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Caught in the Slow Lane: Effects of Unstable Internet Connectivity on Accessing Academic Resources and Collaborative Learning

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Abstract. This research examined the effects of unstable internet connectivity on accessing educational resources and collaborative learning among tertiary students. A qualitative methodology, specifically narrative analysis, was employed to capture students' experiences through in-depth interviews. Ten participants were interviewed using open-ended questions. The participants were chosen using a purposive sampling technique based on the predetermined criteria. The study highlighted that students experienced task submission delays due to internet connectivity's erratic nature. They also found accessing online resources to be time-consuming. Furthermore, it was clear that poor internet connection reduced students' enthusiasm and ability to participate, resulting in communication challenges and affecting the promptness of finishing group projects. When the internet connection was strong, students accessed resources more quickly, conducted research more efficiently, and submitted their academic tasks on time. Conversely, poor connectivity led to significant delays and increased stress, negatively impacting their academic performance. This paper demonstrated that the internet is crucial for a more progressive educational landscape, enabling learners to gain more knowledge and improve their skills. It encouraged collaborative efforts between the government and various educational institutions to enhance students' internet access experiences, ensuring they did not fall behind in the global academic landscape.

Keywords: Internet connectivity; Educational resources; College students; Higher education.

1.0 Introduction

In the 1960s, government researchers used the Internet to share information using large computers. In 1966, Robert Kahn introduced the concept of computer networks for communication, TCP/IP, which stands for Transmission Control Protocol and Internet Protocol. TCP/IP began in the late 1960s with the advent of the ARPANET (Advanced Research Projects Agency Network). Advanced Research Projects Agency (DARPA), ARPANET, aimed to connect diverse computers across research institutions. Researchers like Vinton Cerf and Bob Kahn were tasked with creating a communication protocol robust enough to handle this emerging network. In 1973, Cerf and Kahn initiated work on what would become TCP/IP (Transmission Control Protocol and Internet Protocol). Their goal was ambitious: design a flexible, reliable, and scalable protocol suite. Throughout the 1970s, refinements occurred, culminating in the official specifications for TCP/IP published by DARPA in September 1981. These two RFC (Request for Comments) documents – RFC 791 (Internet Protocol or IP) and RFC 793 (Transmission Control Protocol or TCP) – marked the first public introduction of the finalized TCP/IP framework. Adopting TCP/IP as This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).

the standard protocol for ARPANET in 1983 was a pivotal moment—the birth of the global interconnected network we now rely on. Over the decades, TCP/IP has evolved, addressing limitations (such as the transition to IPv6) while remaining the backbone of the internet, enabling seamless communication across continents. The demonstration of ARPANET, the precursor to the Internet, happened in October 1972 at the International Computer Communication Conference, and it coincided with the introduction of email as an early application (Leiner et al., 2022; Andrews, 2019). These developments of the Internet have changed the landscape of communication and information as everything is accessible through various computers and gadgets. However, only some things correspond to equal opportunity as divisions on more substantial internet access exist, specifically the disparities between urban and rural areas. The study was situated in Palimbang, where more substantial internet access is impossible to experience, hampering the students living there. As a result, tertiary students residing in this rural area of the Philippines often find themselves "caught in the slow lane" of the digital highway, facing slower internet speeds, frequent disruptions, and restricted access to online resources and opportunities.

Perez (2023) conducted a study highlighting the academic achievement gap exacerbated by the COVID-19 pandemic, which forced a rapid switch to online learning. The study found that the lack of internet and computer access disproportionately harmed the academic performance of low-income and minority students. In another study, Hossain et al. (2024) analyzed the effects of internet usage on student's academic progress in Bangladesh. They used distinct machine learning (ML) algorithms to predict the students' performance. The study provided valuable insights into how internet usage patterns could be used to predict academic outcomes.

Additionally, a study explored the impacts of digital technologies on students' knowledge, skills, attitudes, and emotions. The study provided a comprehensive overview of how digital technologies reshape the educational landscape and influence student outcomes (Timotheou et al., 2023). Another study also investigated the impact of different Internet uses on students' performance. The study found that increasingly frequent Internet use negatively influences students' academic achievement progression. Notably, higher use of instant messaging applications was linked to girls' poorer mathematics academic performance progression (Akmad, 2024).

