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Analysing Current Digital Poverty Challenges: Student Perspectives on Technological Device and Internet Access Issues in Kedah Rural Schools

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ABSTRACT

In the aftermath of the COVID-19 pandemic, digital poverty has emerged as a critical concern, intensifying the pre-existing disparities in access to information and communication technology (ICT). This article addresses the widening digital divide, particularly affecting economically vulnerable individuals and communities. Post-pandemic, online learning remains a pivotal option, yet economically disadvantaged families may lack the necessary devices and internet connectivity, leading to a stark inequality in learning opportunities. The study focuses on two key aspects: the extent of gadget/device ownership and internet access among informants during online learning. These questions serve as a foundational exploration into the current landscape of digital poverty. Conducted in the context of Malaysia's remote learning (*Pembelajaran Dalam Talian* or PdPR) enforced during the Movement Control Order (*Perintah Kawalan Pergerakan* or PKP), the research findings expose significant challenges in facilitating online education. This article endeavours to elucidate these obstacles, offering insights to shape strategies that respond to the evolving demands of technology in a digital Malaysia.

1. Introduction

In today's evolving education landscape, digital technology has become essential to ensure equal learning opportunities [1]. However, this shift has highlighted the issue of digital poverty, where access to devices and internet connectivity remains unequal. Although the Internet Users Survey 2022 reported an increase in internet usage to 92.7%, a 4.0% rise compared to 2020, more than half of users in rural areas faced challenges such as poor coverage, slow speeds, unreliable connections and low overall quality [2]. This article drew insights from the experiences of the 2020 pandemic, a period when many activities shifted to online platforms.

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This study explores the issue of digital poverty by focusing on students in rural schools in Kedah. As technology transforms education, it is crucial to understand the challenges these students face with limited access to devices and internet connectivity [3].

This study highlights that digital access is not just about education; it is also a socio-economic necessity. Digital poverty affects more than just online learning—it also limits job opportunities and social connections [4]. Additionally, economic challenges are closely tied to digital poverty and living in rural areas further reduces the chances of being digitally connected [5].

The digital divide worsens existing inequalities, leaving some people behind in economic, social and educational areas [6]. With information and communication technology (ICT) becoming a key part of everyday life, closing this gap is not just an academic goal but a vital step toward a more inclusive and fair society [7]. This study focuses on the experiences of students in rural schools to offer insights that can guide specific actions, policy changes and efforts toward a more digitally connected future.

This study aims to examine the current state of digital poverty among students in rural schools in Kedah, Malaysia. It focuses on two key research questions. The first question looks at the level of gadget or device ownership among students during online learning, highlighting the broader issue of access to technology and digital skills. The second question investigates internet access during online learning, emphasizing how the lack of affordable and reliable connectivity affects students' education, especially during the remote learning period enforced by the COVID-19 Movement Control Order (PKP) [8,9].

The main objective of this article is to analyse the current situation of digital poverty among students in rural schools, specifically in the state of Kedah. By examining the perspectives of these students, the study aims to provide valuable insights for targeted actions, policy changes and initiatives to reduce digital inequality. Focusing on the unique experiences of students in rural Kedah, it seeks to support efforts towards a more inclusive education system. The study highlights the challenges these students face in accessing digital resources and bridging the digital divide, ultimately contributing to a fairer and more connected future.

2. Literature Review

The evolving nexus between digital technology and socio-economic disparities has become a focal point in contemporary scholarly discourse. As global societies undergo a transformative shift into increasingly digitized landscapes, the repercussions of these changes on poverty and inequality have come to the forefront of academic investigation.

Mitigating digital inequalities is crucial for fostering a fair and inclusive society, particularly as routine activities progressively shift to electronic platforms. Vassilakopoulou *et al.,* [7] underscore the essential role of digital resources in sustainable value creation, emphasizing the urgent need to bridge digital divides for the advancement of sustainable digitalized societies. The study's outcomes seek to not only steer future research but also offer researchers a foundational reference point to contextualize their work in this pivotal domain.

