NAVIGATING THE EDUCATION LANDSCAPE: CHALLENGES AND SOLUTIONS FOR IMPLEMENTING DISTANCE LEARNING IN PAKISTAN POST-2020

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ABSTRACT

This research study delves into the complexities of implementing effective distance learning in underdeveloped countries, with a special focus on post-2020, the era of the COVID-19 pandemic. The primary objective is to identify challenges and shortcomings hindering the effective integration of distance learning, particularly in the context of Pakistan. A comprehensive survey involving students, faculty, and management across various educational institutions nationwide was conducted to gather insights. The responses were analyzed, yielding a summary that encapsulates the diverse perspectives of the surveyed stakeholders. The study underscores the imperative to address these challenges and provide applicable remedies, not only in times of global crises, but as a continuous educational paradigm. The ultimate aim is to facilitate the optimal implementation of distance learning, transcending geographical and socio-economic barriers in underdeveloped nations.

Keywords: Distance Learning, E-Learning, Underdeveloped Countries, Educational Challenges, Post-Pandemic.

Key Points

a)   The study focuses on implementing effective distance learning in underdeveloped countries post-2020, emphasizing challenges in integration, particularly in Pakistan. It has a comprehensive analysis involving students, faculty, and management.

b)   Since the COVID-19 pandemic prompted underdeveloped countries like Pakistan to adopt distance learning, existing disparities in technology access and digital skills posed significant challenges. The research explores hurdles faced during the transition, seeking to identify and address obstacles for sustained effectiveness in both crisis and regular educational settings.

c)   This research is a unique case of Pakistan, involving 283 respondents from various educational institutions, evaluating the impact of examining technology and resource accessibility. The research findings offer valuable insights, guiding future strategies for enhancing e-learning initiatives in similar contexts.

The research findings have unveiled the challenges of distant learning in underdeveloped countries, categorized into technology access, curriculum adaptation, faculty training, and infrastructure vulnerability to natural disasters. It also provides remedies and best practices including the addressing of digital divide, adapting curricula, fostering engagement, providing personalized learning, ensuring equitable access, and developing infrastructure resilience plans.

INTRODUCTION

The COVID-19 pandemic in 2020 posed unprecedented challenges to educational systems worldwide, prompting underdeveloped countries like Pakistan to implement distance learning as an alternative instructional approach. Distant learning, also known as online or virtual learning, allowed educational institutions to continue educating students remotely during lockdowns and social

distancing measures. However, this rapid transition revealed significant challenges, particularly in countries with existing disparities in technology access and digital skills. This research study aims to explore the hurdles faced during the implementation of distance learning in underdeveloped countries, with a specific focus on post-2020 Pakistan.

The study seeks to address two key objectives. Firstly, it aims to identify the obstacles encountered by students, faculty, and management in schools, colleges, and universities across Pakistan during the pandemic and beyond. Understanding these challenges is es- essential to developing effective strategies for distant learning that can be sustained beyond crises. Secondly, the research endeavors to propose remedies and best practices to enhance distant learning's efficacy and inclusivity, not just during pandemics but also in regular educational settings.

1   Literature Review:

The global shift to distant learning during the pandemic prompted extensive research on its impact on education. In the context of underdeveloped countries, the challenges of im- implementing distance learning were accentuated due to pre-existing technology disparities. Adams and Smith (2021) investigated the effects of COVID-19 on education in low-income countries, emphasizing the digital divide's role in hindering distance learning effectiveness. Their findings underscored the urgency of addressing these disparities to ensure equitable educational opportunities.

In the Pakistani context, Khan et al. (2022) examined the experiences of underprivileged students in accessing distance learning during the lockdown. Their study highlighted the detrimental effects of limited technology access and digital skills on students' engagement and academic performance.

Similarly, Ali et al. (2022) explored the challenges faced by educational institutions in implementing distance learning in Pakistan. Their research identified curriculum adaptation, pedagogical approaches, and faculty training as significant barriers requiring attention for successful distance learning integration. Another study by Baig et al. (2023) highlighted the importance of providing technical support and training to faculty and staff to

ensure the smooth implementation of distance learning.

While distant learning enabled educational continuity during crises, Rahman and Qureshi (2021) found ongoing debates about its effectiveness in fostering active learning and student engagement. Their study revealed persistent challenges related to collaborative learning and student motivation.

Additionally, several studies have investigated the social and emotional impact of that learning on students in different contexts. Ahmad and Gupta (2021) examined the psychological well-being of students in virtual learning environments, highlighting the importance of emotional support and student-teacher interactions in mitigating stress and anxiety during distant learning. A study by Alam et al. (2023) found that the lack of parental support and social isolation were significant challenges for students in distant learning settings.

Furthermore, the role of faculty training and digital literacy in enhancing distant learning outcomes has been explored by Mahmood and Ahmed (2022). Their research emphasized the significance of equipping educators with the necessary skills and support to navigate the challenges of online instruction effectively.

Considering these existing studies, this research presents a survey conducted with students, faculty, and management from diverse educational institutions in Pakistan. The study aims to identify challenges, shortcomings, and potential remedies, offering valuable insights to policymakers and educational stakeholders for enhancing distance learning's effectiveness in underdeveloped countries, ensuring a resilient and inclusive educational system for the future.

The unprecedented circumstances brought about by the COVID-19 pandemic brought distant learning to the forefront of education. While it served as a temporary solution to maintain educational continuity, it also exposed various weaknesses in the im- implementation process, particularly in underdeveloped countries like Pakistan. By gaining a comprehensive understanding of the challenges faced by students, faculty, and management, we can work towards formulating effective and sustainable solutions to make distance learning a viable and inclusive mode of education throughout the year.

2   Survey Data:

This pandemic-led transition to online education has posed unique challenges for developing countries, where accessibility to technology and resources is often limited. Pakistan, like many other countries, has faced these challenges and sought to evaluate the impact of e-learning on education while assessing the readiness of educational institutions for online teaching and operational work. To gauge the effectiveness of e-learning and the preparedness of educational institutions in Pakistan, a comprehensive survey was conducted. The survey targeted teaching faculties, students, and management executives working in various schools, colleges, and universities in Pakistan. The aim was to gather insights into the impact of technology and resource accessibility on education and to assess the quality of education provided through online platforms.

The survey questionnaire consisted of two parts:

a)   Focus on the impact of technology and resource accessibility,

b)   Assessment of the effectiveness of online education.

Each part comprised ten questions, providing a well-rounded assessment of the challenges and opportunities associated with e-learning in underdeveloped countries during the COVID-19 pandemic. A sample size of 283 respondents was collected from different educational institutions (from schools to universities) in different regions of Pakistan. The data gathered through the survey was carefully analyzed to identify patterns, trends, and challenges related to e-learning in the country. The survey aimed to provide useful suggestions and comments that can inform future strategies and policies for improving e-learning initiatives and enhancing the preparedness of educational institutions for similar crises in the future.

The impact of technology and resource accessibility on education was assessed through questions that explored the availability of devices, internet connectivity, and access to educational resources. Additionally, the survey examined the challenges faced by teachers, students, and management personnel in adapting to online teaching and operational work. Furthermore, the effectiveness of education through online platforms was evaluated through questions focusing on student engagement, learning outcomes, and the overall satisfaction of teachers, students, and management executives with the e-learning experience. The responses to these questions aimed to provide a comprehensive understanding of the benefits and limitations of e-learning in the context of underdeveloped countries, specifically during the COVID-19 pandemic. By conducting this survey, valuable insights have been gained regarding the impact of e-learning on education and the readiness of educational institutions in Pakistan. The analysis of the collected data has helped identify key areas for improvement, highlight success stories, and offer practical recommendations for enhancing e-learning initiatives in similar contexts. These findings are crucial for policymakers, educational institutions, and other stakeholders involved in the advancement of education in underdeveloped countries during times of crisis.

4   Demographic Analysis:

The survey collected primary data from 283 participants, including students, faculty, and management personnel, to assess the study and preparedness for e-learning. Students constituted the majority (226), followed by faculty members (51), and management personnel (6). The data allowed a comprehensive analysis of perspectives from different stakeholders, shedding light on challenges, benefits, and recommendations related to e-learning implementation in both public (64.3%) and private (35.7%) educational sectors. The diverse representation facilitated a holistic understanding of sector-specific trends and strengths, guiding decision-making and policy development for effective e-learning initiatives during the COVID-19 pandemic.

5   Technology/Resource Accessibility:

The survey investigated the availability of technology and resources during and after COVID-19, revealing diverse internet connectivity options among participants. 42% used cellular data, 6% reported fiber optics, 19% utilized PTCL Broadband, and 29% relied on Cable-Net. Additionally, 3% selected "Other" options like Wi-Fi, satellite, and community networks. Cellular data offers mobile connectivity but may have speed and reliability limitations. Fiber optics and PTCL Broadband provide high-speed, reliable connections, though affordability and accessibility may be limited. Cable-Net offers stable internet with varying reliability and coverage. The findings stress

the importance of understanding these connections' advantages and challenges in designing inclusive e-learning strategies. Another survey explored personal devices for e-learning, with 54% using smartphones, 6% iPads or Android tablets, 8% using desktop computers, and 32% laptops. Each device has distinct benefits and limitations, emphasizing the need for customization and addressing the digital divide. Acknowledging potential drawbacks, such as limited screen size and keyboards, can inform effective e-learning approaches catering to diverse needs.

