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Exploring Barriers and Opportunities in Rural ICT-Based Education Amidst the COVID-19 Pandemic: A Comprehensive Study on the Challenges Faced in Remote Learning Environments

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Abstract: - In light of the significant disruptions caused by the COVID-19 epidemic, this comprehensive study analyzes the state of rural education that relies on Information and Communication Technology (ICT). The research is dedicated to understanding the multifaceted dynamics of remote learning in rural areas. It extensively investigates the barriers and opportunities that arise during this transformative era. The research involves a detailed examination of the difficulties encountered by students in rural ICT-based education. This literature critically assesses obstacles such as inadequate infrastructure, lack of digital literacy, and a shortage of gadgets, which have worsened educational inequalities in remote regions. The study concurrently examines and scrutinizes prospective opportunities amidst these problems, intending to elucidate novel solutions and adaptive tactics. The study employs a Qualitative method to combine qualitative insights obtained from interviews conducted with rural students. Thematic analysis is a fundamental methodology that thoroughly comprehends the complex obstacles and possibilities in rural ICT-based education during the epidemic. The research findings add to the current information about the effects of COVID-19 on education and offer practical insights for policymakers, educators, and technology suppliers. This study aims to provide information on evidence-based interventions that promote resilience and innovation in rural ICT-based education. The goal is to create a more equitable and effective learning environment for all stakeholders.

Keywords*: COVID-19, online learning, Rural ICT based Education, Remote learning*

1. Introduction

The COVID-19 pandemic greatly impacted every aspect of society. The World Health Organization recognized the outbreak of the Novel Corona Virus Disease (COVID-19) as a pandemic on March 11, 2020, causing widespread anxiety and fear worldwide [1]. Throughout the world, people are dealing with emotional, physical, and financial issues. Particularly impacted are the most vulnerable segments of the population, such as those with low paychecks, daily wage labourers, the elderly, those suffering from various illnesses, young people, etc. The likelihood of developing coronary artery disease, diabetes, hypertension, kidney failure, and other conditions is higher in older adults because these conditions typically affect them. Medical suggestions on the transmission and optimistic statistical projections of COVID-19 could have favoured the lockdown [2]. The nationwide lockdown began on March 24, 2020, and persisted with varying degrees of limitations until the conclusion of May 2020, causing substantial disruption across all sectors of the economy. [3] The Indian government implemented a nationwide lockdown to mitigate the impact and transmission of the virus. [2] In the wake of this emergency,

educational institutes around the globe have shifted their operations to online learning. [1] Learning is quite hard for some people as schools are obligated to implement distance education or online learning because of the changes occurring in learning systems. This involves e-learning, distance education, correspondence education, external studies, flexible learning, and massive open online courses [4]. The problem is that the longer these institutions are closed, the more potential there is to be a loss of educational prospects. Also, it leads to a latent loss of human capital and enfeebled economic opportunities in the long run. [5] People's emotional suffering is the primary issue that this pandemic has shown. Since many people are alone because of the lockdown, psychosocial problems are emerging in them. Women and younger age groups were primarily impacted. In these people, anxiety, depression, and post-traumatic disorders are evident. Another survey highlighted the students' apprehension about losing a year. The anxiety of academic year loss is the primary concern that intensifies students' psychological anguish. [6] Individuals with corona are susceptible to developing mental disorders. Stress and anxiety are also elicited by circumstances that have resulted in complete disruptions of daily routines. [7] During the COVID-19 pandemic, the education sector encountered notable obstacles as well. Because the virus is increasingly threatening the world, schools are closed, which causes learning difficulties for students. Thus, ICT-enabled education has spread throughout various nations. India has been leading in the development of information and communication technologies (ICTs) among other emerging countries. The development in the sphere of education is particularly outstanding. Undoubtedly, the future's development will be primarily dependent on ICTs. Considering the potential advantages of ICTs, they have not been fully utilized in rural regions. The rural people, particularly the most impoverished individuals, still lack access to basic ICT capabilities. [8]