According to Crawford's (2021) release article, the changes brought by the Internet to the world are shaping the landscape of work and education. People have become reliant on the Internet, which has become part of their daily routine. During the pandemic, the work-from-home setup has expanded rapidly across the globe, which helps individuals working in the comfort of their homes. However, not all have access to the Internet, as nearly the world's population is divided in half by the lack of Internet access. As a result, they will become even more marginalized as digital technology, the economy, and information rapidly change. The Internet is not merely an entertainment tool, as highlighted during the pandemic when women residing in slums in Manila faced a pronounced digital divide. Despite this divide, they found ways to utilize the Internet by relying on Piso Wi-Fi vending machines. These machines enabled them to stay connected and provided them with a tool for communication, allowing them to fulfill their roles as mothers and enjoy other aspects of life that women are entitled to (Valdez & Javier, 2022).

While studies on Internet connectivity in rural communities have examined topics such as the impact on student learning, the establishment of ICT centers, and the role of the Internet in rural residents' lives, few researchers have investigated the specific experiences through a narrative analysis of the tertiary students on the use of unstable internet connectivity. Understanding the experiences of tertiary students in availing internet connections is crucial, given the shift towards a digital economy where everything is accessible online, including educational resources that could benefit the academic learnings of the students. This study aimed to explore these experiences, providing valuable insights for government authorities to address connectivity issues and diminish the disparity between rural and urban locations. The data obtained from this study would inform policymakers to adopt measures to improve internet connectivity, enabling rural populations to participate actively in the digital world. Furthermore, existing studies often focus on quantitative measures of internet access and adoption rates. However, they must capture the narratives and opportunities that rural students encounter in their daily interactions with the Internet. Therefore, there was a need for qualitative research that delves into the individual stories, perspectives, and motivations of rural college internet users.

This study analyzed the narratives of tertiary students accessing internet connectivity in Palimbang. Specifically, it sought to address the following questions: (1) how does Internet connectivity affect students' academic life in terms of the following? (a) Access to educational resources; (b) Collaborative Learning.

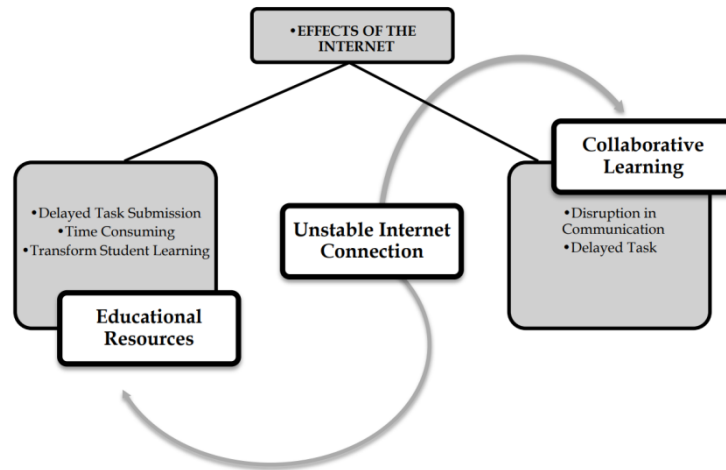


Figure 1. Research Framework

2.0 Methodology

2.1 Research Design

This paper used qualitative inquiry with the use of narrative analysis to vividly understand the complex structure of the experiences; thematic analysis was also utilized to identify recurring patterns and themes of the experiences of the tertiary students to fully grasp the overall interpretation of the data as Creswell (2014) explained that qualitative methodology enables the researcher to fully equip themselves in the exploration of different phenomenon and experiences of the participants involving their in-depth perspectives as outlined by Braun and Clarke (2006).

2.2 Research Locale

The study was carried out in Palimbang, Sultan Kudarat, Philippines. The research area included ten (10) tertiary students of Sultan Kudarat State University, the sole state-owned and higher educational institution of Palimbang, with a total land area of approximately 30,000 sq. meters. The university is located in Barangay Poblacion, Palimbang (SKSU Planning Office, 2024).

2.3 Research Participants

This research interviewed ten (10) tertiary students of Sultan Kudarat State University – Palimbang Campus, five (5) students from the Bachelor of Elementary Education program, and another five (5) students from the Bachelor of Science in Agribusiness program. The participants were selected based on the following criteria: (a) Students using the Internet as their source of academic information and communication, whether through a laptop or cellular phone, (b) 19-25-year-old bonafide tertiary students of Sultan Kudarat State University, (c) born and raised in the municipality of Palimbang, Sultan Kudarat.