During the COVID-19 pandemic, educational institutions embraced online Learning Management Systems (LMS) and Conferencing Tools. The survey focused on their utilization and impact on the learning journey. Most participants used popular platforms like MS Teams, Google Classroom, G-Suite, and Zoom, finding their user-friendly interfaces and versatile features beneficial for seamless navigation, communication, and collaboration. Integrating these tools with existing software and the availability of abundant resources further enhanced the learning experience. However, some participants experienced technical glitches, desired more customization options, and sought better training and support. Privacy concerns were also raised when using external platforms like Zoom. Improving the symphony of e-learning requires addressing these issues to ensure a harmonious and effective digital learning experience for students, faculty, and staff.

5.1 Comprehensive Analysis of Technology-Related Challenges:

The survey conducted among students, faculty, and management aimed to highlight prevalent e-learning problems during and after the COVID-19 pandemic. Several key issues were identified, including power failure affecting 24% of respondents, internet disconnection impacting 39%, device lagging and shutdown issues reported by 9%, software handling issues highlighted by 10%, no internet access cited by 17%, and financial issues with purchasing gadgets reported by 1%. These challenges pose significant setbacks in online learning, hindering continuity and student progress. However, acknowledging these problems allows for alternative solutions, such as investing in backup power sources, improving internet connectivity, optimizing device performance, providing user-

friendly interfaces, bridging the digital divide, and exploring affordable options for essential devices. Addressing these issues can create a more seamless and inclusive e-learning experience, ensuring equitable access to online education in the current and future landscapes.

5.2 Balancing Assistance and Empowerment in Educational Endeavors:

The survey examined the support provided by educational institutes for e-learning during and after the COVID-19 pandemic. Participants, including students, faculty, and management, were questioned about the assistance received and their level of self-arrangement. Results showed varied responses, with 25% mentioning technical support, 24% having to make their arrangements, and 12% receiving financial aid. Flexible deadlines were mentioned positively by 16%, but none reported having this flexibility. Resource availability received positive feedback from 22%, while 62% had to arrange their resources. Alarmingly, 25% reported receiving no support, raising concerns about assistance during challenging circumstances. While some participants acknowledged support in technical assistance, financial aid, and resource availability, there is room for improvement. Institutes should strive to enhance their support systems to ensure comprehensive assistance for effective e-learning, addressing financial constraints, providing adequate resources, and offering flexible options to accommodate diverse needs.

5.3 Navigating the Home Learning Environment:

Figure 12 provides insights into the availability of an optimal study environment for online learning participants. Among students, 61.1% have a dedicated study space, while 38.9% do not. For faculty, 61.5% have a study space, and 38.5% do not. Remarkably, 100% of management participants can access a dedicated study space. These findings indicate that most students and faculty have created dedicated study spaces at home, showing commitment to enhancing their learning experience. However, a significant minority lacks such spaces, potentially impacting focus, and concentration during online sessions. A dedicated study space is crucial for minimizing distractions and fostering effective learning. Efforts should be made to support those without access, ensuring an equitable learning

experience for all participants. In the survey, the analysis of hindrances to learning efficiency in e-learning was based on responses from students, faculty, and management participants. Family interference was acknowledged by 22% of students and 27% of faculty members as impacting learning efficiency, but none from management identified it. Lack of focus/concentration affected 23% of students and faculty while multitasking challenges were reported by 27% of students, 18% of faculty, and 33% of management. 24% of students, 28% of faculty, and 50% of management identified difficulty in managing academic activities. A small percentage reported no hindrances (1% students, 4% faculty). Other factors were mentioned by 3% of students but none by faculty or management. The analysis highlights various usual challenges, and addressing these factors can optimize learning efficiency for all stakeholders.

6   Analyzing E-Learning: Insights and Students' Perspective:

E-learning requires student dynamics and experiences. This investigation examines student opinions on online education. We learned about the influence of e-effectiveness learning through their experiences, challenges, and satisfaction. This analysis illuminates' students' distant education needs, preferences, and concerns. We can improve e-learning by recording their voices.

6.1   Meeting Deadlines in E-Learning: Challenges, Perspectives, and Solutions:

This analysis report explores the satisfaction levels of participants regarding meeting deadlines in e-learning during COVID-19 and the post-pandemic period. While most students are satisfied, 22.1% expressed dissatisfaction due to unrealistic deadlines, extra classes, electricity breakdowns, internet connectivity problems, house chores, and the load of assignments from different courses. Electricity and internet breakdowns are particularly prevalent in underdeveloped areas of Pakistan, significantly hindering timely submissions. Balancing household responsibilities and managing multiple course assignments also challenges meeting deadlines effectively. Addressing these issues can enhance the e-learning experience and alleviate student stress and anxiety.
To enhance e-learning, consider infrastructure development in underdeveloped areas for a stable power supply, expand internet coverage, implement backup power solutions, offer subsidized internet packages, and adopt deadline flexibility. These solutions dress challenges posed by electricity and internet breakdowns, ensuring Pakistan's more inclusive e-learning environment.

6.2   Analyzing the Financial Effects of E-Learning on Students during a Pandemic

The financial implications of e-learning during the pandemic significantly affect students' educational experiences. Positive impacts include increased internet bills (32%), reduced commute expenses (16%), and discounted fees (14%). However, negative impacts are more pronounced, with 70% of students expressing concerns about various financial factors. Challenges include constant fees with no discounts (22%), decreased monthly revenue (15%), and laptop expenses (not perceived as significant). Educational institutions should address these challenges by providing financial assistance, flexible fee structures, and collaborations for improved internet connectivity. Supporting students in managing finances and connecting them with financial support networks can alleviate financial stress and create a more inclusive e-learning environment for academic excellence.

6.3   Unveiling the Statistical Insights: Students' Perspective

In this assessment of e-learning effectiveness, both private and public institutions shared their perspectives. Private institutions displayed a decent level of computer literacy (mostly level 3), while public institutions had more diverse responses, with some reporting limited skills (below level 3). Motivation, adaptability, and punctuality showed moderate levels in both sectors. Public institutions leaned more towards e-learning over traditional methods. Interaction with professors and students, as well as peer learning, required improvement (level 2). Multimedia aids were deemed moderately effective (level 3) in enhancing learning. Support from student affairs officers needed improvement in both sectors. Overall, the analysis revealed strengths and areas for growth in the online educational landscape, providing valuable insights for institutions to enhance their e-learning experience.

6.3.1   Analysis of an Independent Samples t-Test

This section presents a detailed analysis of an independent samples t-test conducted to compare the responses of two distinct groups, Group 1 (Public Sector Students) and Group 2 (Private Sector Students), using Likert scale data. The t-statistic obtained was 0.37, with a p-value of 0.71. These results suggest a subtle discrepancy between the mean scores of the two groups, which may not be statistically significant. It is crucial to interpret the findings cautiously, considering other unaccounted variables that could contribute to the observed variations. Further investigation with additional covariates is necessary to understand the factors influencing the outcomes comprehensively. The analysis highlights the complexities of statistical inference and emphasizes the importance of rigorous examination to draw accurate conclusions from the data.

6.3.2   Analysis of Variance (ANOVA Test Results: Comparing Sector Differences in Educational Institution Metrics:

The analysis investigates significant differences in various metrics related to educational institutions across different sectors (private and public). ANOVA tests were performed for metrics like computer literacy, self-motivation, adaptability, e-learning preferences, and more. The results indicate no significant differences between private and public institutions across the analyzed metrics, suggesting similar educational experiences. However, there are limitations to consider, such as the representativeness of the dataset and potential biases in self-reported responses. The independent samples t-test and ANOVA have limitations and do not account for all influencing factors. It is essential to interpret the results carefully and acknowledge the need for further research to understand the complexities of educational experiences fully. The ANOVA test is a statistical technique used to analyze differences between two or more groups by comparing the variances between groups and within groups. In this analysis, we will perform a one-way ANOVA test for each metric, considering the independent variable as the sector (private or public) and the dependent variable as the corresponding metric. The null hypothesis assumes that there are no significant differences between the sectors, while the alternative hypothesis suggests that at least one sector differs significantly from the others.

The ANOVA test results indicate no significant differences between private and public educational institutions across the analyzed metrics. The p-values obtained for all metrics were above the significance level ($\alpha = 0.05$), suggesting that the null hypothesis cannot be rejected. These findings suggest that the sector (private or public) does not significantly impact the measured metrics. These results might indicate that the quality of education and student experiences are similar between private and public educational institutions. It is important to note that this analysis only focuses on the specific metrics mentioned above, and other factors could differentiate private and public institutions not considered in this study.

