacted by the closing of educational institutions, and other professional institutions. With pressures coming from both internal and exogenous forces, the already fragile educational system may be vulnerable to this (Ministry of Federal Education and

Professional Training, 2020). However, the abrupt switch from in-person to virtual distance learning has largely benefited the private and semi-public educational institutions operating across the nation, if not all of them. In order to help people with limited internet access, the Ministry of Education took swift action by airing online instructional sessions on national television. [10].

The COVID-19 outbreak had generated a climate of fear and concern around the world. It provided a difficult scenario for both students and teachers because no one knew for how long the schools would be closed. In the opinion of Sahu (2020), students whose are meant to graduate this year may experience a delay, which may worsen their depression. The pupils with and without impairments appeared to suffer more because of the present epidemic since they had received less assistance, and teachers were also not adequately qualified to educate them online [11].

In terms of special needs students' learning processes, this study discovered that they are more apprehensive about studying remotely than their non-disabled counterparts, particularly when it involves upgrading from one level to the next [12].

Factors like the loss of social connections, children's poor attention spans, noise and interruptions, poor internet connections, and an absence of independent study skills are taken into account, it can be said that these select few privileged students who attend private school systems in urban areas of the nation have a distinct advantage when compared to students who attend state-funded institutions. [13].

The COVID-19 pandemic has had a significant impact on the professional prospects of university graduates this year. These graduates have faced substantial disruptions in their education, including interruptions in teaching and assessments. Moreover, they are graduating during a time of global recession, which further adds to the challenges they may encounter. Research has demonstrated that graduates from programs with high projected earnings have the potential to mitigate the adverse effects of starting their careers under challenging circumstances. They may achieve this through both increased earnings within their current firms and by seeking opportunities across different organizations. However, graduates from other programs have been found to

experience long-term reductions in their earnings as a result of graduating during an economic recession. This situation underscores the considerable obstacles faced by this year's graduates and the potential lasting impact on their career trajectories. It is important to provide them with additional support and resources to navigate the uncertain job market and mitigate the consequences of the pandemic and economic downturn. [14].

The COVID-19 outbreak had made matters worse for students in nations suffering from, or recovering from, conflict and natural disaster. Researchers argue that emergency procedures should be in place to guarantee an opportunity for education even in times of crisis, even though the Global Campaign for Education (GCE) recognizes the public's safety decision to close schools. GCE is adamant that every student has the legal right to an education, regardless of their living situation or other circumstances. Children, teenagers, and adults all have a right to education in times of catastrophe, and this right must be prioritized from the outset of any emergency response [15].

Many institutions all around the world have completely digitalized their operations due to the pressing demand of the moment. In the middle of this confusion, online education was showing signs of success. Therefore, it was critical at this point to improve the quality of online teaching and learning. When things were tight, people were more worried about how colleges and universities would be able to implement online learning so widely than whether these teaching-learning approaches could deliver high-quality education [16].

Teachers must try to provide the greatest instruction possible while consistently raising the caliber of the courses. Online courses should be made with the students in mind and be interactive, group-based, innovative, and relevant [17].

Making efficient ways for delivering online instruction requires a lot of time from educators. Effective online instructions encourage feedback from students, encourage them to ask questions, and expand their knowledge of the course material [18].

Institutions emphasized pedagogical issues, case studies, project-based learning, and collaborative learning through online instructions [19].

The standard of e-learning programs posed a significant barrier. The government does not have clear educational policies for e-learning programs. There were no quality standards, quality control, e-resource development, or e-content delivery. This issue must be addressed as soon as possible so that everyone can reap the benefits of great education through e-learning [20]. One should not only evaluate the benefits of using online learning during a crisis, but also examine developing and improving the standard of virtual courses given during such events [21].

The COVID-19 crisis has created a significant surge in online learning, remote working, and e-collaboration. Academic institutions worldwide have swiftly transitioned to online learning models, leading to a substantial increase in opportunities within the online learning space. This crisis has acted as a catalyst for the exponential growth of online learning, as well as remote working and e-collaboration, enabling individuals and organizations to adapt and thrive during these challenging times. [22]. When delivering online education, educators should consider five crucial aspects: instruction, content, motivation, relationships, and mental health. These elements must be carefully attended to in order to effectively facilitate online learning [23].

In times of disasters and crises, whether caused by human actions or natural events, educational institutions must demonstrate resilience and explore innovative approaches to ensure the continuity of teaching and learning activities. [24]. The occurrence of natural disasters can serve as a catalyst for researchers, motivating them to embrace and adopt highly innovative communication technology and e-learning tools [25].

In times of crisis, inclusive education can be facilitated using e-learning. It is crucial to implement mechanisms in educational institutions that ensure no student is denied access to education due to factors such as geography, social class, or ethnicity. Before adopting online teaching approaches, it is important to carefully consider the benefits

and drawbacks of technology and fully harness its potential to enhance and facilitate the teaching and learning process. Thorough research on technology is essential to address anxieties and tensions that may arise during crises such as disasters and pandemics like Covid-19, which can cause confusion and unrest [26].

When educational institutions closed and learning became mostly distant during the start of the epidemic, discrepancies between groups of pupils based on a variety of characteristics were created, and existing disparities were exacerbated. The most notable of these characteristics was undoubtedly socioeconomic class, with the poorest pupils' learning time being cut to greater degrees than the richest. Even after schools reopened, discrepancies in attendance persisted, with attendance varying among the most and least poor districts. Furthermore, there was significant heterogeneity behind the averages stated in the literature for lost time at the educational institution, local to regional and student-level local authorities [27].

This shift in the educational system came as a surprise. The school system, which had been in place for years, if not hundreds of years, had to be drastically altered. This pandemic necessitates social-distancing appeals, which must be undertaken to break the chain of the Covid-19 virus's transmission [28]. There is no longer any direct social connection between students and teachers or other students during the learning process [29]. The state-run channel PTV, or Pakistan Television Network, on which Tele school is broadcast reaches 90% of Pakistan's regions, with 63% of Pakistan's homes owning a television set. The Tele school channel mirrored the larger difficulties that highlighted the Pakistani education system that was established during the epidemic [30].

2.2 Significance of The Study

Multiples studies have been conducted in different parts of the world. Therefore, the study is being conducted in NUST to highlight major factors affecting online education system during pandemics.

Chapter 3

METHODOLOGY

3.1 Study Design and Data Availability

This chapter discusses the methodology used in the study. An online survey is used to analyze the experiences of NUST students regarding shifting from Face to Face (FTF) to Distance Learning (DL) mode during COVID-19 waves. The necessity of this online survey becomes essential while studying literature related to e-learning worldwide. Analyzed perspective of NUSTIANS regarding level of satisfaction to from FTF to DL mode shift. The questionnaire highlights six different factors namely educational management, parents perception, resource social media, quality of services/user's perception, cognitive performance and local/school level administrative system. The idea is to identify various problems faced by NUSTIANS while experiencing online education during pandemic. This study provides useful guidelines to administration of NUST towards further improvements in e-learning by reassessing and considering NUST students concerns.

3.2 Scheme of Study

This study is survey analysis of NUSTIANS with respect e-learning experiences during pandemics. The detailed scheme of study followed is given in Figure 3.1:

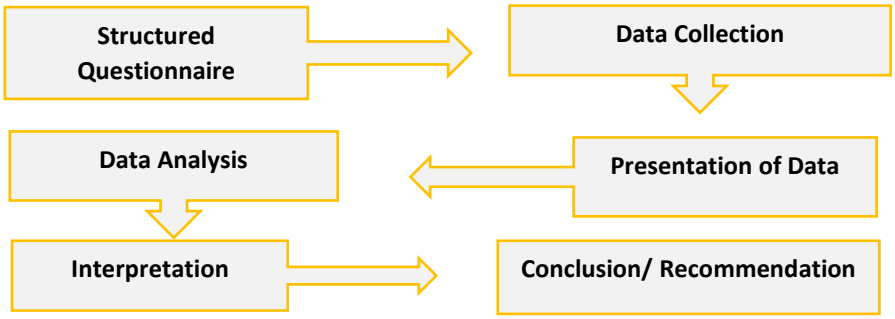


Figure 3. 1 Scheme of Study

3.3 Study Design

For analyzing NUSTIANS perspective i.e students, data has been collected using structured questionnaire. The questionnaire consisting of twenty-four questions are divided into six sections namely:

1) Educational Management
2) Parents Perception
3) Resource Social Media
4) Quality of Services(Overall)
5) Quality of Services(Classroom Activities)
6) Local/ School Level Administrative System

3.4 Sample Size Calculation

In this part of the study, first decided to collect data of NUST total population from Main Office H-12 Campus. When for observation researched to Main Office asked for sharing us NUST total population data. But the administration of Main Office refused to give us this sensitive information with permission letter. Therefore, through proper channel we send permission letter to Main Office and collected this information as given below:

Total Population

Teachers: 814

Students

1) UG: 8,000
2) MS: 6,000
3) PhD: 850

Which means 814 teachers who are teaching in H-12 Campus NUST and 14,850 students are currently enrolled in any department of H-12 Campus NUST. After this we tried to analysis both teachers and students' perspectives regarding shifting of FTF to DL Mode during pandemics. But now a big hurdle comes as to take view from teachers of NUST by fining online questionnaires regarding their experiences was not

possible as each department wants permission letter without it, they were bounded to not participate in this survey. Therefore, this research decided to focus only on students of NUST by making them participants in this research. For this survey first must choose a sample size from the total population of NUSTIANS.

The following statistical formula applied on NUST students' population to get sample size as shown below:

$$n = \frac{N}{1 + N(e)^2}$$

Where,

n= Sample size

N= Population size

e = Level of precision or Sampling of Error which is 5%

Sample size for this study has been calculated at confidence level 95% along with the margin of error at 5% and population proportion 30%. Therefore, calculated sample size for the case study is 316.

3.5 Data Collection

In this part of the study, asked NUSTIANS to fill online questionnaires. However, as part of this study, personal interviews were conducted by them before their online submission online questionnaire. Initially very few NUST students took part in filling this online survey. For handling this issue, in this study have used tools to interact with more NUSTIANS by sending link of our online questionnaires in their emails, using WhatsApp groups targeted girl's hostels and boy's hostels where more participants engaged along with NUST Central Library visited on daily bases and canteens C1 and C2 were interacted with NUST students. One has analyzed NUSTIANS perception regarding DL mode during pandemics keenly through firsthand information. Therefore, due to this data collection strategy one was able to cross the targeted sample size of 316 and researched to 332 NUST participants. That is how appropriate raw data collected for this study.

3.6 Pre-Data Processing

In this part of the study, used statistical software tool to analyze raw data. For this purpose, has used SPSS software version 20 and Microsoft Excel. Through this survey, the research has transformed raw data into meaningful information. Therefore, through this pre-data processing used to distribute and understand each section and apply further formulas to extract useful information in systematic order.

3.7 Demographics

In studying demographics of NUST students. Firstly, asked the students their names. Secondly, participants' responses regarding their gender. Thirdly, participants asked to respond that are they NUSTIAN or Non-NUSTIAN. Fourthly, participants asked to respond that what is their level of education they are currently enrolled in NUST example UG, MS and PhD. As illustrated in Table number 3.1.

Table 3. 1 Demographics Based on Gender, Institutions and Educational Levels of Participants

Sr. No.	Variable	Category	Percentage
1	Gender	Male	70
		Female	30
2	Institution	NUSTIAN	99
		Non-NUSTIAN	1
3	Demographics Educational Level	UG	36
		MS	60
		PhD	4

3.8 Data Presentation

In this part of the study, for data presentation technique method applied to present this survey data using competitive data analysis that will interpretate well terms of visualization, measurement of location and descriptive statistics. This technique helps in understanding NUSTIANS perceptive regarding DL mode.

3.8.1 Visualization

Using visualization technique in this study, through bar charts, frequency distribution and histograms on each section of the questionnaire. That will help in understand data in great presentable manner of the NUST students.

3.8.2 Measurement of Location

In this part of the study, methods applied on data for observations were skewness and kurtosis. This shows frequency of occurrence of NUSTIANS in asymmetry of the distribution and measure of the peakedness of the distribution.

3.8.3 Descriptive Statistics

In this part of the study, methods used were mean, standard deviation, and Chi-Square test for analyzing this online survey data results. That will show us descriptive statistical results. Therefore this study can easily understand and analysis participants perspectives majorly where falls. Moreover, this study can also analysis associations building up between each section questions as well.

Chapter 4

RESULTS AND DISCUSSION:

4.1 Data Pre- Processing:

This study was used to analyze the issues faced by individuals who transitioned from face-to-face (FTF) mode of education to distance learning (DL) mode, focusing on NUST as a case study. Data was collected through an online survey and personal interviews, specifically addressing the education system in Pakistan during the COVID-19 pandemic. In this survey the targeted sample size was 316 participants.

The initial stage distributed emails to students and asked them to take the survey to collect responses. In conducting this survey, also reached out to examine NUSTIANS by using social media such as Facebook and WhatsApp groups to increase the response rate quickly. In parallel, the survey conducted personal conversations with the NUST students, encouraging them to communicate their stories and offered their insightful opinions on learning experience in DL mode. By using these techniques, were able to interview NUSTIANS as well about their point of view with the DL mode of instruction and obtained extensive analysis added from their side.

4.2 Missing Frequencies in Survey Explanation

The questionnaire response rate was higher than the desired number of samples of target 316, as collected 332 responses after completion of the survey. However, this survey examined missing frequencies in several of the responses throughout data processing and analysis. By minute inspection, found that three of the 332 respondents did not respond to any one of the survey's questions. The respondents with ID numbers such as 3, 23, and 59 were deducted to be those who did not respond to a particular question. Since those missed the responses were repeatedly noticed in the data. Therefore, can make the decision to remove these respondents from this study. After that, went ahead and removed these absent respondents from the initial dataset. The three missing responders frequently noted before were among the

maximum 14 missing frequencies in Section A. There was a total of a maximum of 9 missed frequencies in Section B and a maximum of 7 missing frequencies in Section C. Finally, one found a maximum of 12 missed frequencies in Section D. Therefore, three missing respondents weren't included from all the sections notified.

We had a total of 332 respondents, and after removed the 14 respondents that had missed frequencies, once had 318 legitimate responses as sample size. To ensure that they were considered and excluded from this study, also considered the percentage of frequently occurring missed responses at the beginning of this statistical research.

4.3 Results

The results of this survey are presented and discussed separately in the following sections of the questionnaire, which are labeled from Section A to Section G. The specific questions asked in each section can be found in Appendix-1 of the thesis or research paper. In each section, provides an analysis and interpretation of the responses received, highlighting key findings and trends based on the data collected.

4.4 Section A: Basic Information Analysis

A questionnaire was designed to address the NUSTIANS' experience related to DL mode. In Section A of the questions (from A2 to A4) were related to basic information analysis was received from participants. Section A, based on data received 318 responses. The following bar charts shown results from Figure 4.1 to Figure 4.3.

4.4 Section A: Basic Information Analysis

A2: What is your gender?