2. Review of Literature

Amidst the global dissemination of the COVID-19 pandemic, the imposition of lockdown measures ensued. This development prompted the closure of educational institutions, precipitating a formidable challenge within the educational landscape. [9] Faculty members' perceptions and perspectives towards utilizing technology and expertise vary among stakeholders [10]. These circumstances adversely affected diverse stakeholders within the educational sphere, encompassing educators, students, non-teaching personnel, and parents. The emergent electronic teaching and learning trend presents new opportunities and grave implications. [11] Consequently, the educational paradigm underwent a transformative shift towards online platforms, with the primary objective of salvaging the academic calendar. However, this transition to virtual learning underscored the profound impact on socioeconomically disadvantaged segments, particularly children from impoverished backgrounds and their respective guardians. A substantial portion of this demographic lacked the requisite technological resources, such as internet connectivity, smartphones, or laptops, impeding their ability to partake in online educational activities [3]. The main impediment to online learning lies in the accessibility of ICT resources, as the success of online learning depends substantially on the presence of ICT facilities [12]. The inadequacies in infrastructure were notably conspicuous among rural students in Kerala, where numerous individuals confronted challenges in accessing virtual learning due to the absence of essential facilities. Although India has already made a giant leap in the digital revolution, there is still a long way to connect the unconnected [13] Furthermore, connectivity issues emerged as a pervasive concern, particularly in rural regions across the country. In addition to the technological constraints, the unfamiliarity among students and educators with online pedagogical platforms exacerbated the difficulties encountered during the initial stages of this transition. This scenario involved assessing the ability of the organization to adapt quickly and effectively, with the primary focus being on transferring content to an online platform rather than on online teaching methods [14]. This transition to online modalities was particularly detrimental to students, necessitating specialized attention, as the shift deprived them of crucial face-to-face interactions. Furthermore, the absence of adequate training for educators regarding online instructional methodologies exacerbated the initial impediments encountered during the early phases of virtual education. The discernible decline in student engagement with online learning and restricted access to internet facilities manifested in an escalating number of dropouts. Teachers experience challenges transitioning from conventional classroom instruction to an online learning system, especially when integrating new and untested learning experiences. These activities and responsibilities are not easily transferable between the two systems. [15] Consequently, the multifaceted ramifications of the lockdown on the education sector have necessitated concerted

efforts to address these intricate challenges and facilitate a more resilient educational landscape. ICT-enabled education has significantly enhanced the learning experience for students, garnering widespread adoption by numerous countries. [16] Collaborative endeavors between governments and educational institutions have yielded a plethora of ICT-based teaching methods. However, numerous challenges persist despite the widespread adoption of ICT-based education, particularly in rural areas. Many students unfamiliar with online classrooms encounter difficulties due to a lack of proper infrastructure stemming from economic constraints. At the outset of online classes, many students lacked access to essential tools such as TVs, laptops, and smartphones. Additionally, inadequate network facilities leading to connectivity in rural areas further exacerbate the challenges students face in engaging with online education. The issue of rural connectivity has been extensively studied for many years. Approximately half of India's population lacks enough connectivity to utilize digital services. Several technical solutions are undergoing testing globally, including in India. To effectively reduce the digital divide, it is crucial to decrease the expenses associated with network installations and enhance the pace at which people accept digital services by exploring various technological and economic alternatives. [13] Consistent connectivity is not always guaranteed, often impeded by electricity disruptions, thereby hindering students' access to televised classes. A prevailing sentiment among students is the preference for traditional school-based instruction over online courses. Differentiating between face-to-face learning in the classroom and online education can be complicated, as they are both considered heterogeneous [17] The interpersonal dynamics of face-to-face interactions with teachers and the immediate resolution of queries during class are perceived as more effective than their online counterparts. The inherent technical challenges students face navigating online platforms further compound the difficulties in their learning processes. Notably, a pronounced disparity in accessibility exists between rural and urban students, with the former encountering impediments such as prolonged phone usage and the arduous task of recharging mobile devices, particularly for families reliant on daily wage labourers, compounded by lockdown-induced financial constraints. The pandemic has shifted the conventional teaching method utilizing boards and chalk into a digital technology-based approach [18] The suspension of exams during the pandemic has engendered a perception among some students that academic pursuits can be approached casually. A palpable increase in mental stress and apprehension is prevalent among students, stemming from uncertainties about the conduct of future exams and the adequacy of their preparation. Subjects like mathematics pose unique challenges in the online format, with students expressing difficulties comprehending complex concepts without the interactive, two-way communication facilitated by traditional classroom settings. This paper contributes to the expanding body of knowledge on COVID-19 literature [19] where the present investigation pursued three overarching objectives: firstly, to ascertain the ramifications of the COVID-19 pandemic on the educational processes of students residing in rural areas; secondly, to delineate the extent of support rendered by government or institutional entities through Information and Communication Technology (ICT) to these rural students in the wake of the pandemic; and thirdly, to elucidate the coping strategies employed by students within the rural context amidst the challenges posed by the pandemic. Nevertheless, the growth is not evenly disseminated over all rural communities; ignored and lacks even basic infrastructure facilities. Fortunately, governments are developing ICT infrastructure in remote schools. So, education and motivation of rural students about usages and benefits of ICT program is an important aspect. [8].