After conducting the ANOVA test on the dataset, the following Table 1 represents the results that were obtained for each metric:

TABLE 1

Sectors	F-value	p-value	Conclusion
Computer literacy	0.001	0.980	
Self-motivation towards studies	0.578	0.450	
Adaptive to dealing with problems related to online system	0.078	0.781	
E-learning over traditional learning methodology	0.437	0.512	There is no significant difference in computer literacy between private and public educational institutions.
Punctuality/class participation	0.359	0.551	
Productivity of studies during the pandemic versus normal days	0.167	0.684	

Interaction with professor/students	0.661	0.420
Possibility of peer learning	0.699	0.407
Effectiveness of pedagogy in using audio/visual aids	0.032	0.858
Effectiveness of student affairs officers in resolving issues	0.254	0.617

Several limitations should be considered when interpreting the results of this analysis:

● The dataset used for this analysis might not be representative of the entire population of private and public educational institutions.

● The survey responses are self-reported and subject to potential biases and errors.

● The analysis only considers a limited set of metrics and does not account for other factors that might influence educational experiences.

● The assumptions of the ANOVA test, including independence, normality, and equal variances, should be met for accurate interpretation of the results.

The analysis of variance (ANOVA) test was conducted to investigate the differences in educational institution metrics across different sectors. The obtained F-value was 0.11, and the corresponding p-value was 0.74. The F-value measures the ratio of between-group variability to within-group variability. In this case, the low F-value suggests that there is a slight difference between the sectors in terms of the educational institution metrics. The p-value, on the other hand, measures the statistical significance of the results. A high p-value indicates that the observed differences between the sectors are not statistically significant, meaning that they could have occurred due to random chance. Based on the results of the ANOVA test, there is no significant difference between private and public educational institutions in terms of computer literacy, self-motivation towards studies, adaptability to online systems, e-learning preferences, punctuality/class participation, productivity during the pandemic, interaction with professors and students, the possibility of peer learning, the effectiveness of audio/visual aids in teaching, and effectiveness of student affairs officers in issue resolution. These findings suggest that the sector does not play a significant role in determining these educational institution metrics. However, it is important to consider the limitations of this analysis when interpreting the results. In conclusion, the analysis of an independent samples t-test and ANOVA test provides valuable insights into the dataset and allows us to draw meaningful conclusions. The Independent samples t-test indicates a modest difference between the mean scores of Group 1 (Public Sector Students) and Group 2 (Private Sector Students). However, the obtained p-value suggests that this difference may not be statistically significant. Therefore, we fail to reject the null hypothesis and conclude that the mean scores between the public and private sector groups may not differ significantly. The ANOVA test results show that there are no significant differences between private and public educational institutions across the analyzed metrics. The p-values for all metrics are above the significance level, indicating that the sector (private or public) does not significantly impact the measured metrics. These findings suggest that the quality of education and student experiences are similar between private and public educational institutions for the given metrics. Moreover, both the independent samples t-test and ANOVA test have certain limitations. The dataset used may not be representative of the entire population. The assumptions of the tests, such as independence, normality, and equal variances, should be considered. The results are based on the statistical analysis and do not account for other potential factors or variables that could influence the outcomes.

7 Exploring the E-Pedagogy System: Faculty Perspectives on E-Learning in Educational Institutions

An enthralling journey waits as the enigmatic realm of e-learning is unraveled through the discerning gaze of 52 esteemed faculty participants from schools, colleges, and universities. This captivating

exploration focuses on the perceptions and experiences of these seasoned educators, shedding light on the e-pedagogy system that has transformed the educational landscape. The aim is to comprehensively understand how faculty members perceive and navigate the world of digital learning, with their insights and recommendations holding the key to unlocking the true potential of this digital frontier.

7.1 Unveiling the E-Pedagogy Time Management Conundrum: Faculty Perspectives on Balancing Workload and Efficiency

The realm of education has witnessed a significant shift towards e-learning, necessitating the exploration of various aspects of the e-pedagogy system. One crucial aspect that demands attention is faculty members' time and workload management. As educational institutions embrace digital platforms for teaching and learning, faculty members face unique challenges in managing their time effectively and efficiently. The transition to e-pedagogy often brings new demands, such as adapting to online teaching tools, developing digital content, and facilitating virtual student interactions. Balancing these responsibilities with existing workload commitments can be a formidable task for faculty members. This study aims to delve into the time and workload management perspectives of faculty members in the context of the e-pedagogy system. With a focus on the experiences and insights of 52 faculty participants from diverse educational institutions, including schools, colleges, and universities, we seek to uncover the intricacies of managing teaching responsibilities in the digital age. Through in-depth interviews and surveys, we will explore the strategies employed by faculty members to effectively allocate their time, handle increased workload demands, and maintain a balance between teaching and other professional commitments. By examining the perspectives of faculty members, we aim to gain a comprehensive understanding of the challenges they face and the strategies they employ to navigate the e-pedagogy time management conundrum. The findings of this study will shed light on the best practices, potential barriers, and areas for improvement in supporting faculty members in optimizing their time and workload management within the e-pedagogy system. This research seeks to contribute to the enhancement of faculty experiences and the overall effectiveness of e-learning in educational institutions.

7.1.1 Analyzing the Relationship between Teaching Load and Satisfaction Levels

To examine the relationship between teaching load and level of satisfaction among a sample of 52 participants, a z-test has been conducted. The test aims to determine whether there is a significant association between these two variables based on the observed proportions of teaching load and satisfaction levels. The data consists of two groups: Group 1 represents different teaching load categories, including less than 12 hours, 12 to 18 hours, and more than 18 hours. Group 2 represents the level of satisfaction, categorized as satisfied and not satisfied. As shown in Figure 1, initially define the null hypothesis and alternative hypothesis, which serve as the basis for the analysis. Next, calculate the pooled proportion by combining the observed proportions from both groups. This will give an overall estimate of the proportion. After calculating the pooled proportion, compute the standard error, which measures the variability in the sample proportions. The standard error provides insight into the precision of our estimate. Using the observed proportions and the standard error, calculate the test statistic, known as the Z-score. This statistic compares the differences between the observed proportions and the expected proportions under the null hypothesis. With the test statistic in hand, able to determine the p-value associated with the Z-score. The p-value represents the probability of obtaining a Z-score as extreme as the calculated value or more extreme, assuming the null hypothesis is true. In this case, performing a two-tailed test. Finally, based on the calculated p-value and the chosen significance level (alpha), a decision has been made regarding the null hypothesis. If the p-value is less than the significance level, reject the null hypothesis and conclude that there is evidence to suggest an association between teaching load and level of satisfaction.
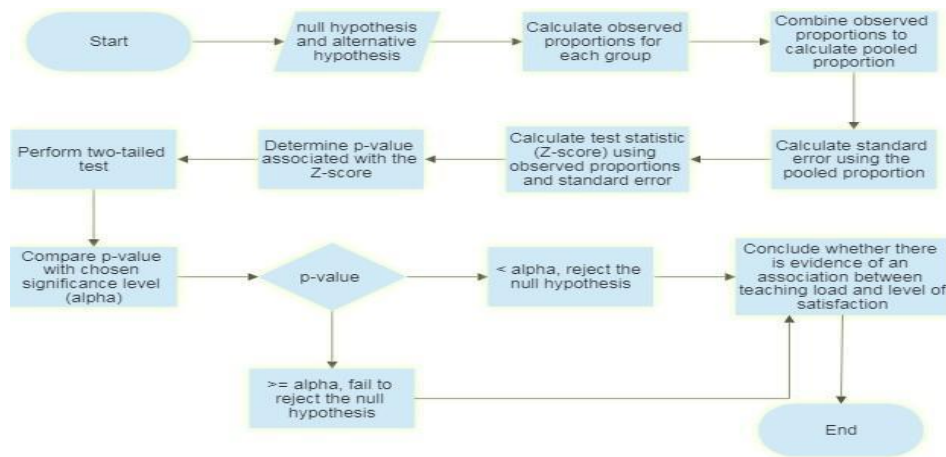
FIGURE 1: logical sequence and operations of Z-test

This analysis will shed light on the relationship between teaching load and faculty satisfaction, providing valuable insights into the potential impact of workload on satisfaction levels. To perform a Z-test, we will compare the proportions of Group 1 (teaching load) and Group 2 (level of satisfaction) using the observed proportions and the given sample size shown in Table 2.