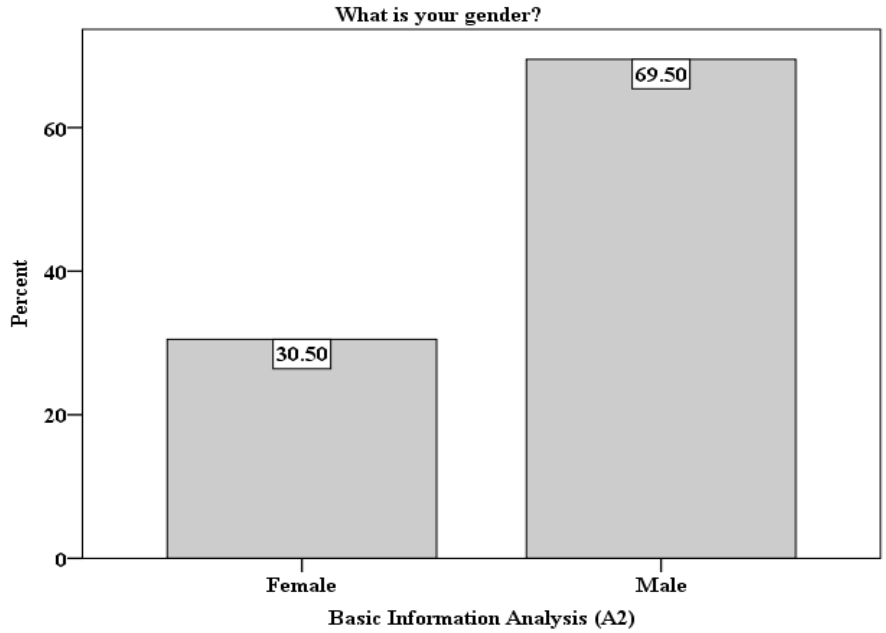


Figure 4. 1 Basic Information Analysis Bar Chart

With respect to gender, 70% of the respondents were male and the 30% were female.

A3. Are you NUSTIAN?

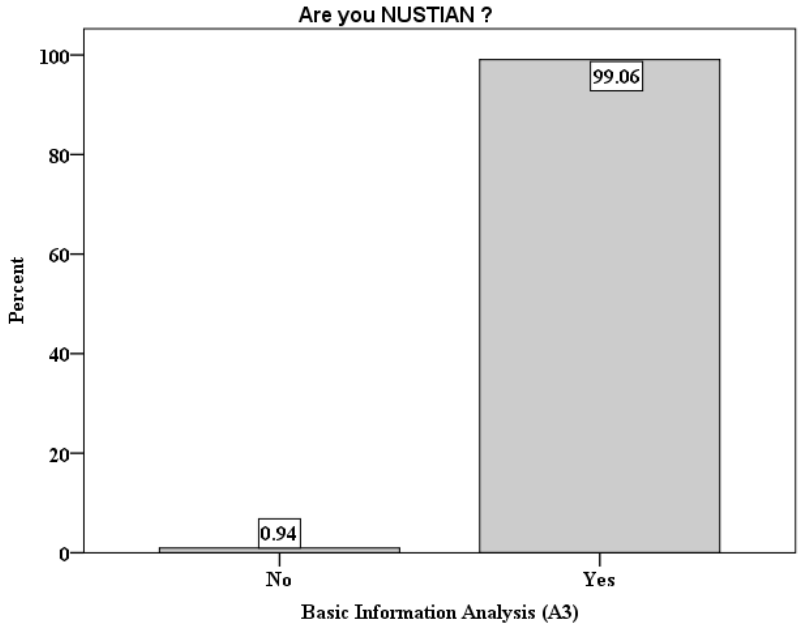


Figure 4. 2 Basic Information Analysis Bar Chart

As mentioned, that this is a case study of NUST. Therefore, 99% of the respondents are from NUST. However, while collecting field responses, we found about 1% of the respondents being Non-NUSTIAN.

A4. What is your level of education in NUST?

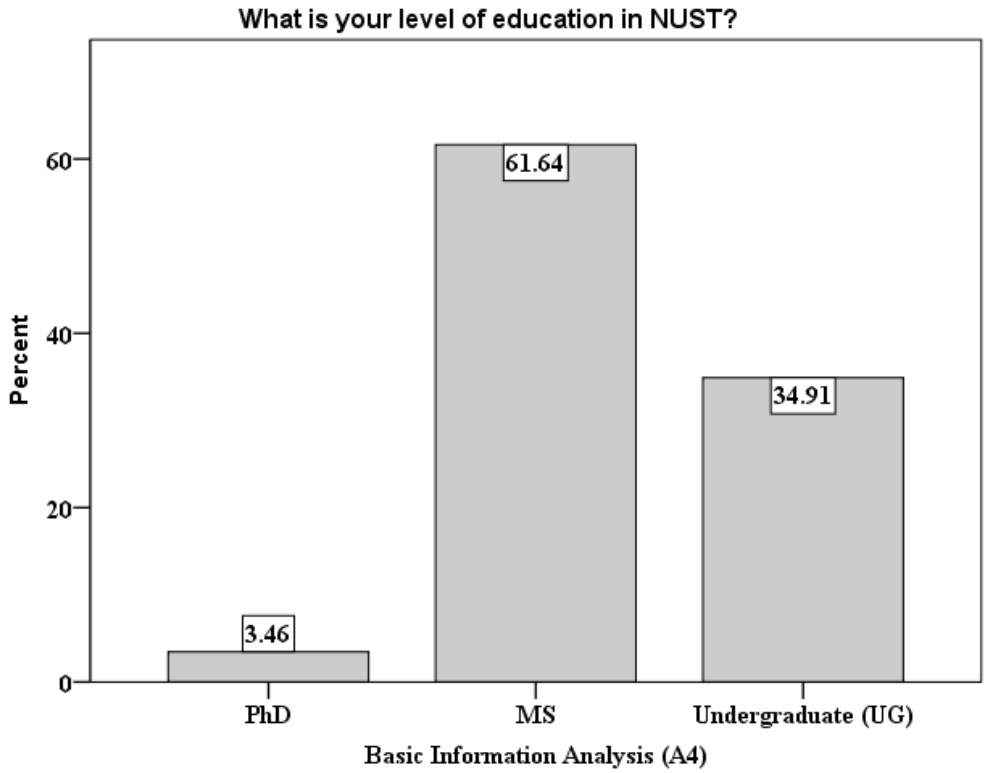


Figure 4. 3 Basic Information Analysis Bar Chart

With respect to the level of education of the respondents, 3.46% belong to PhD, 61.64% belong to MS and 34.91% belong to Undergraduate category.

4.5 Particpants Responded: Different Factors Testing

Participants' responses in the following sections, namely Section B to Section G, are discussed separately in the thesis. Each section focuses on testing different factors related to the research topic. The sections are as follows:

1. Section B: Educational Management
2. Section C: Parents' Perception
3. Section D: Resource Social Media
4. Section E: Quality of Services (Overall)
5. Section F: Quality of Services (Classroom Activities)
6. Section G: Local/School Level Administrative System

In each section, participants were asked to respond to statements using a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The responses obtained provide valuable insights into the participants' perceptions and experiences related to the respective factors being tested in each section. The thesis further elaborates on the analysis of these responses and presents the findings in a comprehensive manner.

4.6 Section B: Educational Management

The purpose of educational management is to create an effective and efficient learning environment within educational institutions. It involves supporting, promoting, and sustaining effective teaching and learning practices. Considered the recent technological evolution that has directly impacted on teaching strategies and assessing procedures, where educational management required to be flexible and sensitive to both local level and global interchanges. Internationally the educational management systems, including those at NUST, faced severe difficulties because of the COVID-19 pandemics. As a result, it was decided to use NUST as a case study to examine how students felt about the changes in educational management.

Our goal of using the questionnaire was to analyze NUST students' perspective primarily linked to educational management. This portion consisted of two statements, and respondents were required to respond to them with justice by answering questions B1 and B2. We received a total of 318 responses for this section.

The details and visual representation of the responses can be found in Figure 4.4 and Figure 4.5, which display bar charts illustrating the results. Additionally, Figure 4.6 presents a histogram to depict the distribution of responses. Furthermore, examined the associations between the questions and the results of this analysis are presented in Table 4.2.

By analyzing the responses, aimed to gain insights into NUST students' perspectives and experiences regarding the educational management practices during the COVID-19 pandemic. The thesis further elaborates on the findings, interpretations, and implications derived from this analysis.

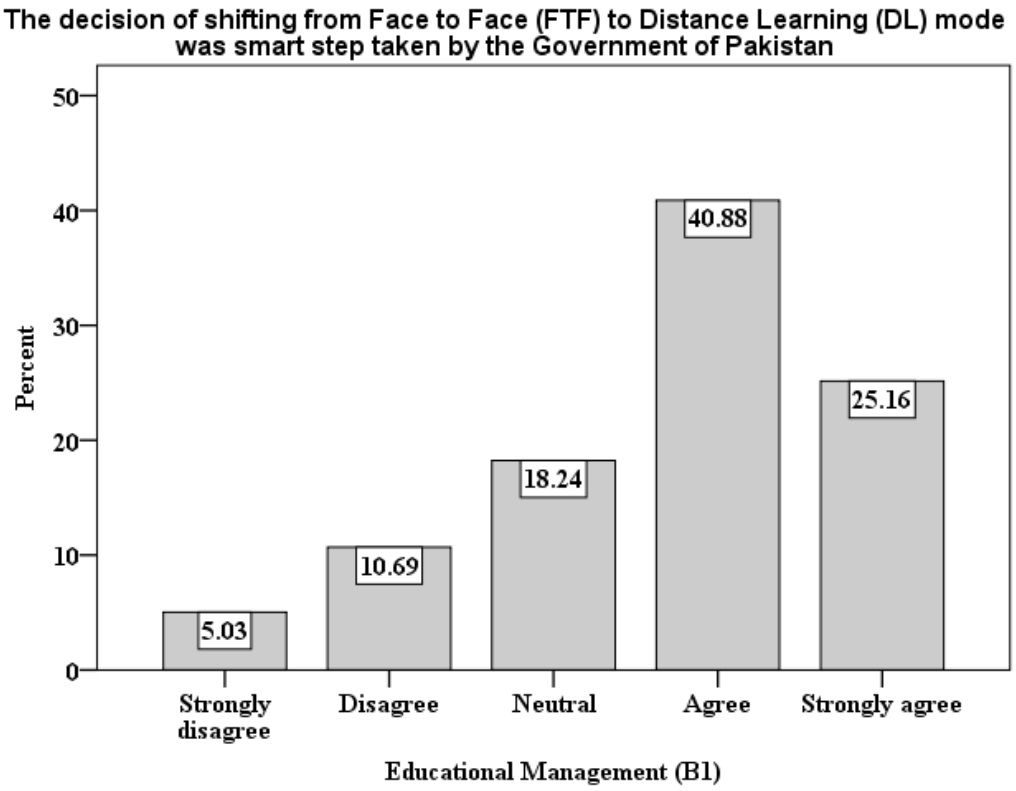


Figure 4. 4 Educational Management Bar Chart

Explanation of Bar Chart

There are 66.04% of the respondents showing an agreement that decision of shifting face to face FTF to Distance Learning (DL) mode was smart step taken by the Government of Pakistan.

Whereas 18.24% of the respondents are neutral, and 15.72% are showing disagreement.

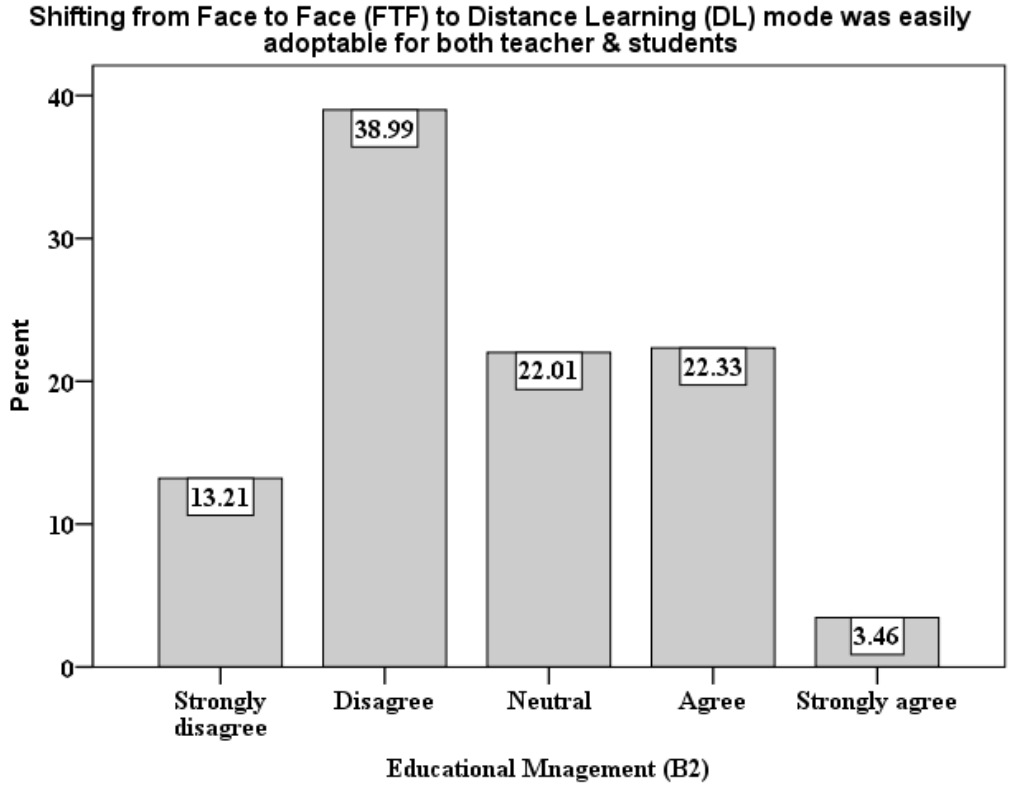


Figure 4. 5 Educational Management Bar Chart

Explanation of Bar Chart

There are 25.79% of the respondents showing an agreement for the statement that shifting from FTF to DL mode was easily adoptable for teachers and students. Whereas 22.01% of the respondents are neutral, and 52.2% are showing disagreement.

Average Response of Section B

Table 4. 1 Educational Management

Descriptive Statistics							
	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Educational Management	318	1.00	5.00	3.18	0.88	-0.20	-0.19

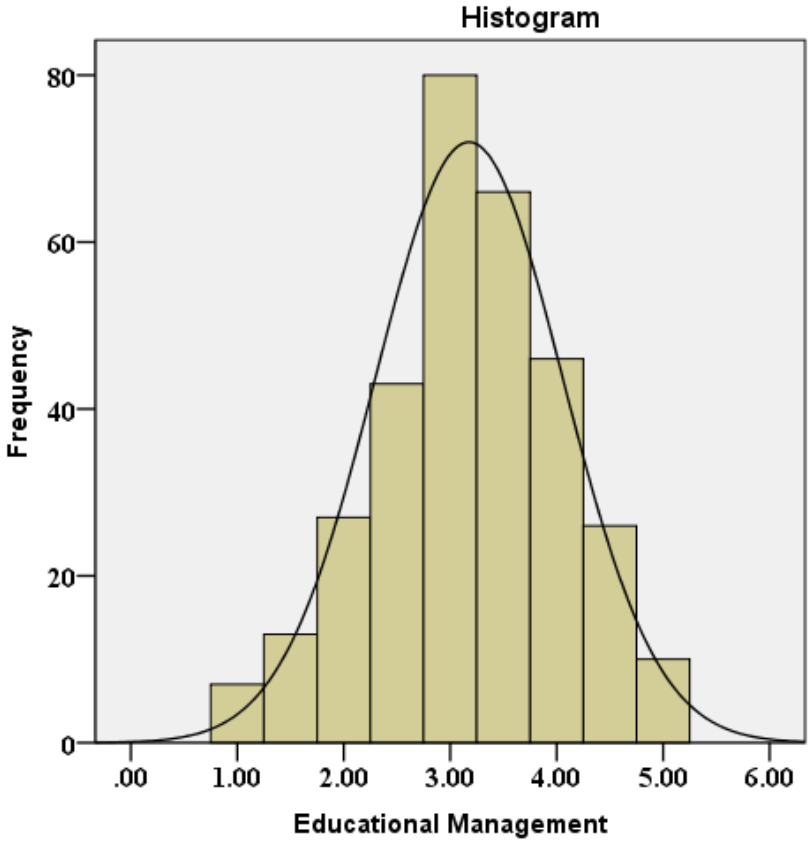


Figure 4. 6 Educational Management Histogram

Interpretation of Section B

Table No.4.1 presents the descriptive statistics for the average of responses in the educational management section. The mean value of 3.18 suggests that, on average,

respondents displayed a neutral tendency in their responses. This is further supported by the histogram shown in Fig No.4.6, which indicates a relatively symmetrical distribution with a slightly sharper peak.The values of skewness and kurtosis provide additional insights into the distribution of the variable. Since the distribution is approximately symmetrical and the peak is slightly sharper, can infer that the variable is normally distributed with a tendency towards neutrality.The overall conclusion drawn from these findings is that the majority of the respondents demonstrated a neutral behavior regarding their perceptions of educational management. This tendency towards neutrality can be attributed to the specific responses given by the participants for each question in the section.For the first question, approximately 66% of the respondents showed agreement or strong agreement. However, for the second question, 52% of the respondents indicated disagreement or strong disagreement. These contrasting responses contribute to the average tendency leaning towards neutrality.