The significance of technology in education is underscored by Sun *et al.,* [4], who explore the intricate relationships between technology use, students' academic performance and socio-economic status. The study suggests that, despite technology being a prevalent trend in American education systems, its effectiveness as an accelerator for teaching and learning efficiency relies on appropriate leverage. Emphasizing the impact of socio-economic status and social capital, the research highlights their influence on students' access to institutional resources and opportunities to use technology, with superior social capital correlating with improved educational outcomes. While

the impact of technology on academic performance across subjects remains inconclusive, a positive link is identified, particularly in mathematics and science. The article concludes that although technology is not a universal solution, it has the potential to enhance learning outcomes through targeted plans and effective assessment systems.

Shahren *et al.,* [8] tackles the pressing issue of digital poverty during the COVID-19 pandemic in Malaysia, spotlighting the challenges faced by students with limited resources for online learning. Drawing from available literature, the study underscores constraints such as limited internet access, financial barriers and technological hurdles. The findings stress the imperative of accessible technology and financial support to surmount these challenges, emphasizing the indispensable role of inclusivity in shaping effective digital education.

Holmes *et al.,* [10] contribute to this discourse by exploring the intersection of digital exclusion and poverty in the UK. Employing qualitative methods, their study delves into the structural inequalities that shape the online experiences of low-income individuals. By interviewing coaches and participants, the research unveils the intricate relationship between poverty, housing conditions and digital exclusion. The findings highlight the importance of considering offline factors that influence online opportunities, advocating for a holistic understanding of the dynamics between poverty and digital access.

Asongu *et al.,* [11] study spans 57 developing countries, focusing on the linkages between ICT dynamics, inequality and poverty to promote gender-inclusive education. Utilizing Generalized Method of Moments estimators, the research establishes critical thresholds for positive ICT impacts on poverty and inequality. The findings emphasize the significance of policy interventions that address income inequality to advance gender-inclusive education, pointing towards the transformative potential of targeted strategies.

Xu [12] examines the impact of digital finance and social security expenditures on rural-urban household income poverty. Through a meticulous analysis of area- and household-level data, the study suggests that digital finance could serve as a catalyst in reducing urban-rural income poverty gaps, with social security expenditures reinforcing this effect. This research adds a nuanced layer to the understanding of how digital financial mechanisms can play a role in mitigating poverty disparities.

Lechman *et al.,* [13] broaden the scope by contributing insights into the relationship between ICT deployment and poverty alleviation in developing countries. Utilizing macro data from 40 developing nations spanning 1990 to 2019, their study underscores the positive impact of growing ICT deployment, increased school enrolments and augmented material wealth on poverty reduction. This research emphasizes the multifaceted nature of poverty reduction through the lens of digital technology.

Dzator *et al.,* [14] investigation scrutinizes the effect of ICT on poverty reduction in sub-Saharan African countries, applying a dynamic system-generalized method of moment estimator to panel data from 44 countries covering the period 2010–2019. The findings reveal varying impacts of different ICT variables on poverty reduction, underscoring the need for comprehensive policies considering economic growth and income redistribution. This research adds granularity to our understanding of the nuanced relationship between different dimensions of ICT and poverty reduction in diverse regional contexts.

These scholarly works collectively contribute to a nuanced understanding of the intersection between digital technology and socio-economic disparities. They unravel the intricacies of how digital access or lack thereof, influences poverty and inequality across various global contexts, offering valuable insights for policymakers, researchers and practitioners alike. The synthesis of these studies

paints a rich tapestry of the complexities involved in harnessing digital technologies for inclusive socio-economic development.

3. Research Method and Instrument

This research focuses on students in the Sik district of Kedah. As shown in Table 1, Sik is the largest district in the state [15].