TABLE 2

Group 1	Group 2
Less than 12 hours: 67.9%	Satisfied: 69.2%
12 to 18 hours: 24.5%	Not satisfied: 30.8%
More than 18 hours: 5.7%	

Proportion's Group 1 vs Group 2

a)   Define the hypotheses; H0: The teaching load and level of satisfaction are independent; H1: There is an association between teaching load and level of satisfaction

b)   Calculating the pooled proportion by using the following equation (1) $p = \dfrac{n_1p_1 + n_2p_2}{n_1 + n_2}$

(1) where n_1 and n_2 are the sample sizes for Group 1 and Group 2, respectively, and p_1 and p_2 are the observed proportions. Calculating the standard error by using the following equation (2)

$Error = \sqrt{(p(1-p)(1/n\_1 + 1/n\_2)}$ (2)

c)   Now, analyzing the test statistic (Z-score using the equation (3)

   $z = (p\_1 - p\_2)/Error$ (3)

The calculated value for p, error, and z-score are determined to be 0.345, 0.079, and 4.33 respectively, after the completion of the calculations.

d)   The p-value is analyzed by conducting a two-tailed test, wherein the probability in equation (4) of obtaining a Z-score as extreme as 4.333 in either tail of the standard normal distribution is determined. By utilizing a standard normal distribution table or a statistical calculator, it is observed that the p-value is exceedingly small (p-value < 0.001).

$p\text{-}value \approx 2 * P (Z > 4.333)$ (4)

Based on the Z-test results conducted with a sample size of 52, a significant association is observed between teaching load and level of satisfaction, leading to the rejection of the null hypothesis. The interdependence between teaching load and level of satisfaction suggests that the amount of teaching load can potentially influence individuals' satisfaction levels.

7.1.2 Unveiling the Battle of Time: Class Content Preparation in Online vs Physical Pedagogy

The purpose of this analysis was to explore the relationship between time calculation and class content preparation time, specifically focusing on the online and physical modes of preparation. Polynomial regression was applied to the given data to model and predict the preparation time based on the time calculation. The dataset consisted of three samples, with each sample representing a different time calculation category: "Less than 4 hours," "4 to 8 hours," and "More than 8 hours." For each time calculation category, there were corresponding values for online class content preparation time and physical class content preparation time. The polynomial regression model with a degree of '2' was chosen to capture potential nonlinear relationships between the time calculation and preparation time variables. The polynomial features were generated using the 'PolynomialFeatures' class from scikit-learn, and the regression models were fitted using the 'Linear Regression' class. The analysis revealed the following results:

a)   Online Class Content Preparation Time:

●   The polynomial regression model indicated a positive relationship between time calculation and online class content preparation time.

●   The regression line exhibited a concave shape, suggesting that the preparation time increased at a decreasing rate as the time calculation increased.

●   The model predicted that for time calculations less than 4 hours, the online class content preparation time was around 46.2%. As the time calculation increased to 2 and 3, the predicted preparation times decreased to approximately 43.7% and 42.5% respectively.

b)   Physical Class Content Preparation Time:

●   The polynomial regression model indicated a negative relationship between time calculation and physical class content preparation time.

●   The regression line exhibited a convex shape, indicating that the preparation time decreased at a decreasing rate as the time calculation increased.

●   The model predicted that for time calculations less than 4 hours, the physical class content preparation time was around 76.9%. As the time calculation increased to 2 and 3, the predicted preparation times decreased to approximately 49.6% and 41.9% respectively.

Figure 2 shows the polynomial regression analysis revealed distinct patterns in the relationship between time calculation and class content preparation time for online and physical modes. The online class content preparation time showed a positive relationship, whereas the physical class content preparation time exhibited a negative relationship with the time calculation. These findings provide insights into the varying nature of preparation time requirements based on different time calculation categories.

7.1.3 Exploring Non-Teaching Time Commitments and Responsibilities:

In this analysis, the non-teaching time commitments per week and the nature of non-teaching responsibilities among a group of individuals will be examined. The data will be used to determine the distribution of respondents across different categories of non-teaching time commitments and the corresponding nature of their responsibilities shown in Table 3

TABLE 3

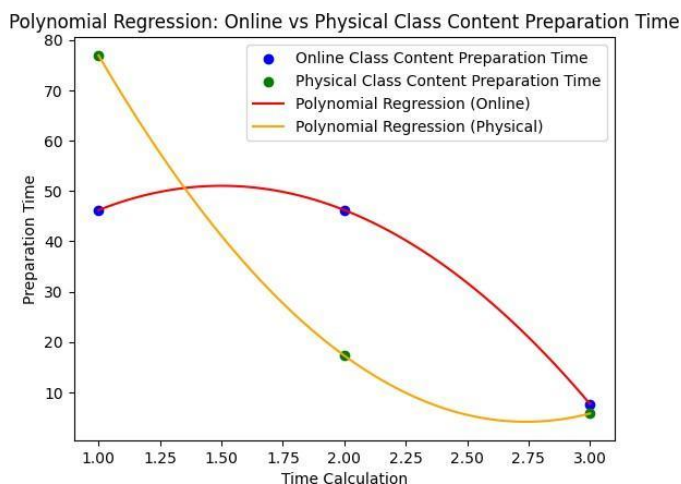| Non-Teaching Time Commitments per Week	None 3.80%	Less than 2 hours 25%	2 to 4 hours 32.70%	More than 4 hours 38.50%
Non-Teaching Responsibilities Nature	None 33%	Management Work 58%	Research Work 6%	Extra/Co-curricular activities 4%

FIGURE 2: Polynomial Regression on Class Content Preparation Time

Insights will be gained regarding the varying levels of non-teaching time commitments and the nature of responsibilities undertaken by individuals. It is noteworthy that a sizable portion of respondents (38.50%) reported that more than 4 hours per week are spent on non-teaching responsibilities. This suggests a considerable investment of time in activities outside of teaching. On the other hand, 3.80% of respondents reported having no non-teaching time commitments. Regarding the nature of non-teaching responsibilities, it was found that most respondents (58%) are engaged in management work, indicating their involvement in administrative duties and tasks related to the organization and coordination of educational activities. Additionally, 6% of respondents participate in research work, highlighting their contribution to academic research and scholarly pursuits. A smaller percentage (4%) indicated involvement in extra/co-curricular activities, indicating their participation in additional educational initiatives beyond the core curriculum. Valuable insights are provided by this analysis into the non-teaching time commitments and responsibilities among the surveyed individuals. The distribution and nature of these commitments can inform resource allocation and support for faculty and staff by educational institutions and policymakers, ensuring a conducive environment for both teaching and non-teaching activities.

7.1.4 Constraints in the Effectiveness of E-Pedagogy:

In this analysis, the constraints that hinder the effectiveness of e-pedagogy are explored, with a specific focus on the possible factors affecting personal affairs. The data collected reveals the percentage of respondents who identified numerous factors as constraints in their professional practice.

a)   Delay in academic decision causing short deadlines for preparation: A constraint identified by a significant proportion of respondents (61.1%) is the delay in academic decision-making, which results in short deadlines for preparation. Short deadlines are caused by delays in academic decisions, placing additional pressure on educators to deliver quality online lectures and assessments within limited timeframes.

b)   More time required to plan online lectures and assessments: The need for more time to plan online lectures and assessments is expressed by a majority of respondents (80.6%). Educators require additional time to adapt teaching methods and materials, create digital content, and design effective online assessments. The demand for extra time highlights the complexity and effort involved in delivering high-quality online instruction.

c)   Unlimited contact hours with students: A constraint identified by a substantial portion of respondents (41.7%) is unlimited contact hours with students. The virtual learning environment often blurs the boundaries between work and personal life, making it challenging for educators to establish a healthy work-life balance. The constant availability of student support and engagement can lead to increased stress and burnout.

d)   Eleventh-hour meetings: The occurrence of eleventh-hour meetings is reported as a constraint by a considerable number of respondents (44.4%).

These last-minute meetings can disrupt planned schedules and create time management challenges for educators. Such unexpected demands can hinder effective lesson preparation and limit the time available for personal affairs.

e)   Increased work hours: Increased work hours are highlighted as a constraint by a considerable proportion of respondents (33.3%). The transition to e-pedagogy often requires educators to invest additional time in learning new technologies, adapting teaching materials, and providing online support to students. Extended work hours can encroach upon personal time and lead to heightened stress levels.

The analysis sheds light on the various constraints' educators face in the realm of e-pedagogy. These constraints have implications for work-life balance, lesson planning, and overall job satisfaction. Educational institutions and policymakers must address these constraints by providing adequate support, resources, and time allocation to ensure the effectiveness and well-being of educators in the online teaching environment. The importance of timely academic decision-making, the provision of sufficient planning time, the establishment of boundaries for contact hours, the minimization of eleventh-hour meetings, and the promotion of a healthy work-life balance should be recognized to enhance the effectiveness of e-pedagogy and mitigate the constraints faced by educators.