These observations suggest that there may be a range of opinions and experiences among the respondents regarding educational management practices at NUST during the COVID-19 pandemic. The thesis delves further into analyzing and interpreting these findings to gain a comprehensive understanding of the participants' perspectives.

Association of Attributes (Section B: Educational Management) Testing of Hypotheses of Section B

Formulation of Hypotheses

$H_{0:}$ The two criteria of classification are independent

H_1: The two criteria of classification are associated

Table 4. 2 Association of attributes using Chi-square (Qualitative Independent Variables)

Total questions are two (B1 and B2)	
Pair	(B1, B2)
Estimate of Chi-square	56.52
P-value	0.00*

Where, * indicate that results are statistically significant at 5% level of significance.

The chi-square test is a statistical method used to determine if there is a significant association between two categorical variables. In the case of questions B1 and B2, we can use the chi-square test to assess the association between the responses to these two questions.

The chi-square test formula for association is as follows:

$$\chi 2 = \Sigma \frac{(O - E)^2}{E}$$

Where,

$\chi 2$ = Chi-squared

O= observed value

E= expected value

Σ= sum

The degrees of freedom for chi-square are calculated using the formula:

$$df = (r - 1)(c - 1)$$

Where,

r= the number of rows

c= the number of columns

To calculate the expected frequency, one assume that there is no association between the variables and calculate the expected counts based on the overall distribution of responses.

Once calculated the chi-square test statistic, compare it to the chi-square distribution with the appropriate degrees of freedom to obtain the p-value. The degrees of freedom depend on the number of categories for each variable (in this case, the number of response options for B1 and B2).

For example, as mentioned that the calculated chi-square test statistic resulted in a p-value of 0.00. This indicates that the association between questions B1 and B2 is statistically significant, as the p-value is below the usual threshold for significance (e.g., $\alpha = 0.05$).

By determining the association between these two questions, can infer whether there is a relationship or dependency between the responses to B1 and B2. The thesis can further discuss the nature and implications of this association in the context of educational management at NUST.

To calculate the expected counts for each cell in the chi-square contingency table, one need to multiply the probabilities of each category in B1 with the probabilities of each category in B2 and then multiply the result by the sample size. Here's a step-by-step process:

Calculate the probabilities for each category in B1 and B2 by dividing the frequency of each category by the total sample size (318 in this case). Multiply the probability of each category in B1 with the probability of each category in B2.Multiply the result from step 2 by the sample size (318) to obtain the expected count for each cell.

For example, let's say B1 has three categories (A, B, C) and B2 has four categories (X, Y, Z, W), and one have the following observed frequencies:

To calculate the expected count for the first cell (A-X), follow these steps:

Calculate the probabilities for B1: P(A) = 10 / 318 P(B) = 20 / 318 P(C) = 30 / 318

Calculate the probabilities for B2: P(X) = 10 / 318 P(Y) = 15 / 318 P(Z) = 20 / 318 P(W) = 25 / 318

Multiply the probabilities: Expected count for A-X = P(A) * P(X) * 318

Repeat these steps for each cell in the contingency table to calculate the expected counts.

Note: The degrees of freedom for the chi-square test can be calculated using the formula df = (r - 1) * (c - 1), where r is the number of rows and c is the number of columns in the contingency table. In this case, if B1 has r categories and B2 has c categories, then the degrees of freedom would be (r - 1) * (c - 1).

Association of Attributes between B2 and B1

Count

		B2. Shifting from Face to Face (FTF) to Distance Learning (DL) mode was easily adoptable for both teacher & students					Total
		4	2	3	5	1	
B1. The decision of shifting from Face to Face (FTF) to Distance Learning (DL) mode was smart step taken by the Government of Pakistan	4	26	58	33	2	11	130
	2	7	14	3	0	10	34
	3	12	27	10	0	9	58
	5	24	22	20	9	5	80
	1	2	3	4	0	7	16
Total		71	124	70	11	42	318

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.52[a]	16	0.00

a. 9 cells (36.0%) have expected count less than 5. The minimum expected count is .55.

4.7 Section C: Parents Perception

In Section C of the questionnaire, participants were asked about their parents' perception regarding the shift from face-to-face (FTF) mode to distance learning (DL) mode during the pandemic. The question (C1) aimed to analyze NUST students' responses related to their parents' acceptance of this educational transformation. The data collected from 318 participants was used to analyze the responses in this section. Figure 4.7 shows the results in a bar chart format, providing an overview of the distribution of responses for the question related to parents' perception. The bar chart helps visualize the frequency or percentage of participants who expressed different levels of acceptance or perception regarding the shift to DL mode as perceived by their parents. Detailed information and interpretations of the results can be found in the respective section of the report or research document. Please refer to Appendix-1 for the specific wording of the question (C1) asked in Section C of the questionnaire.

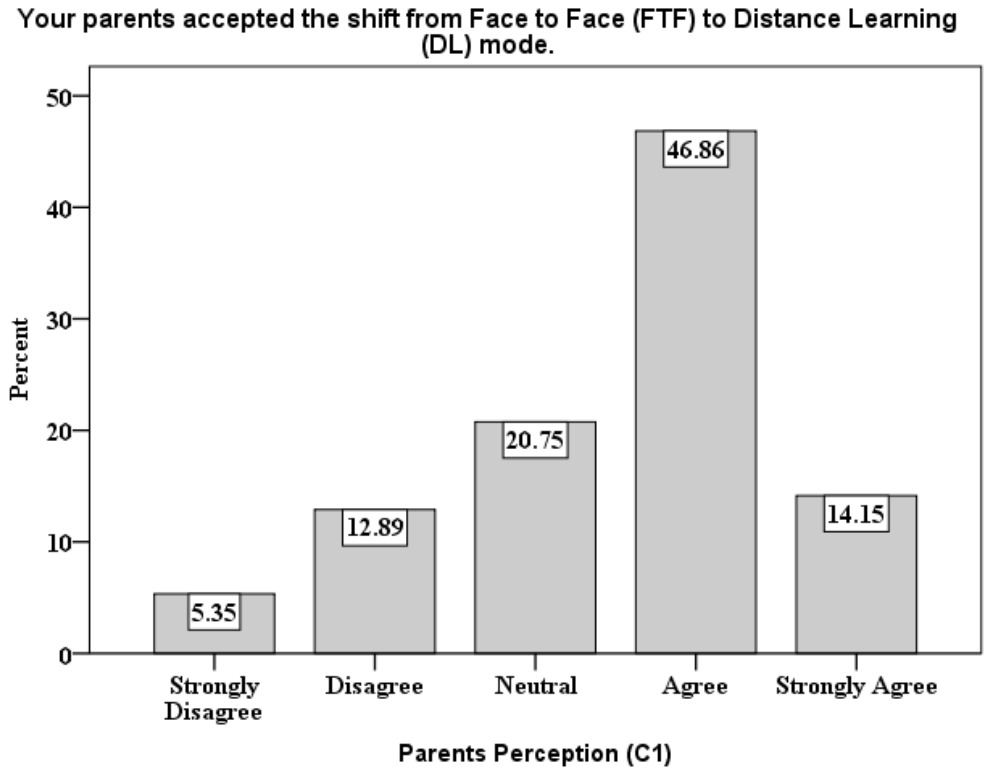


Figure 4. 7 Parents Perception Bar Chart

Explanation of Bar Chart

There are 61.01% of the respondents showing an agreement for the statement that their parents accepted the shift from Face to Face (FTF) to Distance Learning (DL) mode. Whereas 20.75% of the respondents are neutral, and 18.24% are showing disagreement.

Table 4. 3 Parents Perception Checking

Descriptive Statistics							
	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Parents Perception	318	1.00	5.00	3.52	1.06	-0.70	-0.11

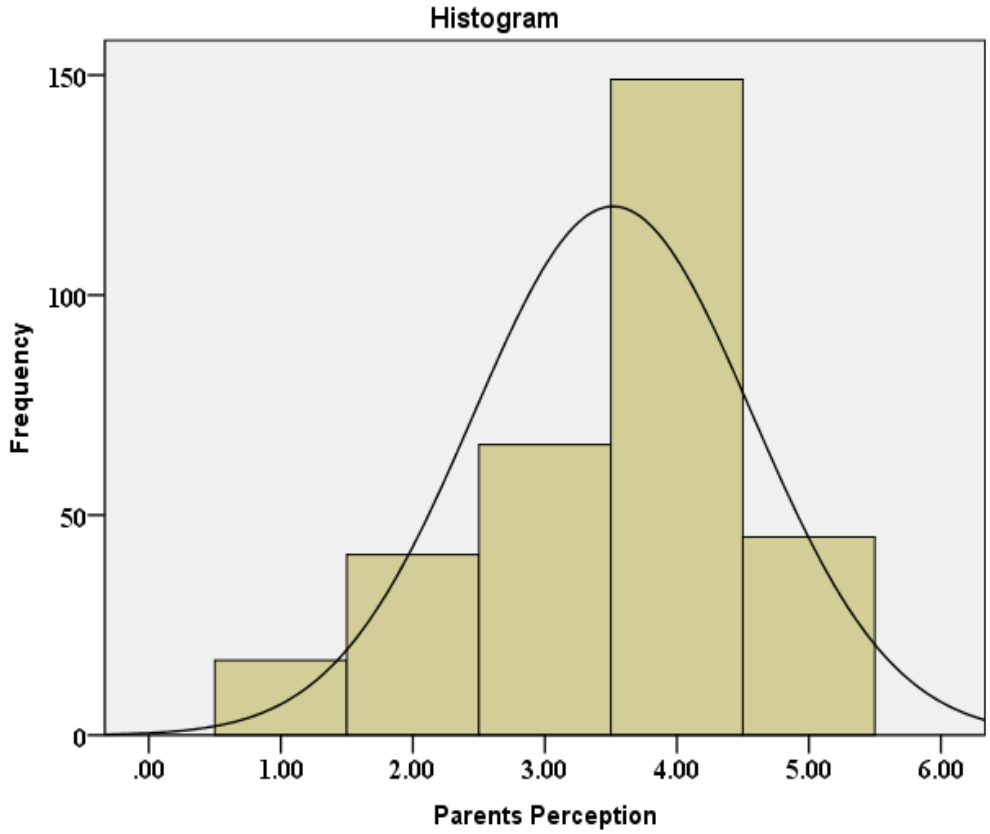


Figure 4. 8 Parents Perception Histogram

Interpretation of Section C

Based on the descriptive statistics provided in Table No.4.3, the average response (mean value) for the question related to parents' perception in Section C of the questionnaire is 3.52. This indicates a tendency of respondents towards the agreement scale. The histogram in Fig No.4.8 also supports this inference, showing a symmetrical distribution with a slightly sharper peak. The skewness and kurtosis values further confirm that the variable's distribution is approximately symmetrical. The overall conclusion is that the majority of the respondents showed agreement behavior regarding their parents' perception of the shift from FTF to DL mode during the pandemic. The reason for the average response tending towards agreement is that approximately 61% of the respondents showed agreement or strong agreement, while 18% expressed disagreement or strong disagreement, and 21% remained neutral. This distribution of responses contributes to the overall tendency towards agreement. These findings provide insights into the perceptions of NUST students' parents regarding the educational transformation and can be further analyzed and interpreted in the respective section of the research document or report.

4.8 Section D: Resources Social Media

In the section of social media, the questionnaire aimed to analyze NUST students' responses regarding the usage of social media for educational purposes and the impact of expensive internet packages on accessing educational resources through social media during the shift from FTF to DL mode during the pandemic. Based on the data received from 318 participants, the responses to the two statements in Section D of the questionnaire (D1 and D2) were analyzed. The results are presented in the form of bar charts in Figures 4.9 to 4.11, and the descriptive statistics can be found in Table 4.5.

The histogram in Figure 4.6 provides a visual representation of the distribution of responses. By observing the values of skewness and kurtosis, we can determine the

shape of the distribution. If the skewness is close to zero and the kurtosis is close to 3, it indicates a normal distribution. However, without the specific values of skewness and kurtosis, it is difficult to make a definitive conclusion about the shape of the distribution. Associations between the questions in Section D were checked and the results are presented in Table 4.5. These associations help identify any relationships or dependencies between the variables. These findings provide insights into the experiences and challenges faced by NUST students regarding the usage of social media and the affordability of internet packages for accessing educational resources during the transition to DL mode. These results can be further analyzed and discussed in the relevant section of the research document or report.

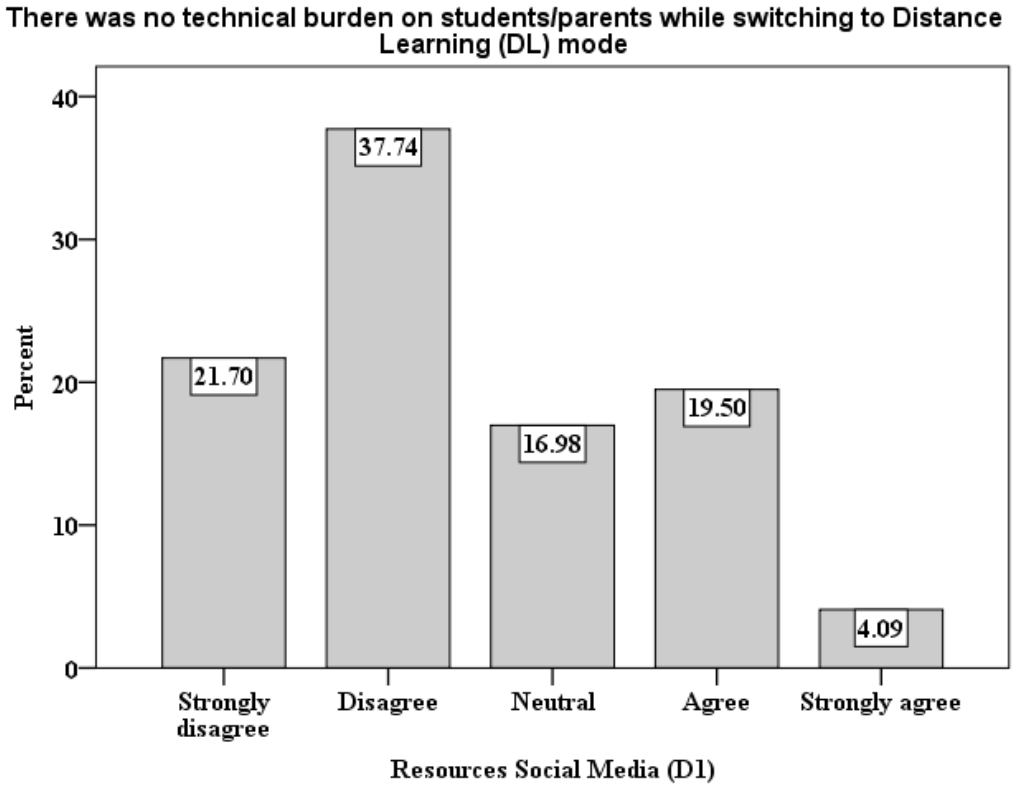


Figure 4. 9 Resources Social Media Bar Chart

Explanation of Bar Chart

There are 23.59% of the respondents showing an agreement for the statement that there was no technical burden on students/parents while switching to Distance Learning (DL) mode. Whereas 16.98% of the respondents are neutral, and 59.44% are showing disagreement.