Table 1
List of districts in Kedah and their area (km^2)

District	Area (km^2)
1) Kota Setar	420
2) Kuala Muda	913
3) Kubang Pasu	946
4) Langkawi	526
5) Kulim	774
6) Baling	1,529
7) Padang Terap	1,359
8) Pendang	629
9) Sik	1,635
10) Yan	246
11) Bandar Baharu	271
12) Pokok Sena	244

It represents a rural area that faces significant challenges with connectivity. Figure 1 shows the location of Sik within Kedah.

In the pursuit of gaining a comprehensive understanding of the experiences of the individuals involved, namely the students, a qualitative research approach has been adopted. This approach enables an in-depth exploration of the lived experiences of the informants, allowing for a more profound insight into their perspectives.

Given the intricate nature of the subject matter, particularly the challenges related to gadget or device ownership and internet access during online learning, face-to-face interviews have been selected as the primary method for data collection. This methodological choice is intentional, aiming to facilitate a nuanced examination of the multifaceted aspects associated with these challenges. By directly engaging with informants, this study aims to grasp the subtle details and complexities that define the qualitative aspects of students' experiences in the Sik district.

Fig. 1. Kedah district map

The research methodology strategically utilized purposive sampling techniques, a deliberate choice aimed at selecting informants who could provide rich and varied insights into the digital poverty phenomenon in the specific rural context of Sik. To identify these informants, collaboration with the Kedah State Education Department (JPNK) was pivotal. JPNK's role in selecting rural schools in Kedah further ensured a targeted and contextually relevant participant pool. The school management then played a crucial role in identifying students as informants, ensuring a diverse representation that encapsulates the various facets of digital poverty experienced in rural settings.

Semi - structured face-to-face interviews formed the core of the data collection process, offering a dynamic platform for in-depth conversations with the informants. Thematic analysis, a robust qualitative analytical approach, was employed to distil patterns and themes from the collected data. The data were systematically organized into themes aligned with the sub-questions formulated for analysis. This method allowed for a comprehensive exploration of the nuances surrounding gadget or device ownership and internet access, providing a rich tapestry of qualitative insights.

The interview protocol (Figure 2) serves as a crucial instrument in this study, acting as a structured guide that outlines the questions and topics to be addressed during the interviews with the informants [16]. This instrument is meticulously designed to extract comprehensive and detailed

information regarding digital poverty among students in the B40 community, focusing on two primary research questions: the extent of gadget or device ownership and the scope of internet access during online learning.

The protocol begins with an introduction that not only sets the stage for the interview but also establishes a connection with the informant. Expressing gratitude and explaining the research's purpose help create a comfortable atmosphere, promoting openness and honest responses. The emphasis on confidentiality and the request for consent to record the interview demonstrate ethical considerations in the research process.

The heart of the instrument lies in the structured research questions. These questions are strategically categorized into factors related to knowledge, physical conditions and social and economic aspects. Each category is designed to explore specific dimensions of the digital poverty phenomenon, allowing the researcher to gather rich qualitative data. Questions span from the informant's experiences during online learning and their knowledge about digital tools to the physical environment of their learning space and the socio-economic factors influencing their access to technology.

The closing section of the interview protocol is thoughtful and considerate. It not only provides an opportunity for informants to share additional insights but also seeks their willingness to be contacted for further discussions or transcript reviews, demonstrating a commitment to ethical research practices.

In essence, the interview protocol is a meticulously crafted tool that guides the interviewer through a systematic exploration of various facets of digital poverty among students. Its structure ensures consistency across interviews, facilitating a comparative analysis of responses and its thoughtful design encourages a meaningful and open dialogue with the informants, ultimately contributing to a nuanced understanding of the challenges they face in the digital learning landscape.