The constraints in the effectiveness of e-pedagogy are a topic of critical discussion, as they pose significant challenges to the learning process. One such constraint is the laid-back attitude of students towards studies. This issue raises concerns about student motivation, engagement, and willingness to actively participate in learning activities. Without an initiative-taking approach from students, the effectiveness of e-pedagogy is compromised. Another constraint is the unreasonable excuses given by students. These excuses hinder the learning process and can lead to a lack of accountability. By accepting such excuses, students are not held responsible for their actions, which can negatively impact their overall educational experience. The extension in deadlines is another constraint that affects the effectiveness of e-pedagogy. While occasional extensions may be necessary, frequent extensions can disrupt the learning flow and hinder progress. It is important to establish clear and reasonable deadlines to maintain a sense of structure

and discipline in the online learning environment. Disciplinary issues in class pose a significant constraint to e-pedagogy. Instances of disruptive behavior, lack of respect, or failure to adhere to classroom rules can undermine the learning atmosphere. These issues require effective management strategies to create a conducive environment for meaningful learning to take place. The unavailability of resources is a notable constraint in e-pedagogy. Limited access to necessary materials, technology, or reliable internet connectivity can impede students' ability to fully engage in online learning activities. It is crucial to ensure that students have equal access to essential resources to maximize the effectiveness of e-pedagogy. Lastly, less student turnover presents a constraint as it indicates a lack of active participation and engagement. For e-pedagogy to be effective, students must actively interact with the course content, participate in discussions, and collaborate with their peers. A low student turnover rate suggests a lack of enthusiasm or involvement, which can diminish the overall effectiveness of e-pedagogy. These constraints in e-pedagogy demand attention and proactive measures. Addressing the laid-back attitude of students, discouraging unreasonable excuses, managing deadlines effectively, promoting discipline, ensuring resource availability, and fostering active student participation are crucial for enhancing the effectiveness of e-pedagogy and delivering a high-quality online learning experience.

7.1.5   Enhancing Quality of Education in an Online Classroom: Pedagogical Approaches

To enhance the quality of education in an online classroom, several pedagogical approaches have been employed based on the survey results. These approaches have been implemented to ensure effective teaching and learning experiences for students. One of the identified pedagogical approaches is screen sharing, which allows educators to share their screens with students, enabling them to view presentations, demonstrations, or other relevant materials in real-time. This facilitates visual engagement and enhances understanding of the subject matter. Another approach is the use of video links to tutorials. By providing students with access to video tutorials, they can review and reinforce their understanding of concepts at their own pace. This asynchronous learning method supports self-paced learning and provides additional resources for

students to grasp difficult concepts. Recorded lectures have also been utilized as an effective pedagogical approach. By recording lectures, students can revisit the content multiple times, allowing for better comprehension and revision. This flexibility accommodates diverse learning styles and ensures that students have access to course content anytime, anywhere. Collaborative sheets in the form of Word or Excel documents have been employed to encourage active student participation and collaboration. Students can collaborate on assignments, projects, or discussions in real-time, fostering a sense of teamwork and shared learning experiences. Online quizzes serve as another pedagogical approach to assess students' understanding and progress. These quizzes can be designed to provide immediate feedback, allowing students to identify areas of improvement and consolidate their knowledge. Utilizing Padlet jam boards facilitates interactive and visual engagement. Students can contribute ideas, share resources, and collaborate on virtual boards, promoting creativity and active participation. In lab-based courses, inviting a limited number of students to live video demonstrations provides hands-on learning experiences in a virtual environment. This approach allows students to observe experiments or procedures

closely and engage in discussions or Q&A sessions. Additionally, providing online video tutorials complements traditional lectures and provides students with additional resources and explanations to supplement their learning. By incorporating these pedagogical approaches, educators aim to foster an engaging and interactive online learning environment, enhance students' understanding and retention of course material, and promote collaborative and independent learning.

7.1.6 Ensuring Academic Integrity in the Online Classroom: Exploring Effective Online Assessment Methods and Robust Anti-Cheating Measures

With the rapid growth of online education, ensuring academic integrity in the online classroom has become a crucial concern. This analysis delves into the methods adopted or adapted for online assessment among 52 respondents. The aim is to explore the effectiveness of these methods in maintaining academic integrity and to identify robust anti-cheating measures implemented by educators. Among the 52 respondents, a diverse range of online assessment methods were adopted or adapted to evaluate student performance. Figure 3, shows the distribution of these methods.
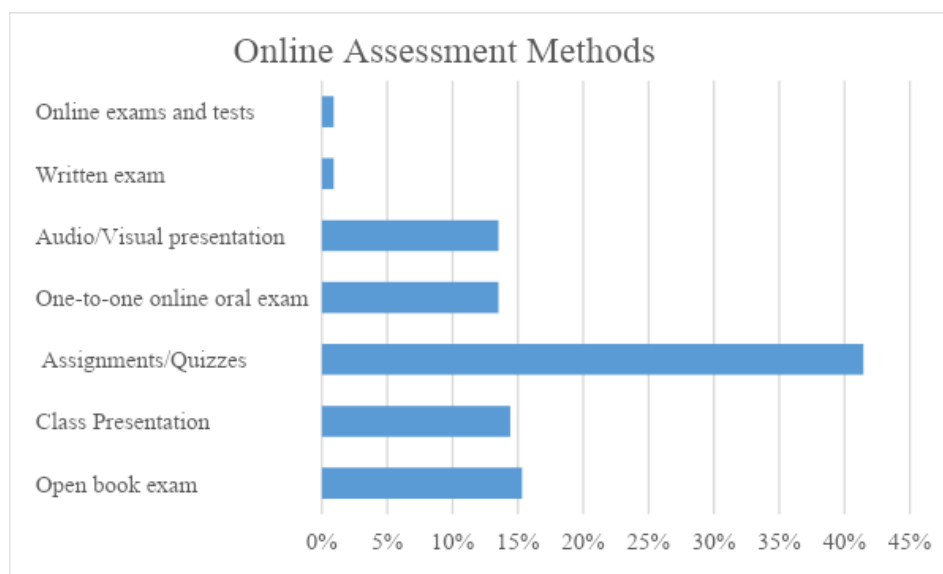

FIGURE 3: Online Assessment Methods

The analysis indicates that assignments/quizzes were the most prevalent online assessment method,

with 41% of respondents utilizing this approach. Assignments and quizzes provide opportunities for

students to apply their knowledge and skills in a structured manner. The inclusion of open-book exams, class presentations, one-to-one online oral exams, audio/visual presentations, and written exams also highlights the diverse approaches employed to assess student learning in the online environment.

To ensure academic integrity and prevent cheating or plagiarism in online assessments, educators have implemented various measures. The measures reported by the respondents include:

a)   Subjective Questions: Incorporating subjective questions in assignments, quizzes, and exams requires students to provide detailed explanations and analyses. This approach discourages plagiarism and prompts students to demonstrate their understanding and critical thinking abilities.

b)   Proctoring Tools: Some educators have employed proctoring tools to monitor students during online exams. These tools use features like screen recording, facial recognition, and keystroke analysis to detect any suspicious behavior or cheating attempts.

c)   Timed Assessments: Setting strict time limits for assignments, quizzes, and exams reduces the possibility of students seeking external assistance or engaging in unauthorized collaboration. Timed assessments encourage students to rely on their knowledge and skills.

d)   Randomized Questions: Randomizing the order or selection of questions ensures that each student receives a unique assessment, making it difficult for students to share answers or engage in collusive practices.

e)   Plagiarism Detection Software: Educators have utilized plagiarism detection software, such as Turnitin, to identify instances of copied content in assignments and essays.

This helps deter students from engaging in plagiarism and promotes academic honesty. The analysis reveals a diverse range of online assessment methods adopted or adapted by educators to evaluate student performance in the online classroom. Assignments/quizzes emerged as the most widely used method, emphasizing the value of continuous assessment and active student engagement. To address concerns about cheating and plagiarism, educators have implemented robust anti-cheating measures. These include the incorporation of subjective questions, the use of

proctoring tools, timed assessments, randomized questions, and plagiarism detection software. These measures aim to promote academic integrity, discourage dishonest practices, and ensure a fair evaluation of student knowledge and abilities. However, it is important to acknowledge that no single approach can eliminate the possibility of cheating in an online environment. The ongoing development of innovative anti-cheating technologies, continuous monitoring, and the implementation of comprehensive academic integrity policies are crucial to maintaining the credibility and fairness of online assessments. The analysis underscores the importance of adopting effective online assessment methods and robust anti-cheating measures to ensure academic integrity in the online classroom. By utilizing a combination of assessment strategies and implementing preventive measures, educators can foster a culture of honesty, authenticity, and accountability in online learning environments. Continuous evaluation and refinement of these methods and measures will be essential as online education continues to evolve.

8   Unveiling the Statistical Insights: Faculty Perspective

This analysis aims to assess the effectiveness of pedagogical approaches in improving e-learning among faculty members. The survey included questions asking respondents to rate various aspects of pedagogy on a scale of 0 to 5. The questions and their results are discussed below.

a)   Which sector does your educational institution belong to?

The majority of respondents rated their institutions' sector as 4, indicating a high level of applicability and relevance to their context.

b)   All course elements are stored on the LMS (Learning Management System), i.e., learning objectives, textbooks, evaluations, and lesson plans. The average rating for this question was 3, suggesting that while many institutions store course elements on the LMS, there is room for improvement in ensuring comprehensive coverage and accessibility.

c)   Accessing recorded lectures/utilizing Audio/Visual Aids.