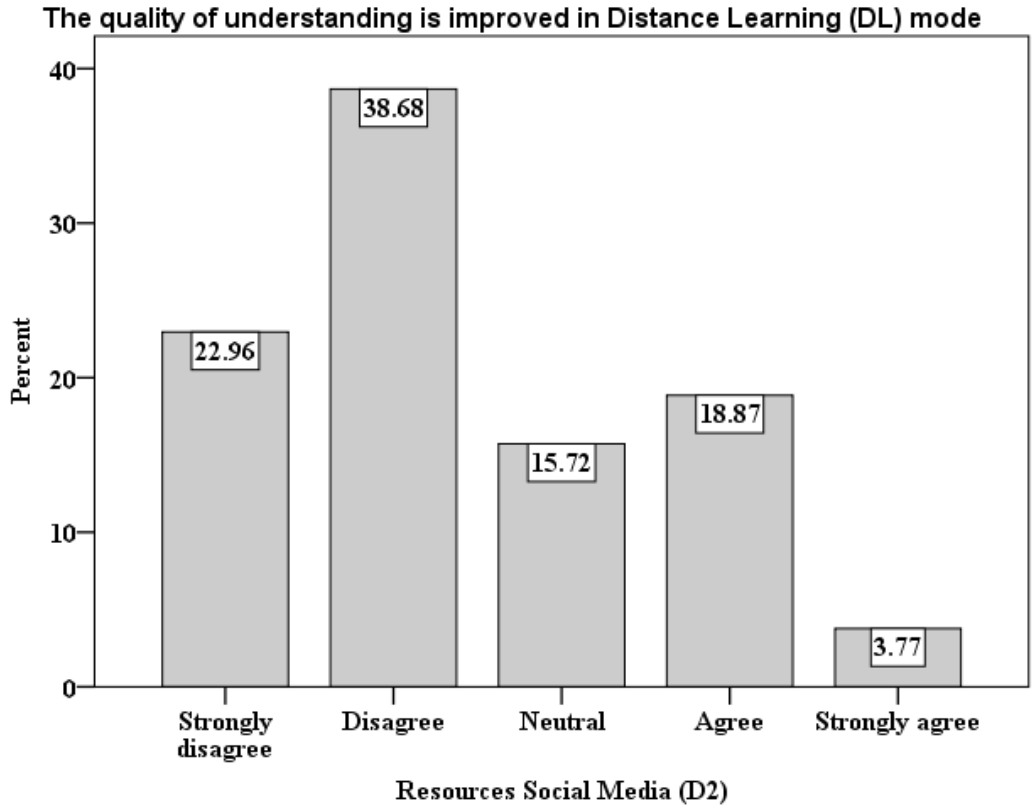


Figure 4. 10 Resources Social Media Bar Chart

Explanation of Bar Chart

There are 22.64% of the respondents showing an agreement for the statement that the quality of understanding is improved in Distance Learning (DL) mode. Whereas 15.72% of the respondents are neutral, and 61.64% are showing disagreement.

Table 4. 4 Resources Social Media Checking Associations

Descriptive Statistics							
	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Resources Social Media	318	1.00	5.00	2.44	0.94	0.34	-0.68

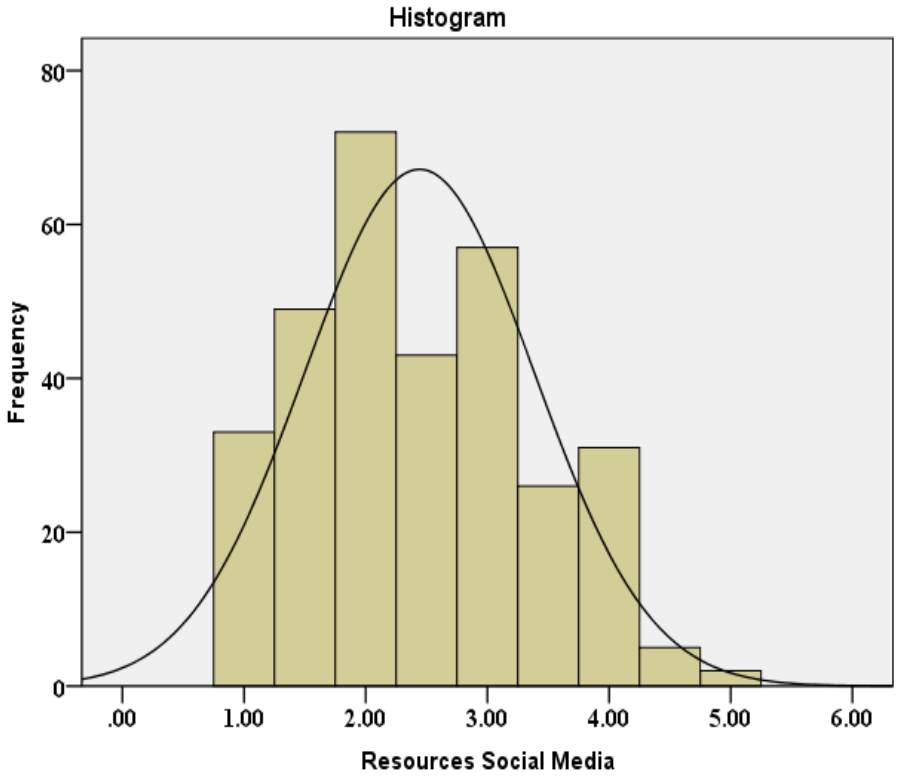


Figure 4. 11 Resources Social Media Histogram

Interpretation of Section D

In the section of resources social media, the descriptive statistics of the average responses for the two questions (from D1 and D2) are presented in Table No.4.4. The mean value of 2.44 indicates a tendency of respondents towards the disagreement

scale. This can also be observed in the histogram shown in Figure No.4.11. The values of skewness and kurtosis suggest that the distribution of the variable is approximately symmetrical with a slightly sharper peak. Based on the responses received from the participants, the overall conclusion is that the majority of respondents showed disagreement behavior with respect to resources social media. This can be attributed to the fact that approximately 59% of respondents disagreed or strongly disagreed with the first question, and 62% disagreed or strongly disagreed with the second question. Therefore, the average tendency of the responses lies on the disagreement scale.These findings indicate the challenges and concerns faced by NUST students regarding the use of social media as a resource for educational purposes during the shift to DL mode. Further analysis and discussion of these results can be included in the research document or report to provide a comprehensive understanding of the participants' perspectives.

Association of Attributes (Section D: Resources Social Media)

Formulation of Hypotheses

H_0: The two criteria of classification are independent

H_1: The two criteria of classification are associated

Table 4. 5 Association of attributes using Chi-square (Qualitative Independent Variables)

Total questions are two (D1 and D2)	
Pair	(D1, D2)
Estimate of Chi-square	76.61
P-value	0.00*

Where, * indicate that results are statistically significant at 5% level of significance.

Based on the p-value we concluded that there is association between the questions (D1, D2) exists

4.9 Section E: Quality of Services (Overall)

In the section of quality of services (overall), aimed to analyze the NUST students' responses related to their perceptions and experiences of online education during the shift to DL mode. This section consisted of five statements, as mentioned in Appendix-1.

The responses received from the participants in Section E (from E1 to E5) were used to assess the quality of services and the students' perceptions. Based on the data collected, 318 responses were analyzed. The results of this analysis are presented through bar charts in Figures 4.12 to 4.16, and the histogram in Figure 4.17. Additionally, associations between the questions were examined, as shown in Table 4.7.The participants were asked about their satisfaction with the quality and standard of lectures delivered through DL mode, the technical training of teachers for online interactions, the usefulness of social media groups for educational communication, the perceived improvement in the quality of teaching during online classes, and their satisfaction with class attendance taken by teachers in DL mode. Further analysis of the data can be conducted to explore the participants' responses in more detail and derive insights regarding the quality of services and the users' perceptions of online education. This information can contribute to understanding the effectiveness and efficiency of the online learning experience at NUST during the pandemic.

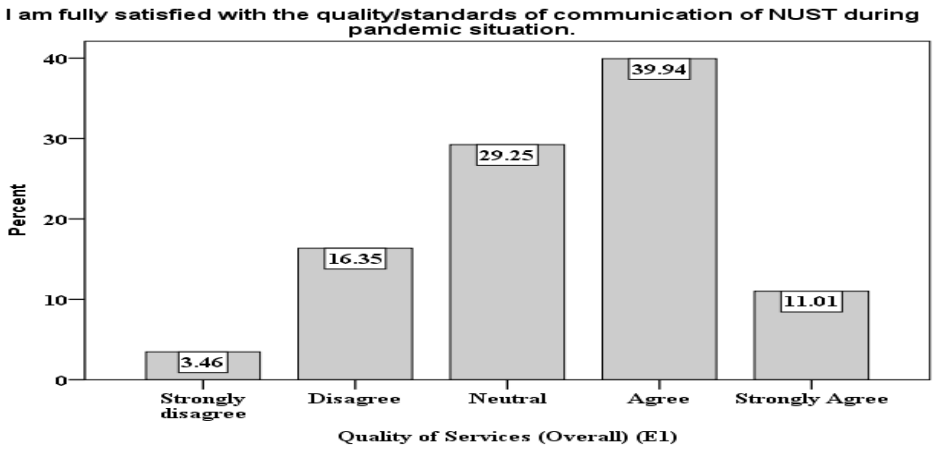


Figure 4. 12 Quality of Services (Overall)

Explanation of Bar Chart

There are 50.95% of the respondents showing an agreement for the statement that I am fully satisfied with the quality/standards of communication of NUST during pandemic situation. Whereas 29.25% of the respondents are neutral, and 19.81% are showing disagreement.

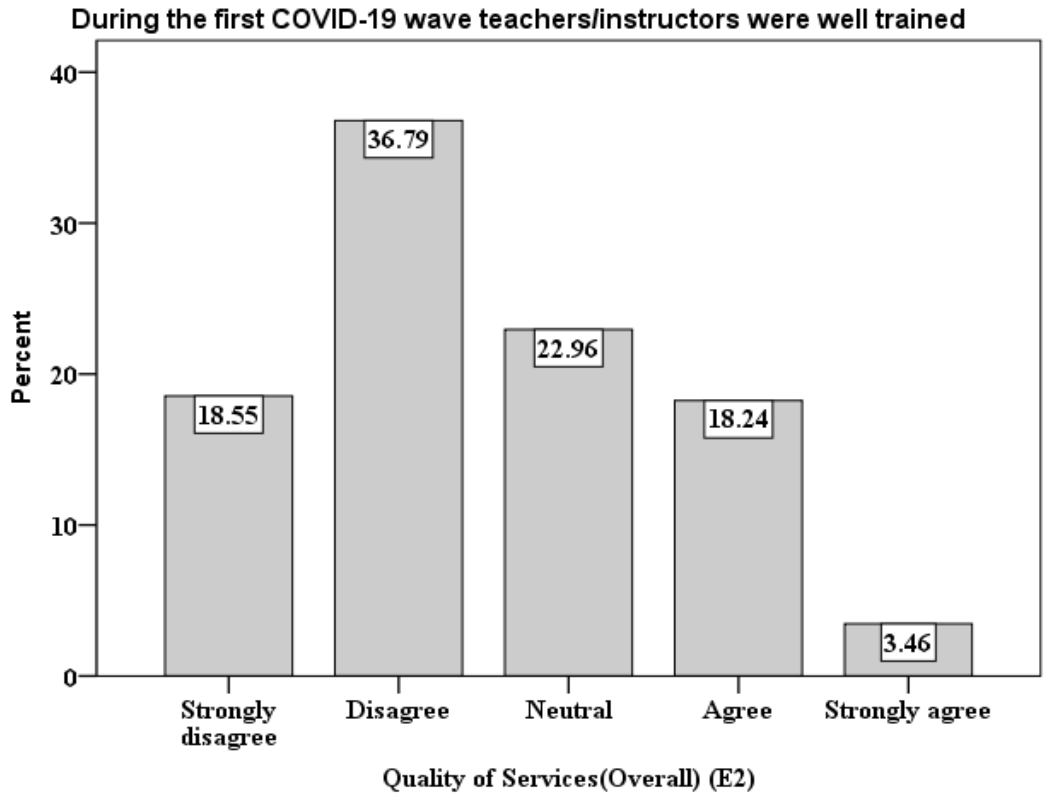


Figure 4. 13 Quality of Services (Overall)

Explanation of Bar Chart

There are 21.7% of the respondents showing an agreement for the statement that during the first COVID-19 wave teachers/instructors were well trained. Whereas 22.96% of the respondents are neutral, and 55.34% are showing disagreement.

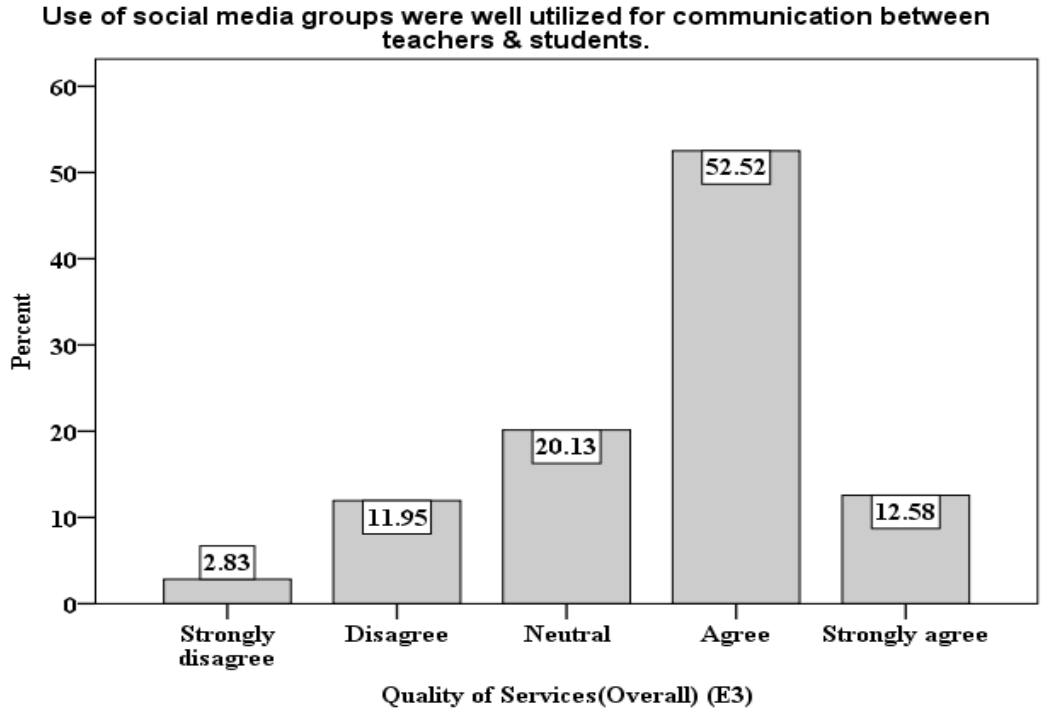


Figure 4. 14 Quality of Services (Overall)

Explanation of Bar Chart

There are 65.1% of the respondents showing an agreement for the statement that they were full satisfied from the quality of teaching by use social media groups were well utilized for communication between teachers and students. Whereas 20.13% of the respondents are neutral, and 14.78% are showing disagreement.