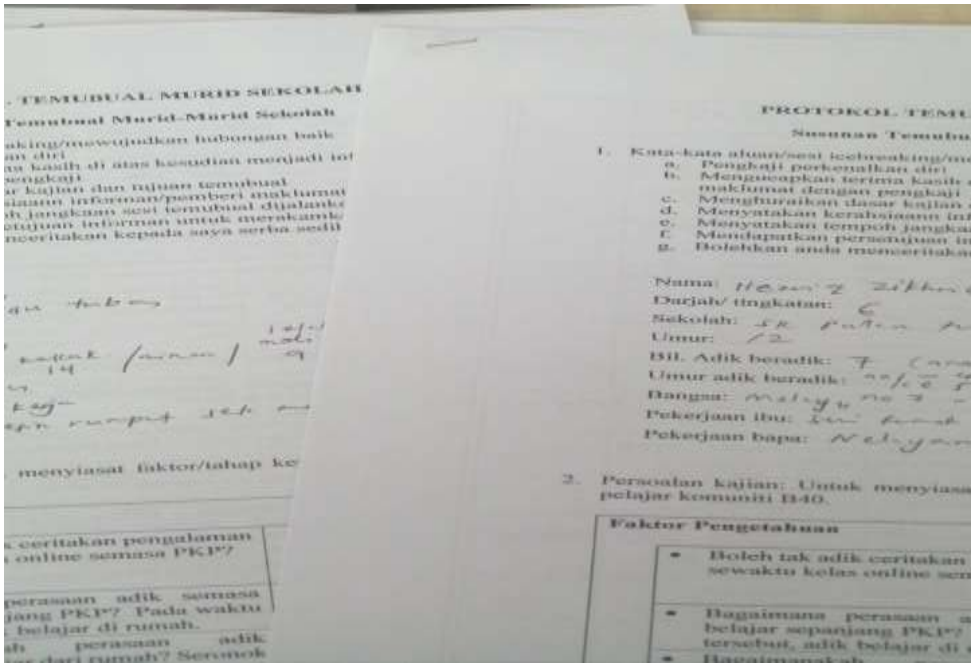

Fig. 2. Snapshot of the interview protocol

Upholding the principles of ethical research, the study prioritized transparency and respect for the rights of the informants. Before initiating interviews, the researcher diligently communicated the purpose of the study, ensuring that the informants were well-informed about the objectives and

potential impact of their participation. In obtaining informed consent, the researcher emphasized the confidential nature of the information shared and assured the informants that their data would be used exclusively for research purposes. This commitment to ethical standards lays the foundation for a trustworthy and responsible research endeavour.

The method employed in this study provide a profound understanding of the human experience within the digital poverty landscape. By delving into the narratives of the informants, the study seeks to elevate the discourse surrounding digital poverty, offering a platform for authentic voices to shape the narrative and contribute meaningfully to the ongoing dialogue on equitable access to technology and education in rural contexts.

4. Findings of the Study

The findings of this study are presented in two parts based on the two objectives of the study which come from the research question; "to what extent is the acceptance of PdPR among students". Input through interview questions is inserted in the related questions section. To begin with, the findings of this study will begin with a little demographic of the informants who were asked at the beginning of the interview session.

4.1 Informant Profile

The respondent profile provides a poignant snapshot of the students involved in this study, hailing from a diverse range of backgrounds in the rural school of Sik district, Kedah. The demographic details, including gender, age, race and family dynamics, present a mosaic of experiences that underlines the multifaceted nature of digital poverty in this context.

The gender distribution is relatively balanced, with an equal number of male and female respondents, showcasing an inclusive representation. The age range spans from 8 to 17 years, reflecting the variety of educational stages within the rural school. The racial diversity, comprising Malay, Thai and Chinese backgrounds, mirrors the multicultural fabric of Malaysia.

Family dynamics is an important information in socioeconomic context of the students. The number of siblings, ranging from 2 to 8, suggests varying family sizes. Occupations of parents offer insights into the economic landscape, with occupations such as rubber tapper, fishermen and fruit vendor highlighting the prevalence of traditional livelihoods. Some respondents have parents without formal employment, underscoring potential economic challenges.

Notably, a few respondents have parents with no specified occupation, indicating potential vulnerabilities in terms of economic stability. Moreover, the diverse range of occupations, including babysitters, cleaners and cake sellers, hints at the informal and diverse economic activities within the community.