Respondents rated this aspect with an average score of 3, indicating a moderate level of utilization of recorded lectures and audio/visual aids. There is

potential for further enhancement in leveraging these resources to enrich the learning experience.

d)   Students/class/academic representatives' orientation to ensure public health and safety related to the pandemic.

This question received an average rating of 4, demonstrating that institutions have taken measures to orient students and academic representatives regarding public health and safety during the pandemic. This indicates a proactive approach to addressing the challenges posed by the global health crisis.

e)   Tutorials for students to compensate for the face-to-face learning gap.

The average rating for this question was 3, suggesting that while some institutions provide tutorials to bridge the face-to-face learning gap, there is room for improvement in terms of their availability and effectiveness.

f)   Interaction with professors/students during the online class.

Respondents rated this aspect with an average score of 3, indicating a moderate level of interaction between professors and students during online classes. There is scope for further fostering engagement and active participation through interactive discussions and collaborative activities.

g)   Student consultation hours other than class timings.

The average rating for this question was 3, indicating that institutions offer student consultation hours outside of regular class timings. However, there is room for improvement in terms of availability and accessibility to ensure effective support and guidance for students.

h)   Online class discipline.

Respondents rated this aspect with an average score of 4, highlighting a strong emphasis on maintaining discipline and decorum in online classes. This suggests that institutions have implemented measures to ensure a conducive and focused learning environment.

i)   Your punctuality in class.

The average rating for this question was 4, indicating that faculty members are generally punctual in conducting online classes. This demonstrates their commitment to delivering timely and structured learning experiences.

j)   Lab conduction (only applicable to labs that require hardware).

The average rating for this question was 0, suggesting that the respondents' institutions do not have labs requiring hardware or that this aspect did not apply to their specific context.

The analysis of the survey results reveals both strengths and areas for improvement in the pedagogical approaches adopted by the participating faculty members. Notable strengths include the orientation provided for public health and safety during the pandemic, online class discipline, and punctuality in class. These aspects indicate a proactive and responsible approach towards ensuring a conducive learning environment. However, several areas require further attention. These include enhancing the storage of course elements on the LMS, utilizing recorded lectures and audio/visual aids more effectively, providing comprehensive tutorials to address the face-to-face learning gap, and fostering increased interaction between professors and students during online classes. Moreover, there is scope for improving the availability and accessibility of student consultation hours, as well as exploring ways to incorporate lab experiences for courses that require hardware. The findings from this analysis provide valuable insights into the effectiveness of pedagogical approaches in improving e-learning. While certain aspects of pedagogy, such as public health orientation, online class discipline, and punctuality, have been well-implemented, there is room for improvement in other areas. It is recommended that educational institutions focus on enhancing the storage and accessibility of course elements on the LMS, leveraging recorded lectures and audio/visual aids effectively, providing comprehensive tutorials, fostering increased interaction between professors and students, and ensuring the availability and accessibility of student consultation hours. Additionally, exploring innovative approaches to incorporate practical lab experiences for hardware-based courses can further enhance the quality of e-learning. Continuous evaluation and refinement of these pedagogical approaches will be crucial to ensure ongoing improvements in the effectiveness of e-learning and to provide students with a rich and engaging educational experience. Two tests were performed to conduct a detailed analysis of the above data.

8.1 Exploring the Analysis Results of an Independent Samples t-Test

The purpose of this analysis was to compare the ratings of nine survey questions between public and private educational institutions. The ratings were obtained on a scale from 0 to 5, with higher values indicating more positive responses. The analysis aimed to determine if there were significant differences in the mean ratings of these survey questions between the two groups.

An independent t-test was performed for each survey question to compare the ratings between the public and private groups. The t-test provides information about the magnitude and direction of the differences between the two groups, as well as the statistical significance of these differences. A p-value of less than 0.05 was considered statistically significant.

The t-tests for each survey question are as follows:

a)   All course elements are stored on the LMS: The t-test revealed a t-value of 2.061 and a p-value of 0.056. Although the p-value is slightly above the significance threshold, there is a trend suggesting a difference in ratings between the public and private groups.

b)   Accessing recorded lectures/utilizing Audio/Visual Aids: The t-test showed a t-value of -0.536 and a p-value of 0.599. There was no significant difference in the ratings between the public and private groups for this question.

c)   Students/class/academic representative's orientation related to the pandemic: The t-test yielded a t-value of -0.233 and a p-value of 0.818. No significant difference was found between the public and private groups in terms of ratings for this question.

d)   Tutorials for students to compensate for the face-to-face learning gap: The t-test indicated a t-value of 2.911 and a p-value of 0.010. The ratings for this question were significantly higher in the private group compared to the public group.

e)   Interaction with professors/students during online class: The t-test resulted in a t-value of -0.111 and a p-value of 0.912. There was no significant difference in the ratings between the public and private groups for this question.

f)   Student consultation hours other than class timings: The t-test revealed a t-value of -0.382 and a p-value of 0.707. No significant difference was observed in the ratings between the public and private groups for this question.

g)   Online class discipline: The t-test yielded a t-value of 1.114 and a p-value of 0.280. There was no significant difference in the ratings between the public and private groups for this question.

h)   Your punctuality in class: The t-test showed a t-value of -1.247 and a p-value of 0.227. No significant difference was found between the public and private groups in terms of ratings for this question.

i)   Lab conduction (applicable to labs requiring hardware): The t-test resulted in a t-value of -1.693 and a p-value of 0.110. Although the p-value is above the significance threshold, there is a suggestion of a difference in ratings between the public and private groups.

The analysis revealed some interesting findings regarding the differences in survey question ratings between public and private educational institutions. Specifically, there were significant differences in ratings for the question related to tutorials for compensating face-to-face learning gaps, where the private group had higher ratings. For other questions, no significant differences were observed between the two groups. However, it is important to note that some questions showed trends or tendencies that could be explored further with larger sample sizes. These findings provide insights into specific aspects where public and private educational institutions may differ in their approaches and practices. Further research and exploration are recommended to comprehensively understand the factors contributing to these differences and their potential impact on the educational experience.

8.2 A Comparative Glimpse into Educational Realms Using ANOVA Test

In the vast realm of education, diverse sectors shape students' learning experiences. In this analysis, we embark on a captivating journey to unravel any significant differences between two prominent sectors: the public (government) and private educational institutions. Through a series of nine thought-provoking questions, the idea is to aim to discern the unique perspectives held by individuals within each sector. The ANOVA (Analysis of Variance) test will serve as our guide, shedding light on the statistical significance of these divergent viewpoints. Therefore, the dataset, carefully woven with responses from both the public and private sectors, captures the essence of

each institution's distinctive fabric. Each question unravels a new thread, portraying a vivid tapestry of opinions and experiences. The public sector dataset boasts 12 observations, while its private counterpart encompasses 34 observations, painting a broader picture of the private sector's intricacies. One finds oneself enmeshed in a captivating dance of hypotheses, where one is spellbound by the entanglement and immersed in its intriguing interplay: Null Hypothesis (H0): Within the educational cosmos, no significant difference exists in the mean responses between the public and private sectors. Alternative Hypothesis (HA): A grand tapestry of diversity emerges as a significant difference adorns the mean responses between the public and private sectors. Using Python as our compass, able to embark on a quest to unravel the mysteries of the ANOVA test. Guided by the venerable `f_oneway` function from the esteemed `scipy.stats` module, able to venture into uncharted statistical terrain, where revelations await. The ANOVA test unveils its secrets, revealing a profound revelation of F and p-value are 0.605 and 0.554, respectively. Within these numerical revelations lies the essence of our analysis. The enigmatic F-value, standing tall at 0.605, whispers its secrets. Meanwhile, the p-value, with its mesmerizing enchantment at 0.554, beckons us to decipher its message. In this enchanting realm, the p-value reigns supreme, holding the key to the significance of the findings. As tread carefully on the path of interpretation, it was found that our p-value surpasses the typical significance level of 0.05. Thus, we must embrace the unexpected: there is no significant difference between the public and private sectors in terms of the responses to the questions posed. As we delve deeper into this enchanting tale, we discover that the public and private sectors share similar perceptions and experiences. The echoes of the questions resonate harmoniously across both realms, unifying their voices amidst the educational symphony. As we conclude this chapter of our analysis, we must acknowledge the nuances that lie beneath the surface. Our findings assume that the data provided is representative and that the underlying assumptions of ANOVA, such as normality and equal variances, are met. However, in the vast tapestry of reality, deviations may exist, urging us to embark on further explorations and consider alternative statistical tests. In the realm of education, the public and private sectors converge, their paths intertwined in a dance of knowledge. While our analysis reveals no significant differences between these sectors, it is merely a glimpse into a world teeming with complexity. We part ways with this understanding yet yearn to uncover more tales hidden within the folds of educational diversity.