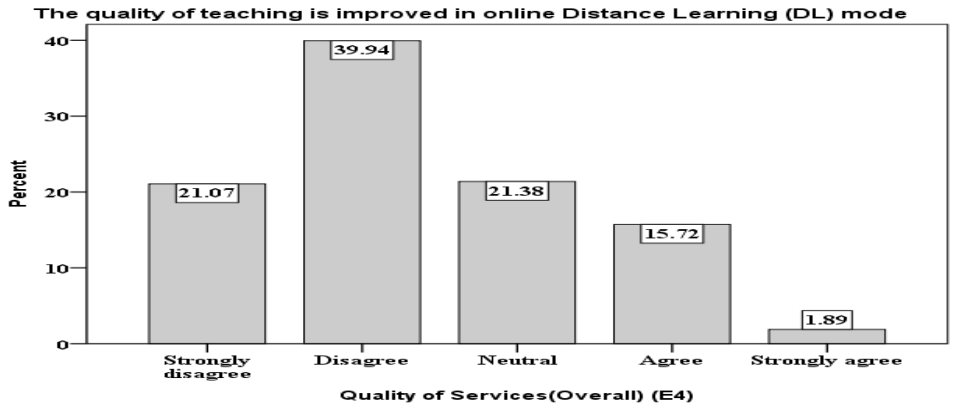


Figure 4. 15 Quality of Services (Overall)

Explanation of Bar Chart

There are 17.61% of the respondents showing an agreement for the statement that they were full satisfied from the quality of teaching is improved in online Distance Learning (DL) mode. Whereas 21.38% of the respondents are neutral, and 61.01% are showing disagreement.

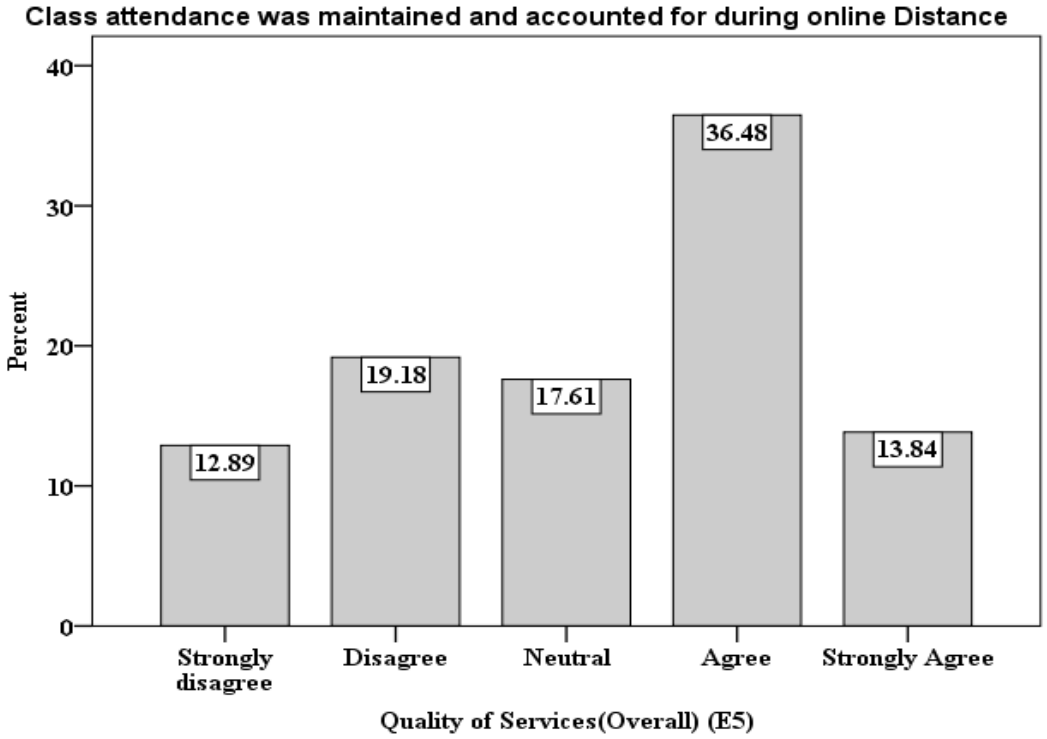


Figure 4. 16 Quality of Services (Overall)

Explanation of Bar Chart

There are 50.32% of the respondents showing an agreement for the statement that they were full satisfied from the quality of services provided by class attendance was maintained and accounted during Distance Learning (DL) mode. Whereas 17.61% of the respondents are neutral, and 32.07% are showing disagreement.

Table 4. 6 Quality of Services(Overall) Checking Associations

Descriptive Statistics							
	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Quality of Services (Overall)	318	1.00	5.00	3.01	0.70	-0.10	0.30

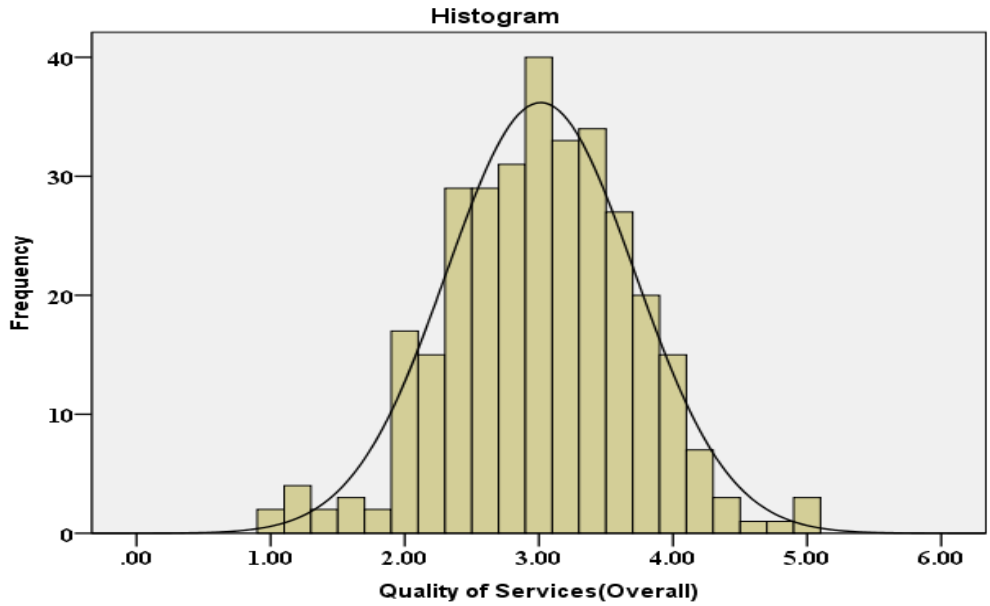


Figure 4. 17 Quality of Services (Overall)

Interpretation of Section E

Based on the descriptive statistics provided in Table No. 4.6 and the visual representation in Figure No. 4.17, it can be concluded that the majority of respondents showed a neutral behavior with respect to the quality of services/user's perception in the online education system. The mean value of 3.01 indicates a tendency towards the neutral scale.

Analyzing the individual questions, it can be observed that: For the first question, approximately 51% of respondents showed agreement or strong agreement. For the second question, approximately 55% of respondents showed disagreement or strong disagreement.For the third question, approximately 65% of respondents showed agreement or strong agreement. For the fourth question, approximately 61% of respondents showed disagreement or strong disagreement. For the fifth question, approximately 51% of respondents showed agreement or strong agreement. These varying responses contribute to the overall neutral tendency in the average responses. It is important to further analyze the reasons behind these perceptions and explore factors that may have influenced the respondents' views on the quality of services and their overall perception of the online education system.

Association of Attributes (Section E: Quality of Services (Overall))

Formulation of Hypotheses

H_0: The two criteria of classification are independent

$H_{1:}$ The two criteria of classification are associated

Table 4. 7 Association of attributes using Chi-square (Qualitative Independent Variables)

Total questions are five (E1, E2, E3, E4 and E5)										
Pairs	(E1, E2)	(E1, E3)	(E1, E4)	(E1, E5)	(E2, E3)	(E2, E4)	(E2, E5)	(E3, E4)	(E3, E5)	(E4, E5)
Estimate of Chi-square	114.75	69.32	81.46	33.09	97.00	102.37	52.38	34.03	53.28	79.86
P-value	0.00*	0.00*	0.00*	0.01*	0.00*	0.00*	0.00*	0.05*	0.00*	0.00*

Where, * indicate that results are statistically significant at 5% level of significance.

All the pairs are significant to each other based on all possible p-values showed association between them except pairs of questions between (E1, E5) similarly questions between (E3, E4) where significance exists on the line.

4.10 Section F: Quality of Services (Classroom Activities)

The section on quality of services (classroom activities) in education focused on assessing NUST students' perceptions of their quality of services in classroom activities during the shift from face-to-face (FTF) to distance learning (DL) mode. The section included five statements related to various aspects of classroom activities. The results from this section were analyzed based on the responses received from 318 participants. The bar charts shown in Figures 4.18 to 4.22 and the histogram in Figure 4.23 provide visual representations of the results for each statement. Additionally, the associations between the questions were examined and presented in Table 4.9. To provide a summary of the findings, the descriptive statistics of average responses (for the five questions) are illustrated in Table No.4.8. The mean value of 3.60 indicates a tendency towards agreement on the scale, suggesting that the majority of respondents showed agreement behavior with respect to quality of services.

Analyzing the individual questions, it can be observed that a significant percentage of respondents expressed agreement or strong agreement for most of the statements. For example, in the second question, approximately 73% of respondents showed agreement or strong agreement that the teacher sharing relevant course material enhanced their quality of services(classroom activities). Similarly, in the fifth question, around 80% of respondents showed agreement or strong agreement that the availability of recorded lectures benefited their quality of services(classroom activities).Based on these findings, it can be concluded that the majority of NUST students perceived that various factors related to DL, such as live lecture presentations, relevant course material sharing, online quizzes, online assignments with deadlines, and recorded lectures, positively influenced their quality of services(classroom activities). Please note that the results and conclusions are based on the provided information and analysis, and further interpretation or validation may require a more in-depth examination of the data.

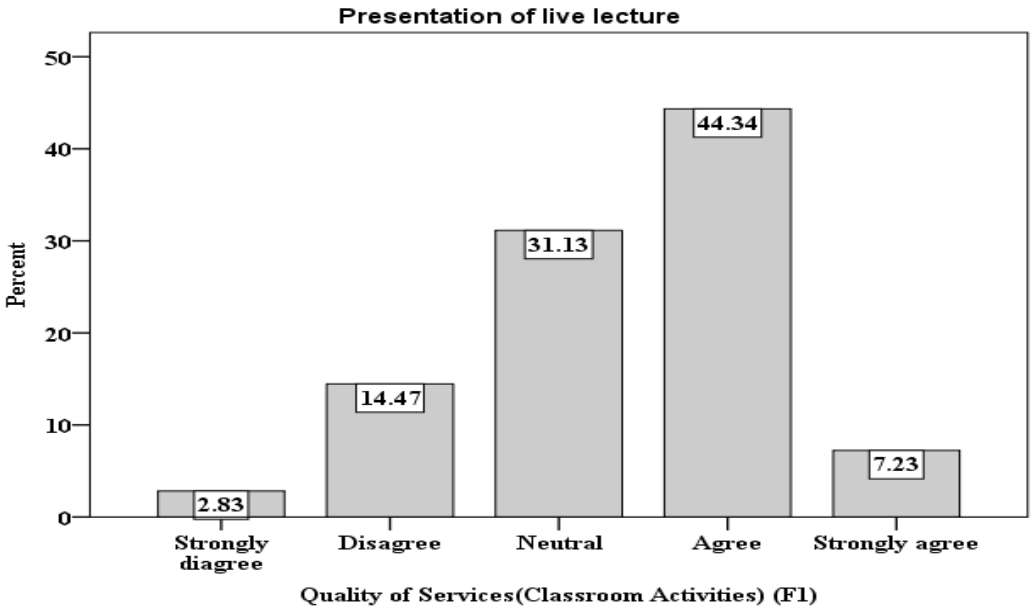


Figure 4. 18 Quality of Services (Classroom Activities) Bar Chart

Explanation of Bar Chart

There are 51.57% of the respondents showing an agreement for the statement that your cognitive performance status improved by taking presentation of live lectures on MS Teams from teachers/instructors of your relevant course during the COVID-19 waves. Whereas 31.13% of the respondents are neutral, and 17.3% are showing disagreement.

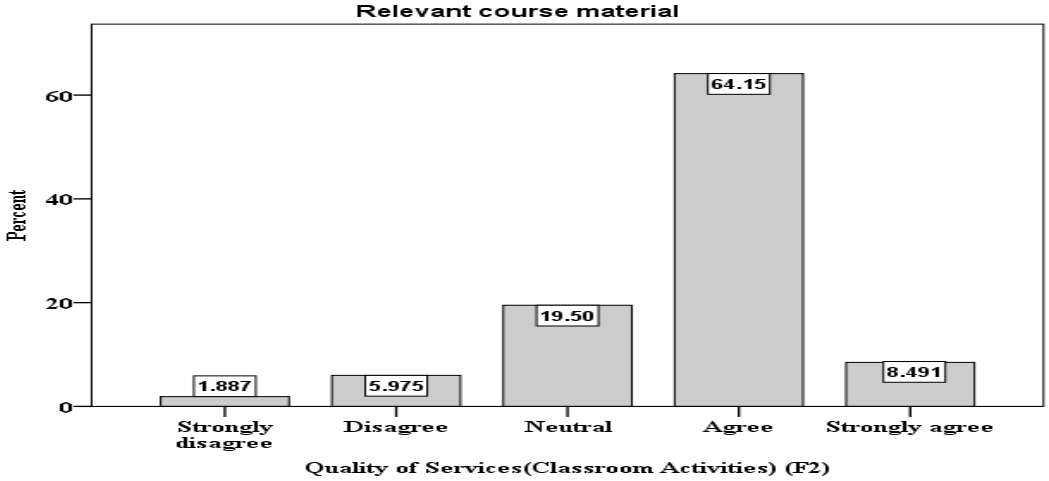


Figure 4. 19 Quality of Services (Classroom Activities) Bar Chart

Explanation of Bar Chart

There are 72.64% of the respondents showing an agreement for the statement that your cognitive performance status improved by teachers/instructors of your relevant course sharing relevant course material during the COVID-19 waves. Whereas 19.50% of the respondents are neutral, and 7.86% are showing disagreement.