The data also bring attention to the significant roles mothers play, predominantly identified as homemakers. This underscores the traditional gender roles prevalent in the community, potentially influencing the dynamics of access to technology and internet services. Fathers, engaged in occupations like rubber tapping, fishing and lorry driving, contribute to the primary sources of income. The summary of the informant information is shown in Table 2.

Table 2
Information of the informant

No.	Respondent Code	School	Gender	Age	Race	Num. of siblings	Father occupation	Mother Occupation
1.	SM1	KA	Male	11	Malay	3	Rubber tapper	Housewive
2.	SM2	KA	Female	10	Malay	4	Fishermen	Housewive
3.	SM3	KA	Male	8	Malay	4	-	Babysitter
4.	SM4	KA	Male	12	Malay	-	-	-
5.	SM5	KA	Female	10	Malay	5	Rubber tapper	Housewive
6.	SM6	KA	Female	12	Malay	4	-	Housewive
7.	SM7	CH	Female	12	Thai	3	Fruit vendor	Clerk
8.	SM8	CH	Female	11	Thai	2	No job	Restaurant servers
9.	SM9	CH	Male	12	Thai	3	Rubber tapper	Housewive
10.	SM10	CH	Male	12	Chinese	3	-	Cleaner
11.	SM11	CH	Male	11	Chinese	3	Handyman	-
12.	SM12	CH	Female	11	Thai	5	Lorry Driver	Housewive
13.	SM13	MJ	Female	16	Malay	8	-	Housewive
14.	SM14	MJ	Male	17	Malay	3	Rubber tapper	Security
15.	SM15	MJ	Female	13	Malay	7	Rubber tapper	Housewive
16.	SM16	MJ	Female	13	Malay	7	Rubber tapper	Housewive
17.	SM17	MJ	Male	17	Malay	4	Rubber tapper	Cake seller
18.	SM18	MJ	Male	16	Malay	4	Handyman	Housewive

This descriptive analysis provides a foundational understanding of the demographic and socioeconomic landscape of the informants. It sets the stage for a more nuanced exploration of how these factors intersect with digital poverty, shedding light on the unique challenges faced by students in rural schools. The richness of this respondent profile lays the groundwork for a comprehensive examination of the impact of digital poverty on various aspects of these students' lives, particularly in the context of online learning.

4.2 Research Question 1: To What Extent is the Ownership of Gadgets/Devices among Informants during Online Learning

To answer this research question, the researcher asked about the ownership of gadgets/technology devices among the informants. This is because gadgets/technology devices are the main tools for PdPR for online learning. The results show:

i. First, half of the informants (SM1, SM4, SM5, SM8, SM10, SM13, SM14, SM17 and SM18) do not have technology devices during online learning. This was clearly acknowledged by the informants in their joint interviews:

   "I don't have a computer."

ii. Second, the researchers also found that there were also among the informants (SM3, SM9, SM11 and SM18) who did not give a response about the devices used by them. This surprised the researchers a little.

iii. Third, what saddened the researchers was that during the interview session, the researchers found that there were also among these students who had never used a computer (SM 15, SM 16).

   "Never used a computer."

iv. Fourth, the researchers found that there were also among the informants who had computers before, but they were damaged.

"The computer was at home before, but now it's already damaged."

v. In the meantime, there are also some of them who just borrow their mother's computer. (SM7)

vi. Therefore, it can be observed that a lack of access to computer equipment is a common issue among informants and some of them rely on alternatives such as community centres or using computers owned by their families. Only several informants owned a computer;

"I have a laptop..." (SM2, SM6)

Overall, the results from informants' answers indicate that almost all of them (SM1, SM3, SM4, SM5, SM6, SM7, SM8, SM9, SM10, SM11, SM12, SM13, SM14, SM15, SM16, SM17 and SM18) use a phone as the primary tool for online learning or during Movement Control Orders (PKP). There is variation in how phones are used, such as using a small phone or borrowing their mother's phone. With the previously mentioned lack of access to computers or laptops, phones have become the primary choice for respondents to access online learning.