9. Ensuring Quality Assurance in the E-Environment: Management Perspective

In today's rapidly advancing digital landscape, the concept of the E-Environment has emerged as a crucial aspect of modern organizations. The E-environment encompasses all the virtual spaces, platforms, and technologies that facilitate communication, collaboration, and business operations in the digital realm. As businesses increasingly rely on digital platforms and technologies to connect with customers, streamline processes, and drive growth, ensuring the quality of the E-Environment becomes paramount. From a management perspective, ensuring quality assurance in the E-Environment involves a comprehensive approach to monitor, assess, and optimize the digital ecosystem within an organization. It encompasses a range of considerations, including the reliability, performance, security, and user experience of digital platforms and applications. The dynamic nature of the E-Environment poses unique challenges for organizations. Technological advancements, evolving user expectations, and the constant threat of cyber-attacks demand an initiative-taking and vigilant approach to managing and maintaining a high-quality digital ecosystem. A robust quality assurance framework provides organizations with the ability to detect and rectify issues, minimize downtime, and deliver a seamless and secure digital experience to stakeholders. Moreover, ensuring quality assurance in the E-Environment goes beyond technical aspects alone. It involves aligning digital initiatives with organizational goals, fostering a culture of continuous improvement, and empowering employees to leverage digital tools effectively. Strategic planning, risk management, and collaboration across departments play a crucial role in cultivating a resilient and high-performing E-Environment. This heading explores the significance of ensuring quality assurance in the E-

Environment from a management perspective. It delves into the key considerations, challenges, and best practices for organizations to optimize their digital ecosystems, enhance productivity, and deliver exceptional digital experiences in an ever-evolving digital landscape.

9.1 Monitoring Faculty and Student Performance in Online Classes: A Procedural Approach

Monitoring faculty performance and student performance in online classes is crucial for ensuring effective teaching and learning outcomes. To achieve this, a comprehensive method combining various approaches can be implemented. The following methods are suggested for monitoring online classes:

a)   Student Evaluation Report: Regular student evaluation reports can be obtained to assess the faculty's performance. These reports can include feedback on teaching methods, clarity of instructions, responsiveness to student queries, and overall satisfaction with the course.

b)   Quizzes/Assignments Results: Monitoring student performance through quizzes and assignments can provide valuable insights into the effectiveness of the teaching and learning process. Analyzing the results can help identify areas where students may be struggling or where further improvement is needed.

c)   Feedback from Students/Class Representatives: Collecting feedback from students or class representatives can provide a holistic perspective on the faculty's performance. This feedback can include aspects such as the faculty's communication skills, ability to engage students, and the overall learning experience.

d)   Punctuality Record: Keeping track of faculty members' punctuality in conducting online classes is essential. Monitoring their adherence to the scheduled class timings helps ensure that students receive consistent and uninterrupted learning experiences.

e)   Classroom Interaction: Observing and assessing the level of classroom interaction between the faculty and students is vital. This can be done through random observations by the Head of the Department or dedicated personnel who can evaluate the faculty's ability to facilitate discussions, encourage participation, and address student queries effectively.

f)   Parents Feedback: Engaging with parents and obtaining feedback on their child's online learning experience can provide valuable insights into the faculty's performance. Parental feedback can highlight areas of improvement and help in addressing any concerns or challenges faced by students during online classes.

g)   Online Meetings with Parents: Conducting online meetings with parents can serve as a platform to discuss student progress, address any concerns, and gather feedback on the faculty's performance. These meetings can provide an opportunity to establish effective communication channels between the faculty and parents.

h)   Outcome-Based Education Record: Monitoring the achievement of desired learning outcomes can be done through the implementation of outcome-based education strategies. Tracking the progress of students in achieving the intended learning outcomes helps assess the effectiveness of the teaching methods employed by the faculty.

Based on a survey, it has been found that the most effective methods for monitoring faculty performance are random observations by the Head of the Department or resolute personnel. This method ensures unbiased evaluation and provides a comprehensive assessment of the faculty's teaching skills and classroom management. Similarly, monitoring student performance, quizzes, and assignments along with classroom interaction have proven to be the most effective methods. These methods allow for regular assessment of students' understanding and engagement in the learning process. By implementing a combination of these monitoring methods, educational institutions can ensure quality assurance in the e-environment, promote continuous improvement, and enhance the overall online learning experience for both faculty and students.

9.2. Measures to Observe Ethical Norms and Discipline of Students during Online Classes:

Maintaining ethical norms and discipline among students during online classes is essential for creating a conducive learning environment and promoting academic integrity. To ensure these aspects are upheld, educational institutions implement various measures and strategies. This article explores three key measures: the establishment of an Effective Discipline Committee, random monitoring by authorized

personnel during class, and regular checks of recorded lectures and classes.

a) Effective Discipline Committee: To address disciplinary issues in online classes, institutions often form an Effective Discipline Committee comprising faculty members, administrators, and student representatives. This committee sets guidelines and regulations regarding student behavior, code of conduct, and expectations during online classes. They also manage disciplinary cases, investigate complaints, and enforce appropriate penalties or corrective actions when necessary.

b) Random Monitoring by Authorized Personnel: Random monitoring of online classes by authorized personnel is an effective way to ensure students adhere to ethical norms and maintain discipline. These personnel may include heads of departments, deans, or resolute staff members. They observe live sessions or review recorded sessions to assess students' behavior, participation, and adherence to guidelines. Random monitoring helps detect and address any disruptive or unethical conduct promptly.

c) Checking of Recording of Lectures/Classes: Recording online lectures and classes has become a customary practice for remote learning. Institutions can use these recordings as a valuable tool for monitoring student behavior and ensuring ethical conduct. Faculty members or assigned staff periodically review the recorded sessions to identify any instances of misconduct, inappropriate behavior, or academic dishonesty. This allows for timely intervention and necessary disciplinary actions.

d) Code of Conduct and Ethical Guidelines: In addition to the measures, educational institutions establish and communicate a clear code of conduct and ethical guidelines specifically tailored for online classes. These guidelines highlight expected behavior, rules for engagement, and consequences for any violations. Students are expected to adhere to these guidelines to maintain a respectful and productive learning environment.

e) Educational Awareness Programs: Institutions may conduct educational awareness programs to educate students about the importance of ethical behavior and discipline in online classes. These programs can cover topics such as academic integrity, netiquette, respectful communication, and responsible use of technology. Promoting

awareness and understanding makes students more likely to uphold ethical standards during online classes.

f) Student Engagement and Support: Creating an engaging and supportive online learning environment can also contribute to maintaining ethical norms and discipline. Institutions encourage active student participation, foster a sense of belonging, and provide support mechanisms such as online counseling services. When students feel valued and supported, they are more likely to exhibit responsible behavior and adhere to ethical standards.

g) Collaboration with Parents and Guardians: Educational institutions recognize the importance of parental involvement in monitoring and reinforcing discipline during online classes. Regular communication with parents or guardians helps create a shared responsibility for students' conduct. Institutions may share guidelines, updates, and progress reports to keep parents informed and engaged in promoting ethical behavior.

h) Continuous Evaluation and Feedback: Regular evaluation and feedback processes are crucial for monitoring and improving discipline in online classes. Faculty members provide constructive feedback to students, addressing any behavioral or disciplinary issues promptly. Additionally, students are allowed to provide feedback on the learning experience, including their observations on the conduct of their peers.

i) Personal Responsibility and Accountability: Promoting personal responsibility and accountability among students is paramount. Institutions emphasize the importance of individual responsibility in upholding ethical norms and discipline during online classes. Students are encouraged to take ownership of their actions, respect their peers and instructors, and actively contribute to a positive and inclusive learning environment.

j) Transparent Communication Channels: Establishing transparent communication channels between faculty, students, and relevant stakeholders is essential. Institutions provide platforms where students can raise concerns, seek guidance, or anonymously report ethical violations. Open communication fosters trust, encourages ethical behavior, and facilitates the resolution of disciplinary issues.

The survey conducted to evaluate the effectiveness of measures to observe ethical norms and discipline during online classes revealed that the checking of recording of lectures and classes received the highest number of votes. Participants widely supported this measure as an essential tool for measuring and maintaining ethical standards. The respondents recognized the value of recorded sessions in monitoring student behavior, detecting instances of misconduct, and ensuring academic integrity. By reviewing these recordings, educational institutions can identify any violations of ethical norms, address disciplinary issues, and take appropriate actions. The overwhelming support for this measure highlights the importance of leveraging technology to uphold ethical standards in online learning environments and emphasizes the need for regular checks of recorded lectures and classes to measure and enforce ethical norms effectively. Ensuring ethical norms and discipline during online classes requires a multifaceted approach. By implementing measures such as an Effective Discipline Committee, random monitoring, and regular checks of recorded lectures and classes, educational institutions can promote a culture of integrity, respect, and responsible behavior among students. These measures, combined with clear guidelines, awareness programs, and supportive environments, contribute to the overall success of online learning experiences.