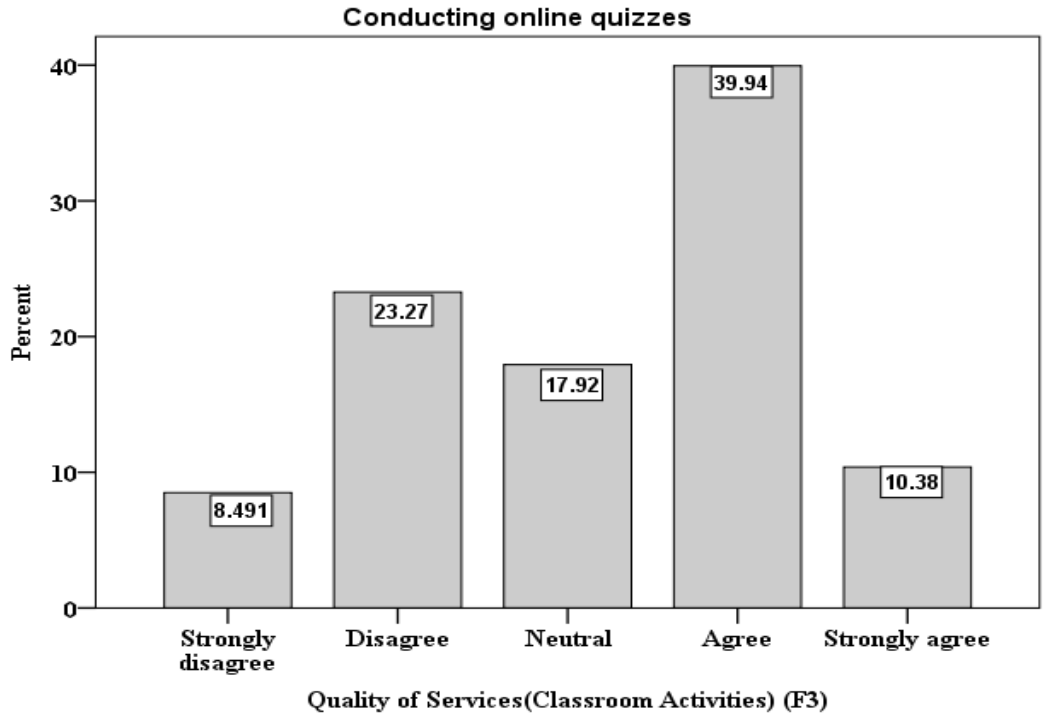


Figure 4. 20 Quality of Services (Classroom Activities) Bar Chart

Explanation of Bar Chart

There are 50.32% of the respondents showing an agreement for the statement that your cognitive performance status improved while conducting online quizzes during the COVID-19 waves. Whereas 17.92% of the respondents are neutral, and 31.76% are showing disagreement.

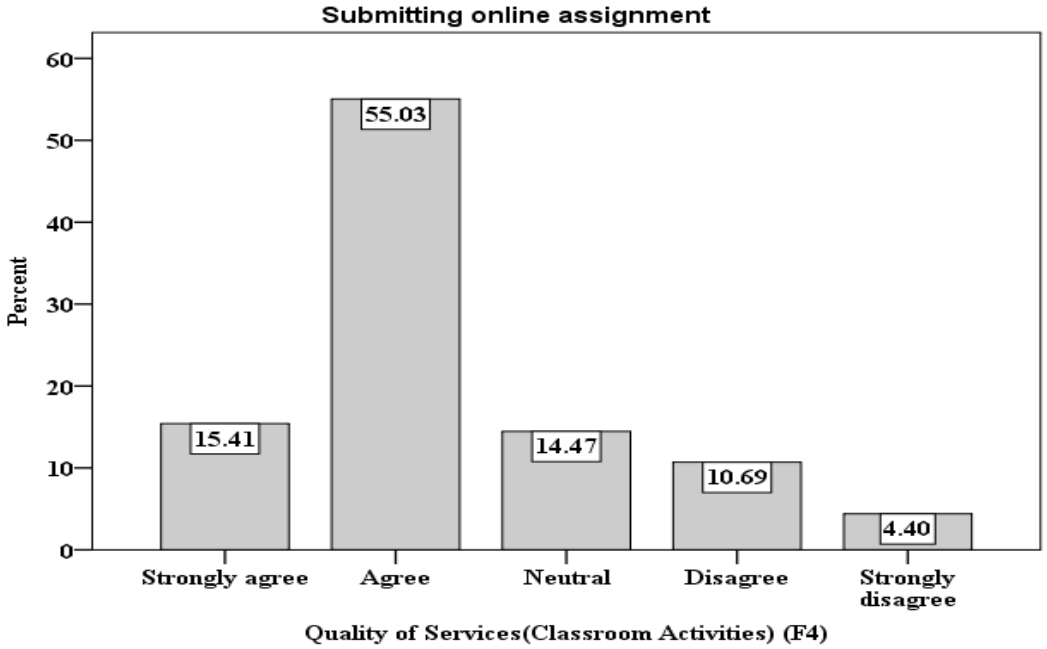


Figure 4. 21 Quality of Services (Classroom Activities) Bar Chart

Explanation of Bar Chart

There are 70.44% of the respondents showing an agreement for the statement that your quality of services (classroom activities) improved while submitting online assignment during the COVID-19 waves. Whereas 14,47% of the respondents are neutral, and 15.09% are showing disagreement.

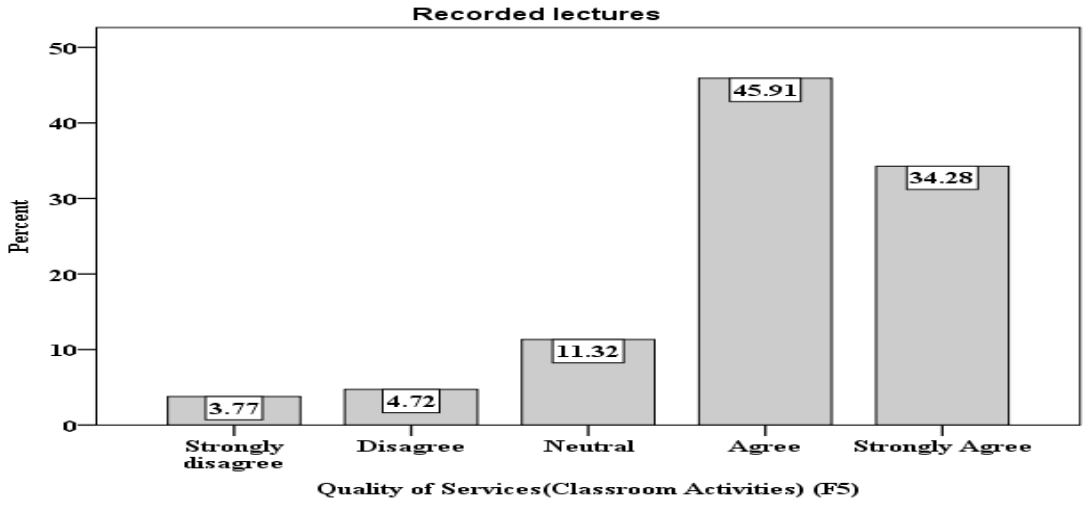


Figure 4. 22 Quality of Services (Classroom Activities) Bar Chart

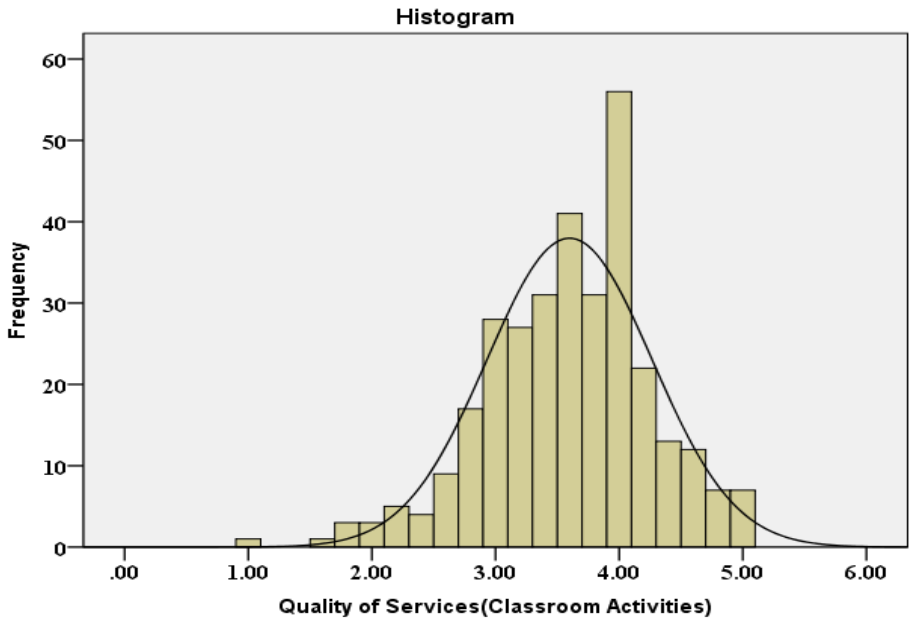
Explanation of Bar Chart

There are 80.19% of the respondents showing an agreement for the statement that your quality of services regarding classroom activities improved while taking recorded lectures during the COVID-19 waves. Whereas 11.32% of the respondents are neutral, and 8.49% are showing disagreement.

Table 4. 8 Quality of Services (Classroom Activities) Checking Associations

Descriptive Statistics							
	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Quality of Services (Classroom Activities)	318	1.00	5.00	3.60	0.67	-0.45	0.58

Figure 4. 23 Quality of Services (Classroom Activities) Histogram



Interpretation of Section F

Based on the descriptive statistics and analysis for the section of quality of services (overall). Based on the information you provided, it is evident that the respondents generally exhibited a tendency towards agreement in their perceptions of quality of services (classroom activities) during the shift to online classes.

The mean value of 3.60 indicates that the average response tends towards the agreement scale. This finding is supported by the visual representation of the histogram in Figure No.4.23, which displays a symmetrical distribution of the variable.

Analyzing the individual questions, it can be observed that most of the respondents showed agreement or strong agreement for each statement. Specifically: For the first question, approximately 52% of respondents agreed or strongly agreed. For the second question, approximately 73% of respondents agreed or strongly agreed. For the third question, approximately 51% of respondents agreed or strongly agreed. For the fourth question, approximately 70% of respondents agreed or strongly agreed. For the fifth question, approximately 80% of respondents agreed or strongly agreed. These findings suggest that the respondents perceived positive effects on their quality of services (classroom activities) during online classes. The agreement scale indicates that most of the respondents recognized the benefits of factors such as live lectures, relevant course materials, online quizzes, online assignments, and recorded lectures in enhancing their quality of services (classroom activities).

Overall, the analysis indicates a favorable perception regarding quality of services (classroom activities) among the respondents during the transition to online education.

Association of Attributes (Section F: Quality of Services (Classroom Activities))

Formulation of Hypotheses

H_0: The two criteria of classification are independent

$H_{1:}$ The two criteria of classification are associated

Table 4. 9 Association of attributes using Chi-square (Qualitative Independent Variables)

Total questions are five (F1, F2, F3, F4 and F5)										
Pairs	(F1, F2)	(F1, F3)	(F1, F4)	(F1, F5)	(F2, F3)	(F2, F4)	(F2, F5)	(F3, F4)	(F3, F5)	(F4, F5)
Estimate of Chi-square	226.90	96.51	82.18	70.32	119.25	92.39	81.45	243.14	94.54	175.38
P-value	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*

Where, * indicate that results are statistically significant at 5% level of significance.

All the pairs are significant to each other based on all possible p-values showed association between them.

4.11 Section G: Local/School Level Administrative System

The section on the educational administrative system aimed to assess NUST students' satisfaction with the local or school-level administrative system during the transition from face-to-face (FTF) to distance learning (DL) mode. It consisted of eight statements (G1 to G8) that explored various aspects of the administrative system.

Based on the data received from 318 participants, the results were visualized using bar charts (Figure 4.24 to Figure 4.31) and a histogram (Figure 4.32). Additionally, associations between the questions were examined and presented in Table 4.11.To provide a comprehensive analysis, it would be beneficial to include the descriptive statistics, such as the mean, skewness, and kurtosis, for each question in the section. These statistics will offer insights into the level of satisfaction among the respondents and the distribution of their responses.

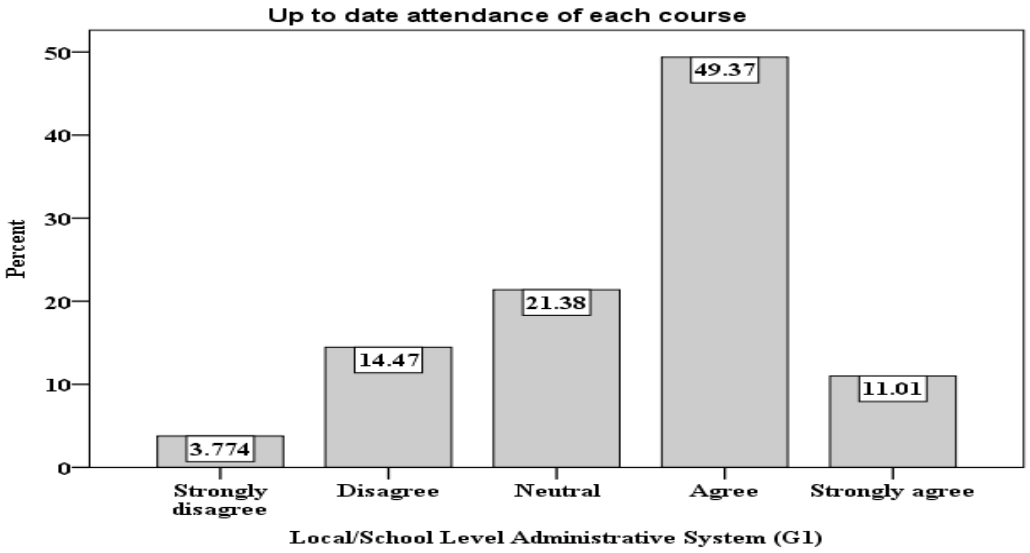


Figure 4. 24 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 60.38% of the respondents showing an agreement for the statement that during the COVID-19 waves on QALAM up to date attendance of each course uploaded. Whereas 21.38% of the respondents are neutral, and 18.24% are showing disagreement.

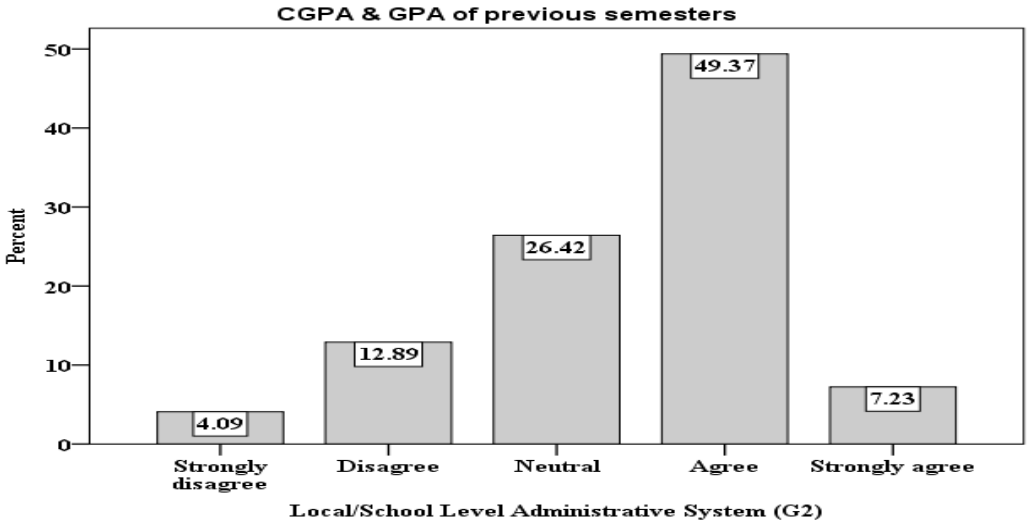


Figure 4. 25 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 56.6% of the respondents showing an agreement for the statement that during the COVID-19 waves your CGPA and GPA compared to previous semesters percentage raised. Whereas 26.42% of the respondents are neutral, and 16.98% are showing disagreement.