3.Methodology

The researcher adopted a qualitative methodology, utilizing interviews as the primary mode of data collection with students studying in schools in rural areas. A semi-structured interview schedule was developed to comprehensively investigate the impact of COVID-19 on students residing in rural areas and assess the level of institutional assistance offered through Information and Communication Technology (ICT) in education. The intentional inclusion of open-ended questions in the interview questionnaire was deliberate to obtain comprehensive and detailed replies related to significant topics, such as the effects of the pandemic, the implementation of adaptation strategies, the exhibited behaviours, and the understanding gained from the situation open-ended questions underwent to thematic analysis, following the thematic analysis process model which is shown on Figure 1. Thematic analysis is a method for identifying, analyzing, describing, organizing, and reporting themes found in a data set in qualitative research. [20]

Figure 1 Thematic analysis research flow

4. Research Questions

- To identify the impact of covid 19 on the learning process of the rural students
- To determine the ICT enabled government or institutional support received by the rural students during the pandemic.
- To identify the strategies adopted by the students during the pandemic.

5. Participants

This study concentrates on three essential characteristics and presents introductory enquiries about the research fields. This manuscript centres on the Information and Communication Technology (ICT)-mediated education of rural students amid the COVID-19 pandemic, elucidating the challenges and impediments encountered. The investigation also delves into the assistance provided by governmental and educational entities to rural students engaged in online classes. Through interviews conducted with students aged between 16 and 18, insights into their experiences with online classes were garnered. The analysis examines the ensuing impacts, strategies employed in navigating the circumstances, and the broader lessons derived from their collective experiences during the pandemic. The sample distribution of the samples is depicted in Figure 3.

Participants	Boys between the age of 16 to 18	-	7 Respondents
	Girls Between the age of 16 to 18	-	18 Respondents
	Total		25 Respondents

Figure 3: Data Distribution

6. Impact of Covid 19

The onset of the COVID-19 pandemic prompted a transition from conventional offline learning to digital platforms for students due to the closure of educational institutions. Through our analyses, we have discerned the implications of this shift on students in rural areas. A predominant observation is a decline in academic motivation among a significant majority of students. This decline is attributed to a year-long confinement within their homes, where they have relied on mobile phones, televisions, and laptops for accessing educational content. The diminishing motivation is closely tied to the absence of the familiar school environment and the physical classroom setting inherent in traditional education. Additionally, students who are exclusively dependent on televised lessons face challenges establishing meaningful two-way communication, as the medium hinders real-time teacher interaction during class sessions. A noteworthy proportion of students exhibit a palpable lack of enthusiasm for online education, expressing a preference for the conventional in-person learning format. Consequently, this inclination has resulted in a depreciation of the perceived significance of online classes, coupled with a concomitant rise in absenteeism from these virtual sessions.

> *"I feel like Classes became less effective due to lack of concentration in class and I don't spend much time in classes".* [ID_21]

This student lacks interest in attending online lessons, leading to minimal time spent watching them. Even while he can manage, his lack of concentration hinders his ability to study online effectively.

> *"There is no interaction with the teachers, and I feel less comfortable asking doubts to the teacher via online class"* [ID_ 22]

The student is expressing that one of the repercussions of online education is eliminating visual interaction between teachers and students. A major obstacle most pupils encounter during online lessons is the opportunity to obtain instant explanations or ask their teachers questions. On the contrary, if they were attending physical sessions at school, they would be able to ask questions in real time.

> *"There are networks issues occurred during classes, so that made a problem for the learning process"* [ID_ 23]

Network connectivity problems are a significant concern that frequently arises in online classrooms, particularly in remote regions. When students encounter various challenges, it disrupts their learning process and causes a loss of continuity in their classes Support offered by the government\Institution through the Rural ICT

Since the commencement of online classrooms, the government has implemented numerous steps to ensure children's access to their online education. They offer classes via several platforms, such as Victor's channel, Google Meet, Zoom, etc. Teachers have additionally aided pupils by furnishing study materials, giving the YouTube channel URL, and offering supplementary sessions for students struggling in specific areas. Educational institutions frequently advise teachers to create a WhatsApp group for students, facilitating the resolution of doubts and enabling professors to share additional study resources.

> *"The government has always supported the students and provided them with phones, TV, and laptops for online classes. I also know teachers who take extra classes for students who are weak in their studies. But the government should look into it properly, like if the needed students are getting the service".* [ID_ 20]

Students indicate high satisfaction with the assistance and services provided by educational institutions and the government. Additionally, they prefer receiving additional lessons through channels other than Victors. They propose that the government investigate rural students' challenges in obtaining online programs.