9.3 Analysis Report: Readiness of the Organization in Terms of Quality Assurance of Education

The purpose of this analysis is to assess the readiness of a particular organization in terms of quality assurance in education. The organization has adopted a set of Standard Operating Procedures (SOPs) to ensure the approval of courses for online teaching, create uniform SOPs for student assessments and evaluation, monitor self-assessment procedures, provide regular monitoring and counseling for faculty adaptability during the pandemic, offer counseling for students/class/academic representatives to address concerns related to the pandemic, implement a tutorial system to compensate for the face-to-face learning gap, establish digital libraries to facilitate distant learning and develop uniform SOPs for conducting labs in lab-based courses. To gather the necessary data, a survey was conducted among the organization's stakeholders. The survey included Likert data questions on a scale of 0 to 5, where 0 represents "Not applicable," 1 indicates a "low level," and 5 reflects the "highest level" of readiness in terms of quality assurance.

Figure 4 shows the results of the survey indicate the level of readiness for each aspect of quality assurance. The SOPs adopted by the organization for the approval of courses for online teaching received a rating of 4, indicating a high level of readiness in this area. This suggests that the organization has implemented well-defined procedures to ensure the quality and appropriateness of online courses. Similarly, the uniform SOPs created for student assessments and evaluation also received a rating of 4, indicating a strong emphasis on standardized assessment practices. This ensures fairness, consistency, and reliability in evaluating student performance across different courses and instructors. However, the monitoring of self-assessment procedures received a rating of 3, suggesting a moderate level of readiness. This indicates that while some measures are in place to encourage self-assessment among students, there is room for improvement in terms of ensuring its effective implementation and monitoring. The regular monitoring and counseling of faculty to acquire adaptability during the pandemic also received a rating of 3, indicating a moderate level of readiness. This implies that while efforts are being made to support faculty members in adapting to the challenges posed by the pandemic, additional support and guidance may be required to enhance their effectiveness in online teaching and learning environments. On the other hand, the students/class/academic representatives counseling to resolve concerns related to the pandemic received a rating of 4, indicating a high level of readiness in addressing the specific needs and concerns of students and academic representatives. This demonstrates the organization's commitment to providing comprehensive support and guidance to ensure the well-being and academic success of its stakeholders during these challenging times. The tutorial system for students to compensate for the face-to-face learning gap also received a rating of 4, suggesting that the organization has implemented effective measures to provide additional support and resources to students to bridge the gap created by

the absence of face-to-face interactions. However, the digital libraries to facilitate distant learning received a rating of 3, indicating a moderate level of readiness. This implies that while digital libraries are available to support distant learning, there may be opportunities to further enhance the accessibility, resources, and functionality of these platforms to better serve the diverse needs of

learners. Lastly, the uniform SOPs for conducting labs in lab-based courses received a rating of 2, indicating a relatively lower level of readiness. This suggests that there is a need for further development and implementation of SOPs specifically tailored to the unique requirements of lab-based courses to ensure effective and safe learning experiences for students.
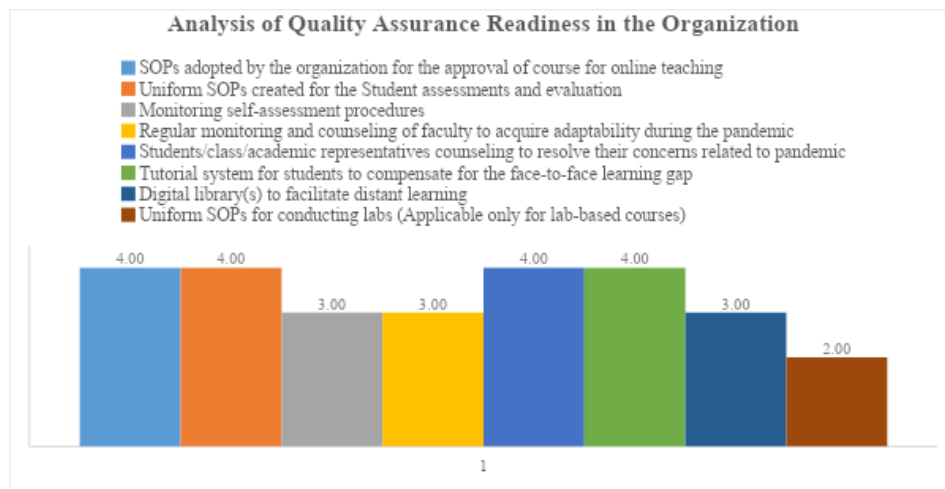
FIGURE 4: Analysis of Quality Assurance Readiness in the Organization

strong readiness in areas such as course approval SOPs, student assessments, counseling support, and tutorial systems, there are opportunities for improvement in areas such as self-assessment procedures, faculty monitoring and counseling, digital libraries, and lab-specific SOPs. These findings can guide the organization in refining its strategies and implementing targeted interventions to enhance the overall quality assurance of education in the online learning environment.

10   Conclusion:
10.1   Challenges of Distant Learning in Underdeveloped Countries
The challenges of implementing distant learning in underdeveloped countries can be broadly categorized into three fundamental areas:
a)   Technology access and digital skills: The digital divide is a major challenge to the implementation of distance learning in underdeveloped countries. Many students and families lack access to computers, the internet, or the digital skills necessary to participate in online

learning. This can create significant barriers to student engagement and academic achievement.
b)   Curriculum adaptation and pedagogical approaches: The traditional pedagogical approaches used in many underdeveloped countries are not always well-suited to distant learning. For example, lectures and group discussions can be difficult to replicate online. This can require significant changes to the curriculum and pedagogical approaches to make distance learning effective.
c)   Faculty training and support: The lack of faculty training and support is another major challenge to the implementation of distance learning in underdeveloped countries. Many faculty members are not familiar with online learning or do not have the skills necessary to deliver effective instruction online. This can lead to problems with course design, delivery, and assessment.
d)   Infrastructure Problem due to Natural Disasters (Challenge): In underdeveloped countries, the vulnerability to natural disasters such as earthquakes, floods, and hurricanes can disrupt the already fragile infrastructure, including internet

connectivity and power supply. These disruptions can severely impede the continuity of distant learning initiatives.

10.2   Remedies and Best Practices for Distant Learning in Underdeveloped Countries

The challenges of implementing distance learning in underdeveloped countries can be addressed by a combination of policy, technological, and pedagogical interventions. Some of the key remedies and best practices include:

a)   Addressing the digital divide: Governments and educational institutions can work to address the digital divide by providing subsidies for computers and internet access, offering digital literacy training, and developing online learning platforms that are accessible to all students.

b)   Adapting the curriculum and pedagogical approaches: Educational institutions can adapt the curriculum and pedagogical approaches to make them more suitable for distance learning. This may involve using more self-directed learning, online collaboration tools, and other strategies that can:

c)   Foster student engagement: Distant learning can be isolating for students, so it is important to find ways to foster engagement and interaction. This can be done through online discussion boards, group projects, and virtual field trips.

d)   Provide personalized learning: Distant learning allows students to learn at their own pace and in their way. This can be accomplished by providing students with a variety of learning materials and activities, as well as opportunities for feedback and guidance from the instructor.

e)   Ensure equitable access: Distant learning should be accessible to all students, regardless of their socioeconomic status or location. This can be done by providing financial assistance for computers and internet access, as well as by offering online courses in multiple languages.

f)   Infrastructure Resilience Planning: To mitigate the impact of natural disasters on distant learning, institutions should develop infrastructure resilience plans. These plans should include backup power sources, redundant internet connections, and disaster recovery protocols. By ensuring that the technological infrastructure can withstand natural disasters, educational institutions can minimize disruptions to distant learning initiatives.

Here are some specific examples of how educational institutions can adapt the curriculum and pedagogical approaches for distant learning:

g)   Use more self-directed learning: This can be done by providing students with pre-recorded lectures, online tutorials, and other resources that they can access at their own pace.

h)   Use online collaboration tools: This can help students connect with the instructor, even when they are not physically in the same place.

i)   Create interactive learning experiences: This can be done using gamification, simulations, and other activities that engage students and help them retain information.

j)   Provide regular feedback: This is essential for ensuring that students are on track and making progress. Feedback can be provided through online quizzes, discussion boards, and individual consultations.

k)   Incorporating these remedies and best practices, including infrastructure resilience planning, into distant learning initiatives can make this mode of education more effective and inclusive, even in the face of natural disasters and other challenges faced by underdeveloped countries.

11   Conflict of Interest:

The authors declare that there is no conflict of interest associated with this research paper. This work was conducted in an unbiased and impartial manner, without any financial, personal, or professional interests that could potentially influence the research outcomes or its interpretation.

In the interest of full transparency, it is important to note that no external organizations or entities have played a role in influencing the research design, data collection, analysis, or decision to publish the findings.

The authors affirm their commitment to upholding the highest ethical standards in research and scholarship and have adhered to the guidelines set forth by the Journal of Education Engineering regarding conflicts of interest. If any potential conflicts arise in the future, they will be disclosed promptly.

12   Acknowledgement:

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