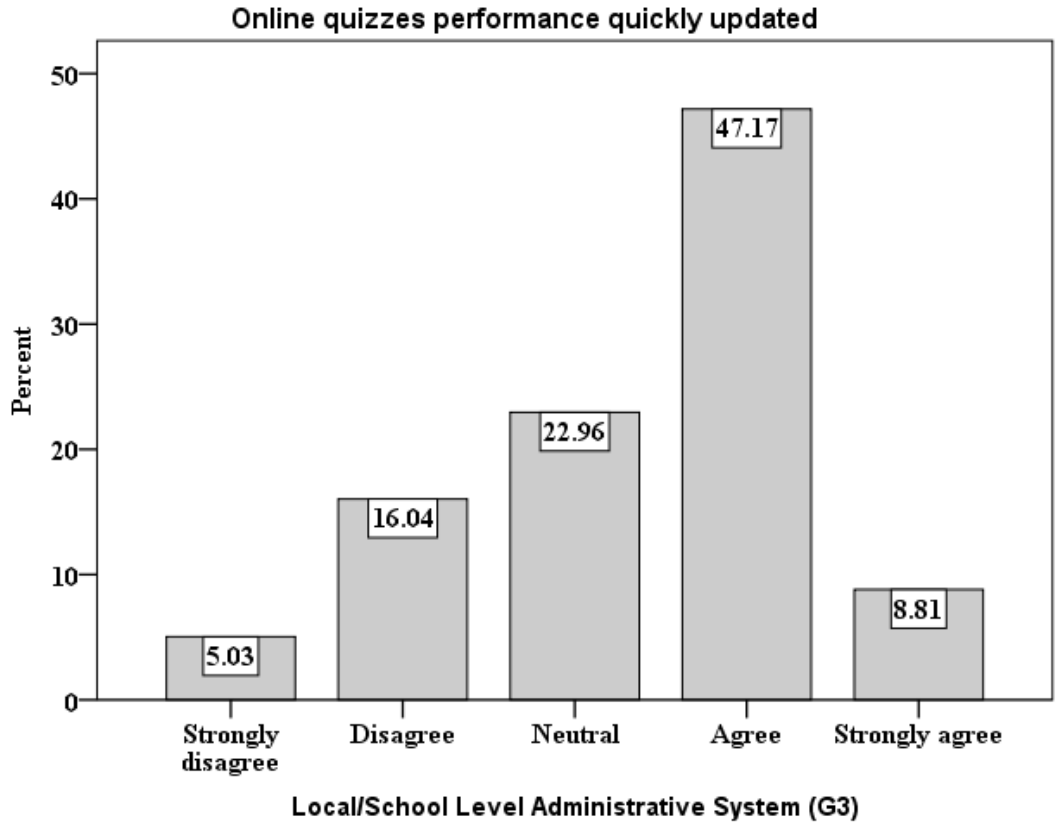


Figure 4. 26 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 55.98% of the respondents showing an agreement for the statement that they were satisfied by the option on QALAM for online quizzes performance quickly updated. Whereas 22.96% of the respondents are neutral, and 21.07% are showing disagreement.

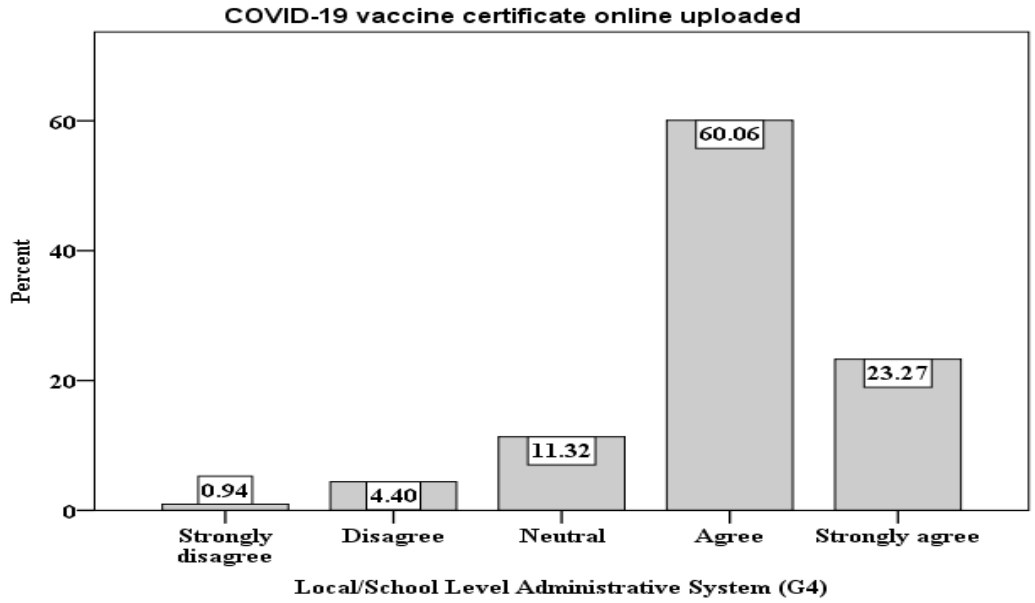


Figure 4. 27 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 83.33% of the respondents showing an agreement for the statement that they were satisfied by the option on QALAM for COVID-19 vaccine certificate uploading process. Whereas 11.32% of the respondents are neutral, and 5.34% are showing disagreement.

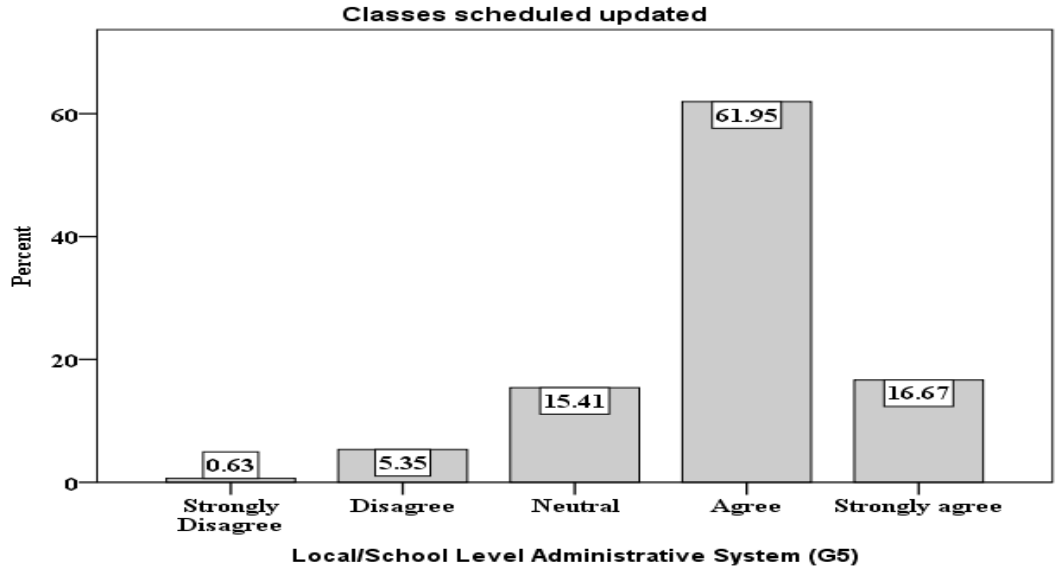


Figure 4. 28 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 78.62% of the respondents showing an agreement for the statement that they were well informed on QALAM about classes scheduled updated. Whereas 15.41% of the respondents are neutral, and 5.98% are showing disagreement.

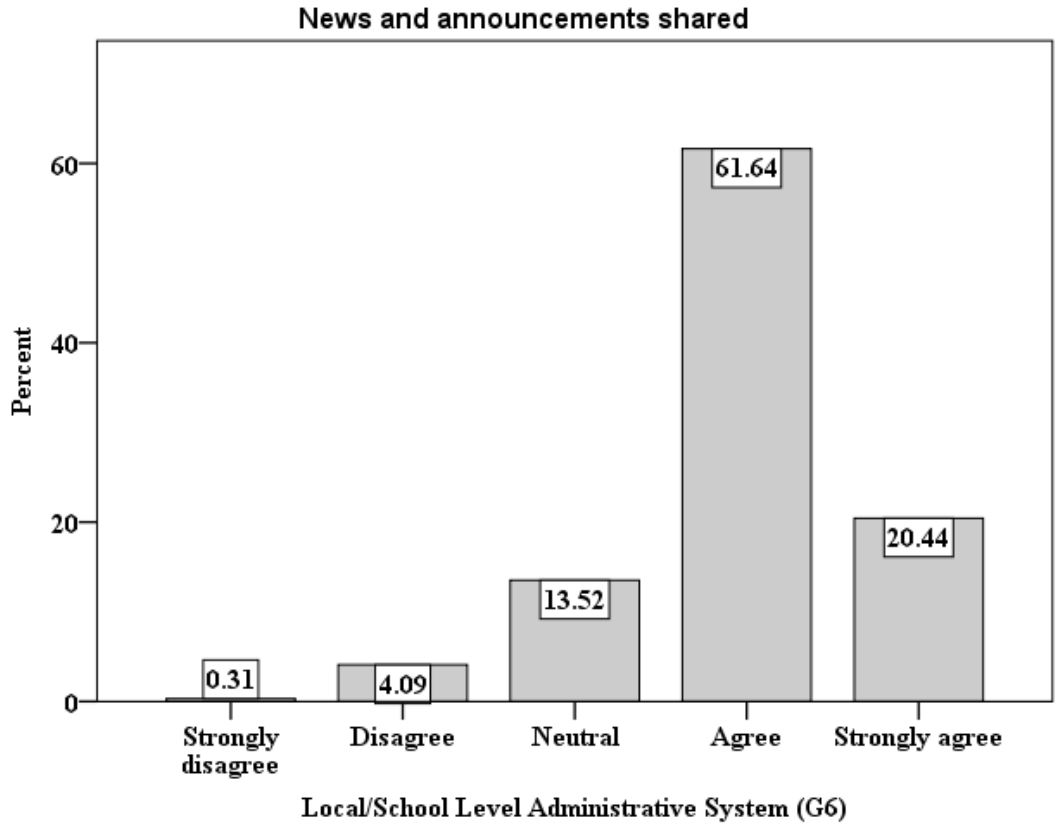


Figure 4. 29 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 82.08% of the respondents showing an agreement for the statement that news and announcements on QALAM. Whereas 13.52% of the respondents are neutral, and 4.4% are showing disagreement.

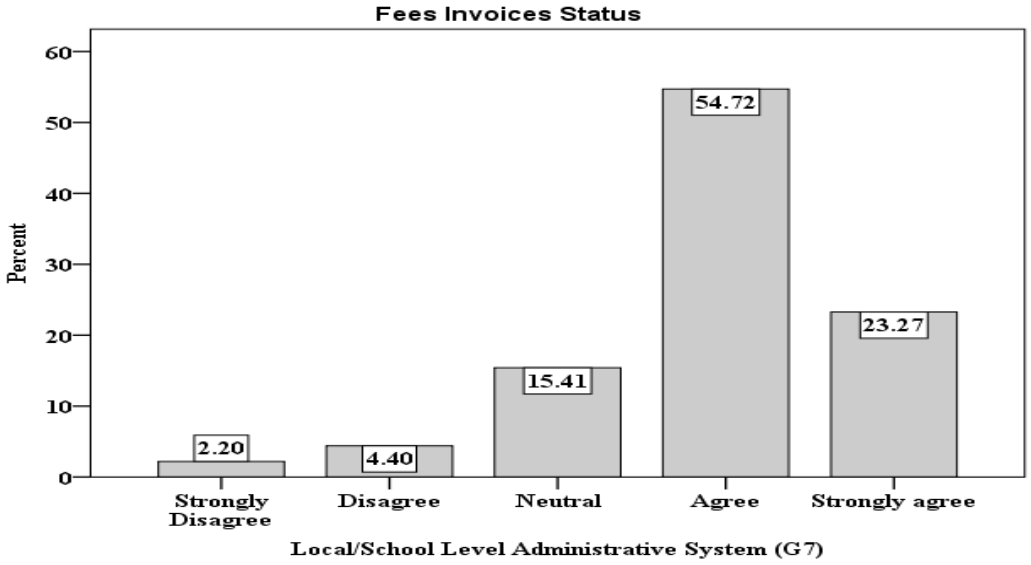


Figure 4. 30 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 77.99% of the respondents showing an agreement for the statement that they received fees invoices status updated in time on QALAM. Whereas 15.41% of the respondents are neutral, and 6.6% are showing disagreement.

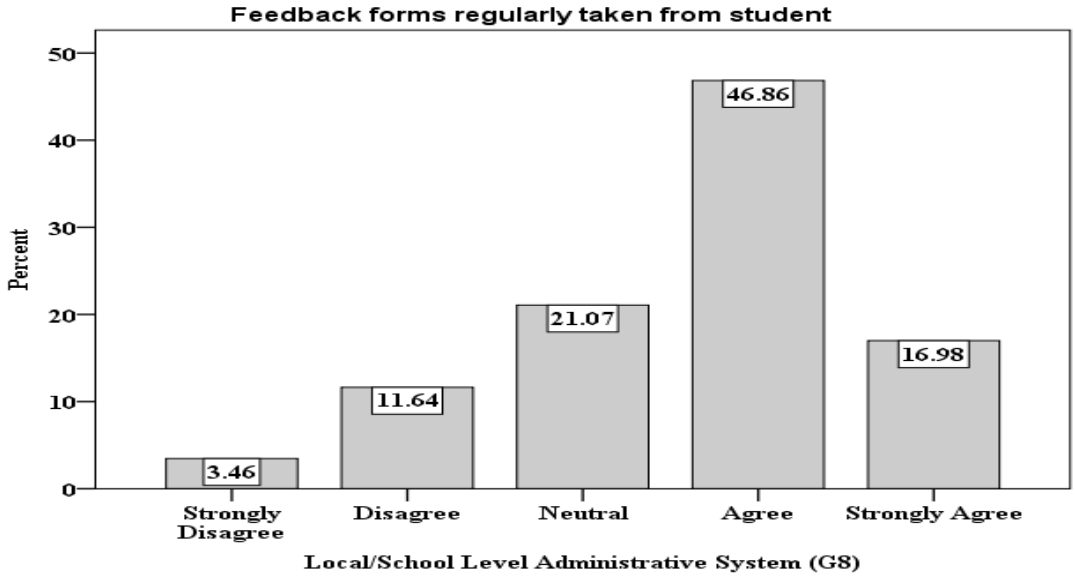


Figure 4. 31 Local/School Level Administrative System Bar Chart

Explanation of Bar Chart

There are 63.84% of the respondents showing an agreement for the statement that feedback forms regularly taken from student on QALAM. Whereas 21.07% of the respondents are neutral, and 15.1% are showing disagreement.