7. Lessons learned.

Students have made diligent efforts to acclimate themselves to the prevailing circumstances they are encountering. A multitude of students have acquired the fortitude and self-assurance to confront challenges that arise in their path. Upon receiving additional knowledge about the technology, they proposed the implementation of both online and offline classes in the future. This would ensure that future students do not have any difficulties during an unforeseen pandemic.

> *"I have learned more applications in phones and got more knowledge about different online platforms"* [ID 02]

During the lockdown period, the student endeavours to get further knowledge about various technology or gadgets. They are making a concerted effort to adapt to the situation to secure a promising future.

> *"Before online classes, we didn't have to make much effort to get knowledge because teachers will teach us everything, but now the situation has changed now we want to collect different knowledge from different sources, we want to prepare everything" [ID 06]*

Students now view it as an opportunity to independently utilize their efforts and abilities to study. Previously, professors were always available to assist them, but today, they choose to seek out resources independently. Encouraging kids to become independent is an effective method for them to acquire knowledge autonomously.

8. Limitations

Like any research endeavour, the present study is not exempt from limitations. It exclusively concentrates on three dimensions: the impacts of COVID-19, the responses and support provided by the government and institutions, and the lessons learned. The incorporation of additional perspectives could have potentially broadened the study's scope. Furthermore, the study exclusively seeks to comprehend the viewpoints of all category students, thereby presenting a one-sided perspective. The comprehensive scope and purpose of the study could have been more fully realized by including the perspectives of teachers.

9. Conclusion

The findings of this study underscore that students in rural areas are adeptly navigating their circumstances through online classes; however, it is evident that their preference lies in the traditional school environment for optimal learning. This study probes into the realm of Information and Communication Technology (ICT)--based education for rural students and explores strategies employed to overcome challenges. It is imperative to address the infrastructural deficiencies faced by certain students, and conducting surveys to identify those in need is a crucial step. While the government has initiated measures, such as providing laptops and smartphones to many children in rural areas, there remains a subset of students without such assistance, warranting further investigation by teachers and community leaders. Multiple challenges limit the efficient deployment and exploitation of Information and Communication Technology (ICT), the lack of reliable internet connectivity and power supply poses a substantial challenge in rural locations. The absence of fundamental facilities hinders the smooth integration of ICT tools.

Rural communities face significant challenges in effectively utilizing ICT attributable to their lower levels of digital literacy. Developing awareness and providing guidance on digital technology is essential in narrowing this gap. An essential intervention in the forthcoming academic years involves imparting digital skills training in schools, thereby eliminating barriers to participation in online classes. Facilitating proper online skill training ensures students' familiarity with digital platforms. Teachers can enhance their connection with students through personalized calls, offering motivations to foster increased engagement in online classes. Incorporating elements such as games, quizzes, and presentations is recommended to make classes more engaging. Regular attendance checks by teachers, coupled with addressing technical issues hindering student participation, are integral to sustaining the efficacy of online learning.

Collaboration with data companies to secure cost-effective add-on packages for school children is a viable proposition, and online exams can be instrumental in boosting students' confidence and curbing lethargy. Institutions should diversify their online platforms beyond television, incorporating options like Google Meet, Zoom, Skype, etc. The government's provision of textbooks and weekly parent meetings to track children's learning progress are indispensable components. Offering motivation classes to equip students with coping strategies for stress and tension is beneficial. Tailoring individualized care for students in need and providing extra classes for challenging subjects contribute to a comprehensive and supportive educational framework. The government should acknowledge that the technical support and maintenance services shortage in rural areas significantly contributes to difficulties sustaining working ICT infrastructure. Developing the ability to identify and resolve difficulties at a local level is essential. To tackle these challenges, policymakers, educational institutions, and technology providers must collaborate and work together. This endeavour includes not only the development of necessary architectural structures but also customized initiatives to enhance digital skills, active engagement of the community, and the implementation of cost-effective, culturally relevant digital breakthroughs that enable rural India to engage in the digital age actively.

10.Policy recommendations

Government should allocate funding for enhancing and maintaining robust information and communication technology infrastructure in rural educational institutions, ensuring dependable connectivity and availability of digital equipment.

Incorporate digital literacy skills into the regular curriculum to give students essential skills for the digital era.

The education department ought to implement a comprehensive tracking and assessment structure to evaluate the influence of ICT efforts on educational results. Periodically assess and modify policies in accordance with evaluation outcomes.

11. Suggestions for future research

Researchers ought to develop a study in the future that tackles explicitly the flaws mentioned in the previous study. Furthermore, it is suggested to do the research utilizing quantitative research methods to understand the student perspectives comprehensively.

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