The findings of this study reveal a critical issue concerning the ownership and access to gadgets/devices among informants during online learning, shedding light on the challenges faced by a significant portion of the student population. The implications of these findings are far-reaching and have substantial implications for the effectiveness and inclusivity of online education, particularly during circumstances such as PKP where reliance on remote learning becomes crucial.

First and foremost, the stark revelation that half of the informants do not possess technology devices for online learning is alarming. This digital divide poses a serious threat to the equitable distribution of educational resources, potentially exacerbating existing disparities in academic achievement. As online learning increasingly becomes a standard mode of education, the lack of access to essential tools like computers or laptops puts these students at a significant disadvantage compared to their peers.

The study's identification of informants who have never used a computer or have faced issues like damaged computers underscores a broader concern regarding digital literacy. Beyond device ownership, the ability to effectively navigate and utilize technology is a prerequisite for successful online learning. The findings suggest that there is a subset of students who may lack not only access to devices but also the necessary skills to engage meaningfully in digital educational environments. This highlights the importance of incorporating digital literacy initiatives alongside efforts to bridge the technological gap.

Furthermore, the study brings attention to the reliance on alternative means, such as community centres or borrowing family members' devices. While these strategies demonstrate resilience and adaptability, they are not sustainable solutions and may compromise the quality of the learning experience. It is imperative for educational institutions and policymakers to address these challenges comprehensively, ensuring that every student has reliable and independent access to the technology required for online learning.

The prevalence of using phones as the primary tool for online learning among the informants raises concerns about the suitability and functionality of such devices for educational purposes. While phones offer a convenient option, they may not provide the necessary functionality for more complex

learning tasks. This limitation could hinder the development of essential skills and competencies, potentially impacting the overall educational outcomes of these students.

In conclusion, the study's findings underscore the urgent need for targeted interventions to bridge the digital divide among students. Policymakers, educators and stakeholders must collaborate to implement sustainable solutions that address issues of device ownership, digital literacy and the quality of access to online learning resources. Without concerted efforts to tackle these challenges, there is a risk of perpetuating inequality in educational outcomes, leaving a significant portion of students behind in the rapidly advancing digital landscape.

4.3 Research Question 2: To What Extent is Access to the Internet during Online Learning Taking Place?

In the exploration of the second research question regarding the extent of internet access during online learning, a nuanced picture emerges from the experiences of the informants (SM1, SM2, SM3, SM4, SM6, SM7, SM8, SM9, SM10, SM11, SM12, SM13, SM14, SM15, SM16, SM17 and SM18). The diversity in their approaches to securing internet connectivity reflects the complex landscape of digital access and the challenges faced by students engaging in online learning.

A predominant reliance on various networks and telecommunication service providers, including Maxis, Celcom, RedOne, Digi, Unifi and Yes, highlights the adaptability of informants in accessing the internet. However, the varied strategies employed underscore the resourcefulness of students, with some opting for home-based Wi-Fi, as exemplified by SM5 and SM9 explicitly stating their use of Wi-Fi during online learning sessions.

"Use Wi-Fi when studying online that day"

The study delves deeper into the quality of internet experiences, revealing a spectrum of connectivity challenges. SM6's observation of Celcom's inconsistent network quality

"If the Celcom, …. line is not very good here"

and SM7's description of fluctuating internet speeds highlight the variability in connectivity conditions.

"Sometimes slow, sometimes fast"

On the other hand, SM8's positive account of uninterrupted and fast internet showcases instances of more favourable connectivity.

"No barriers, fast internet"

The findings collectively emphasize the crucial role of internet access for successful online learning. However, the disparities in internet speed and quality underscore the need for stable and effective connectivity. The mention of students having to "top up" or resort to various sources indicates potential financial implications, emphasizing the hidden costs associated with maintaining internet connections for online education.