Table 4. 10 Local/School Level Administration System Checking Associations

Descriptive Statistics

	n	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Local/School Level Administrative System	318	1.00	5.00	3.71	0.55	-0.47	1.68

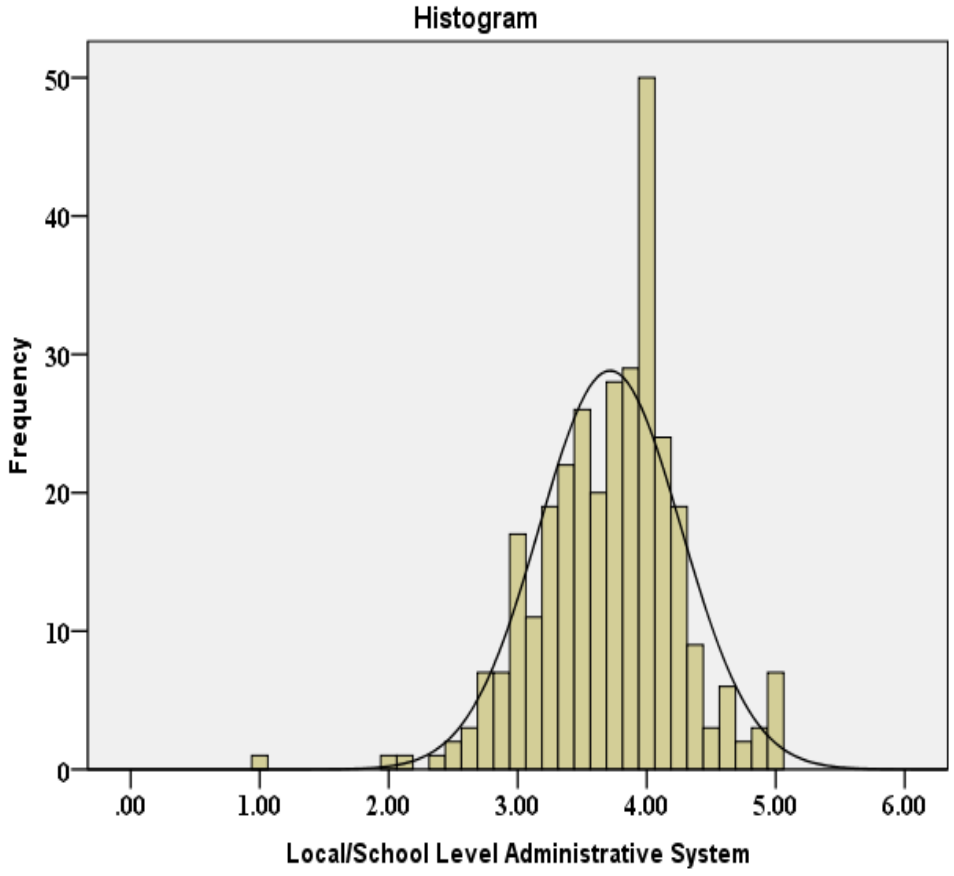


Figure 4. 32 Local/School Level Administrative System Histogram

Interpretation of Section G

Based on the descriptive statistics for the section on the local/school level administrative system. Based on the information provided in Table No.4.10, it can be concluded that the majority of respondents showed agreement behavior regarding the local/school level administrative system. The mean value of 3.71 indicates a tendency towards agreement on the scale. This is further supported by the analysis of individual questions, where a significant percentage of respondents expressed agreement or strong agreement. For example, in the fourth question, 83% of respondents showed agreement or strong agreement, and in the fifth question, 79% of respondents showed agreement or strong agreement. Observing the values of skewness and kurtosis and noting that the distribution is more peaked than normal, it suggests that there is a higher concentration of responses towards the agreement end of the scale. Overall, the results indicate that the respondents were generally satisfied with the local/school level administrative system during the transition from FTF to DL mode.

Association of Attributes (Section G: Local/School Level Administrative System)

Formulation of Hypotheses

H_0: The two criteria of classification are independent

H_1: The two criteria of classification are associated

Table 4. 11 Association of attributes using Chi-square (Qualitative Independent Variables)

Total questions are eight (G1, G2, G3, G4, G5, G6, G7 and G8)							
Pairs of G1	(G1, G2)	(G1, G3)	(G1, G4)	G1, G5)	(G1, G6)	(G1, G7)	(G1, G8)
Estimate of Chi-square	120.98	151.22	93.01	86.86	117.06	73.78	85.39
P-value	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
Pairs of G2	(G2, G3)	(G2, G4)	(G2, G5)	(G2, G6)	(G2, G7)	(G2, G8)	
Estimate of Chi-square	147.17	101.88	71.16	64.95	74.78	62.18	
P-value	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	
Pairs of G3	(G3, G4)	(G3, G5)	(G3, G6)	(G3, G7)	(G3, G8)		
Estimate of Chi-square	93.18	144.25	77.61	81.79	124.04		
P-value	0.00*	0.00*	0.00*	0.00*	0.00*		
Pairs of G4	(G4, G5)	(G4, G6)	(G4, G7)	(G4, G8)			
Estimate of Chi-square	245.39	236.43	134.72	80.26			
P-value	0.00*	0.00*	0.00*	0.00*			
Pairs of G5	(G5, G6)	(G5, G7)	(G5, G8)				
Estimate of Chi-square	427.05	145.93	123.51				
P-value	0.00*	0.00*	0.00*				
Pairs of G6	(G6, G7)	(G6, G8)					
Estimate of Chi-square	235.10	124.01					
P-value	0.00*	0.00*					
Pair of G7	(G7, G8)						
Estimate of Chi-square	124.80						
P-value	0.00*						

Where, * indicate that results are statistically significant at 5% level of significance

.All the pairs are significant to each other based on all possible p-values showed association between them.

Chapter 5

SUMMARY CONCLUSIONS AND FUTURE RECOMMENDATIONS:

5.1 SUMMARY

The COVID-19 crisis has taken the world by surprise, completely transforming the life cycle and forcing the adoption of a virtual lifestyle. Pakistan, being a developing country, has also faced the consequences of the pandemic and introduced various strategies, such as smart lockdowns and work-from-home policies, especially in the educational sector. E-learning has emerged as an alternative way of education, but it has both merits and demerits. To address this issue, a survey was conducted at NUST to analyze students' perceptions of the shift to distance learning (DL) mode. The survey consisted of twenty-four questions divided into six sections: educational management, parents' perception, resource social media, quality of services(overall), quality of services (classroom activities), and local/school-level administrative system. Total collected 318 responses from NUST students at different educational levels. Descriptive statistics, visualization techniques, and chi-square tests were used for data analysis. The results showed that 51.01% of the respondents appreciated the shift to DL mode, while 19.47% were neutral and 29.53% criticized the transformation. The survey identified challenges that can be mitigated to make DL mode more effective, and recommendations were provided. This survey can be valuable not only for NUST but also for the entire educational sector of Pakistan to prepare for future pandemic challenges. In times of unpleasant situations like lockdowns, natural disasters, or political crises, this survey can assist educational institutions in adopting DL mode effectively.

5.2 Conclusions:

Based on the discussion in Chapter 4, we draw the following conclusions for each section:

Section B (Educational Management): The majority of the respondents showed a neutral behavior toward educational management. However, people acknowledged that shifting from face-to-face (FTF) to DL mode was a smart step taken by the Government of Pakistan. Nonetheless, there were concerns and disagreements regarding the ease of adoptability for both teachers and students. According to findings, 45.91% of respondents appreciated the educational management system's shift to DL mode, while 20.13% were neutral, and 33.96% criticized the transformation.

Section C (Parents' Perception): The majority of the respondents agreed with parents' perception of the educational management system. However, there were also neutral and critical viewpoints. As per findings, 61.01% of respondents appreciated the parents' perception shift to DL mode, while 20.75% were neutral, and 18.24% criticized the transformation.

Section D (Resources Social Media): The majority of the respondents disagreed with the resources available on social media. Concerns were raised regarding the technical burden on students/parents during the switch to DL mode and the quality of understanding in DL mode. As per findings, 23.11% of respondents appreciated the resources social media shift to DL mode, while 16.35% were neutral, and 60.54% criticized the transformation.

Section E (Quality of Services (Overall)): The majority of the respondents showed a neutral behavior toward the quality of services (overall). However, there was agreement regarding the quality/communication standards and the use of social media groups for teaching. On the other hand, concerns were raised about the quality of teaching in DL mode. Satisfaction was expressed regarding class attendance maintenance. As per findings, 41.14% of respondents appreciated the quality of

services (overall) shift to DL mode, while 22.26% were neutral, and 36.6% criticized the transformation.

Section F (Quality of Services (Classroom Activities)): The majority of the respondents agreed with the quality of services in classroom activities. Agreement was expressed regarding the improvement in online education through live lectures and the sharing of relevant course material. Online quizzes and the submission of online assignments were also positively acknowledged. As per findings, 65.0% of respondents appreciated the quality of services (classroom activities) shift to DL mode, while 18.9% were neutral, and 16.1% criticized the transformation.

Section G (Local/School Level Administrative System): The majority of the respondents agreed with the local/school-level administrative system. Agreement was expressed regarding course attendance, improvement in CGPA and GPA, online quizzes' performance, and timely updates on QALAM (an educational portal). Satisfaction was expressed with the services provided on QALAM. As per findings, 69.85% of respondents appreciated the local/school level administrative system's shift to DL mode, while 18.44% were neutral, and 11.71% criticized the transformation.

5.3 Limitations:

Certain limitations exist in the current survey:

1. The study was limited to NUST University.
2. The research only represents students' perspectives regarding DL mode.
3. Class imbalance is present in the data.

5.4 Future Recommendations:

The outcomes of this study can contribute to the transformation of the online education system with innovative solutions. NUST H-12 campus can serve as a leading example for other educational institutions in Pakistan. Future studies should focus on

a. Analyzing experiences of other stake holders of the university like teachers and administration

b. Investigating internet, hardware and related issues of teachers working from home and students living in the far-flung areas

Chapter 6

Areas of Application:

The following are areas where our research topic is applicable:

i. Education Sector of Pakistan
ii. Pakistan Bureau of statistics
iii. Global Statistical Education Sector
iv. UNESCO and UNICEF as global leader in Education

6.1 Pakistan Bureau of statistics

The primary government organization in Pakistan, the Pakistan Bureau of Statistics (PBS), oversees gathering, compiling, and disseminating accurate and timely statistical data to researchers, planners, and policy makers. It disseminates a range of studies based on primary and secondary data, with a focus on the nation's social and economic conditions. The Central Statistics Office (CSO) was established in 1950 by the Government of Pakistan as an attached division of the Economic Affairs Division. Since then, both local and foreign consultants have periodically examined the statistical system. The Central Statistical Office (CSO) was converted to a full-fledged Statistics Division in 1972 on the advice of the IBRD Mission. In 1981, the Division underwent a reorganization, and its technical wing (the then CSO).

The Division was reorganized in 1981, and the Federal Bureau of Statistics (FBS) became one of its connected departments, replacing the Division's technical arm (then the CSO). By combining the Federal Bureau of Statistics, the Population Census Organization, the Agricultural Census Organization, and the technical branch of Statistics Division, the Government of Pakistan has created the Pakistan Bureau of Statistics as a step forward.

6.2 Global Statistical Education Sector

The go-to resource for thorough statistics and analysis on important aspects of education, including access, completion, learning, costs, policy, and equity, is the World Bank Ed Stats (Education Statistics) portal. The PISA, TIMSS, PIRLS, PIAAC, EGRA, three regional learning exams (SACMEQ, PASEC, and LLECE), administrative country data from UIS, World Bank databases, and household surveys like the LSMS, DHS, and MICS surveys are some of the sources of data. It comprises the World Bank Education Projects Database, which is organized by the projects' activities, elements, and sectors since 1998.

Users of the Smarter Education Systems tool can curate and select World Bank knowledge products related to education, such as briefs, SABER country reports, impact evaluations, regional reports, research working papers, and other publications, and organize them according to the SABER domains' key education areas. With an interactive map interface, it illustrates how the World Bank supports various nations through operational initiatives and knowledge products.

6.3 UNESCO and UNICEF as global leader in Education

6.3.1 UNESCO

Life-changing education is at the core of UNESCO's mission to foster peace, end poverty, and promote sustainable development. It is a fundamental human right for everyone. The Organization is the only UN body whose mission includes all facets of education. With Sustainable Development Goal 4, it has been given the responsibility of leading the Global Education 2030 Agenda.

With gender equality as its guiding principle, UNESCO provides global and regional leadership in education, enhances educational systems around the world, and uses

education to address current global concerns. From early childhood through higher education and beyond, its work involves high-quality educational development.

6.3.2 UNICEF is calling on governments to:

1. Reach every child and keep them in school.
2. Assess learning levels regularly.
3. Prioritize teaching the fundamentals.
4. Increase catch-up learning and progress beyond what was lost.
5. Develop psychosocial health and well-being so every child is ready to learn.

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APPENDICES:

APPENDIX-1:

QUESTIONNAIRE:

Questionnaire "Analyzing Students' Experience of Online Education during COVID-19 : A Case Study of NUST, Pakistan"

Description: In this survey we are going to analysis using questionnaire taking from students how much they were satisfied or not from transformation of educational system from Face to Face (FTF) to Distance Learning (DL) in Pakistan due to COVID-19 Pandemic Situation.

(Rate for the following Questions) (1= Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)

Session A

Factor Name: Basic Information Analysis

A1. What is your name?

A2. What is your gender?

A) Male
B) Female

A3. Are you NUSTIAN ?

A) Yes
B) No

A4. What is your level of education in NUST?

A) Undergraduate (UG)
B) MS
C) PhD

Section B

Factor Name: Educational Management

Description: Analyzing adoption of Distance Learning (DL) mode

Following are Statements

B1. The decision of shifting from Face to Face (FTF) to Distance Learning (DL) mode was smart step taken by the Government of Pakistan.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

B2. Shifting from Face to Face (FTF) to Distance Learning (DL) mode was easily adoptable for both teacher & students.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

Section C

Factor Name: Parents Perception

Description: Parents acceptance related to Distance Learning (DL) mode

C1. Your parents accepted the shift from Face to Face (FTF) to Distance Learning (DL) mode.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

Section D

Factor Name: Resources Social Media

Description: Social Media switch for Distance Learning (DL) mode

Following is Statement

D1. There was no technical burden on students/parents while switching to Distance Learning (DL) mode.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

D2. The quality of understanding is improved in Distance Learning (DL) mode.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

Section E

Factor Name: Quality of Services (Overall)

Description: Analyzing quality services related to Distance Learning (DL) mode

Following are Statements

E1. I am fully satisfied with the quality/standards of communication of NUST during pandemic situation.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

E2. During the first COVID-19 wave teachers/instructors were well trained.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

E3. Use of social media groups were well utilized for communication between teachers & students.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

E4. The quality of teaching is improved in Distance Learning (DL) mode.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

E5. Class attendance was maintained and accounted for during Distance Learning (DL) mode.

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

Section F

Factor Name: Quality of Services(Classroom Activities)

Description: Analyzing impact on students' cognitive performances with sudden change shifting from Face to Face (FTF) to Distance Learning (DL) model Following are Statements.

F1. Presentation of live lecture

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

F2. Relevant course material

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

F3. Conducting online quizzes

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

F4. Submitting online assignment

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

F5. Recorded lectures

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

Section G

Factor Name: Local/School Level Administrative System

Description: Your level of satisfied with the standards of services provided by university/school administration during pandemic regarding

Following are Statements

G1. Up to date attendance of each course

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

G2. CGPA & GPA of previous semesters

A) Strongly disagree
B) Disagree
C) Neutral
D) Agree
E) Strongly agree

G3. Online quizzes performance quickly updated

A) Strongly disagree
B) Disagree
C) Neutral

D) Agree

E) Strongly agree

G4. COVID-19 vaccine certificate online uploaded

A) Strongly disagree

B) Disagree

C) Neutral

D) Agree

E) Strongly agree

G5. Classes scheduled updated

A) Strongly disagree

B) Disagree

C) Neutral

D) Agree

E) Strongly agree

G6. News and announcements shared

A) Strongly disagree

B) Disagree

C) Neutral

D) Agree

E) Strongly agree

G7. Fees Invoices Status

A) Strongly disagree

B) Disagree

C) Neutral

D) Agree

E) Strongly agree

G8. Feedback forms regularly taken from student

A) Strongly disagree

B) Disagree

C) Neutral

D) Agree

E) Strongly agree