In essence, this research underscores the multifaceted nature of the internet access landscape among students. It not only emphasizes the imperative of ensuring stable connectivity for effective

online learning but also sheds light on the financial considerations that students and their families grapple with. Addressing these challenges is pivotal for creating an inclusive online learning environment that caters to the diverse connectivity needs of students, fostering equitable access in the digital realm. The findings pertaining to access to the internet during online learning illuminate a multifaceted challenge that significantly impacts the educational experiences of the informants. The study captures the diverse array of internet sources utilized by the respondents, underscoring the importance of stable and effective connectivity for successful online learning. However, the variations in internet speed and quality reported by the informants shed light on the complexity and potential disparities in their digital learning environments.

The revelation that the majority of informants rely on various networks or telecommunication service providers, such as Maxis, Celcom, RedOne, Digi, Unifi and Yes, reflects the pervasive nature of mobile and broadband networks in facilitating online education. The dependence on these services highlights the critical role played by private telecommunication companies in supporting the continuity of education. However, the study also surfaces challenges related to the consistency and reliability of these networks, as reported by informants like SM6 and SM7.

The experiences shared by the informants regarding internet speed and quality further emphasize the significance of a robust and consistent internet connection for effective online learning. The inconsistencies reported by some informants regarding the reliability of networks in their respective areas, as well as variations in speed (e.g., SM6's mention of Celcom's network inconsistency), underscore the need for infrastructure improvements and increased investment in ensuring equitable access to high-quality internet services for all students.

The study's documentation of diverse internet sources, including the use of Wi-Fi at home and data from parents' phones, highlights the resourcefulness of students in accessing online educational content. However, it also brings attention to potential challenges, such as shared data plans and the impact of the quality of these connections on the learning experience. This diversity in internet sources indicates that a one-size-fits-all approach may not be sufficient in addressing the connectivity needs of all students, emphasizing the importance of tailored solutions based on individual circumstances.

Furthermore, the study indirectly touches upon the financial implications of maintaining internet connectivity during online learning. The need for informants to top up or access various sources to ensure sufficient internet connectivity suggests potential economic barriers. This underscores the importance of addressing the financial aspects of online education, ensuring that all students have affordable and sustainable access to the internet, thereby mitigating the risk of educational inequalities arising from economic disparities.

In conclusion, the study's findings highlight the intricate interplay of technological, infrastructural and financial factors that influence access to the internet during online learning. Policymakers and educational institutions must acknowledge these nuances and work towards comprehensive solutions that ensure reliable, high-quality and affordable internet access for all students. Bridging the digital divide extends beyond device ownership to encompass the broader ecosystem of connectivity, where disparities can hinder the realization of inclusive and effective online education.

5. Conclusions and Future Research

In conclusion, this study has illuminated the glaring digital disparities among students, exposing a profound digital divide that jeopardizes the inclusivity and effectiveness of online learning. The stark revelation that a substantial number of informants lack access to essential technology devices highlights an urgent need for comprehensive interventions. Furthermore, the diverse experiences in

internet connectivity underscore the complexity of ensuring reliable access, with variations in speed and quality impacting the educational experience [17]. Policymakers, educators and stakeholders must recognize these challenges as a call to action, directing efforts toward bridging the digital divide to ensure that every student has equitable access to the tools and resources necessary for a successful educational journey [18].

Moving forward, future research should delve deeper into the long-term repercussions of the digital divide on students' academic achievements and socio-economic outcomes. The recognition that knowledge is a prerequisite for successful action [19] emphasizes its critical role in realizing desired outcomes. An imperative aspect of this exploration involves investigating the effectiveness of digital literacy programs in enhancing students' technological proficiency, given the growing importance of these skills [20,21]. Exploring community-based solutions and evaluating regional differences in the digital landscape can provide nuanced insights for tailored interventions [22]. Additionally, a critical evaluation of existing policies aimed at narrowing the digital divide is imperative, guiding the formulation of evidence-based strategies to address the evolving challenges in the realm of online education [23]. The trajectory of future research must align with a commitment to fostering an inclusive and technologically equitable educational environment for all.

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