2.4 Research Instrument

The primary instruments of this research were the interview guide questions and consent form, both validated and approved by the research ethics committee of Mindanao State University with IERC approval protocol code 079-2024-MSUGSC-IERC. The interview protocol was designed as open-ended questions to grasp the wholeness of the participants' responses. Permission letter was utilized and sent to the director of Sultan Kudarat State University – Palimbang before interviewing the students, pen and paper for note taking the significant statements, a camera for documentation, and an audio/video recorder to record the responses of the participants for the transcription to make sure that the data is accurate.

2.5 Data Gathering Procedure

In conducting the study, the researcher employed a structured data collection approach by creating a questionnaire guide. The problem statements were carefully examined to align with the research questions. Each problem statement was then linked to relevant questions, ensuring comprehensive coverage of all research issues. Potential participants were communicated with either in person or virtually, inviting their active engagement in the study. Informed consent forms outlining the study's goals and methods were shared with participants, who willingly signed them.

A formal letter seeking permission for interviews was also prepared, documenting research objectives and ethical considerations as the research ethics committee advised. Participants received individual copies of this letter. The researcher adapted their language and communication style to ensure participants' comfort and understanding. Appropriate regional languages (such as Tagalog) were used during in-depth interviews, and participants responded in the same language. After each interview, the researcher sincerely thanked the participants for their valuable time and contributions.

2.6 Ethical Considerations

In qualitative research, adherence to ethical guidelines is crucial, especially given the extended duration of such studies (Arifin, 2018). To ensure ethical considerations, the researcher established transparent communication with participants. They informed participants about the research process, their level of involvement, and access to relevant research areas, fostering trust (Creswell, 2012). Equitable treatment was provided, along with comprehensive information about the research purpose and the use of findings. The researcher avoided misleading questions, treating participants as valuable partners in data collection. Confidentiality and anonymity were prioritized during data processing and report writing. Both favorable outcomes and divergent data were presented, respecting participants' diverse perspectives. After completing the study, the researcher communicated further to validate the findings. Ethical considerations were central to maintaining trust and integrity throughout the research process.

3.0 Results and Discussion

3.1 Effects of the Internet on Tertiary Students

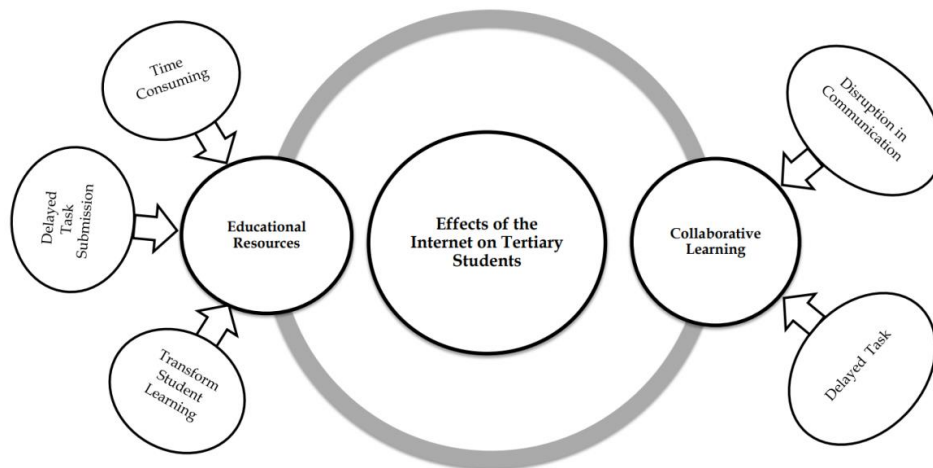


Figure 2. Effects of Internet Connectivity

Access to the Internet plays a crucial role in 21st-century education, as it revolves heavily around integrating technology to assess students' academic performance. According to Seward et al. (2019), classrooms, including students, should not operate in isolation from the world but serve as a positive and safe extension of it. Similarly, Jenkins (2009) emphasizes the digital imperative among students to fully realize their overall potential. Hence, students must not be deprived of internet access, as it is essential for integrating them into the ever-evolving realm

of information and education. The Internet has significantly impacted tertiary students by revolutionizing access to information, facilitating communication, and transforming learning methods (Poushter, 2016). In Palimbang, the instability of internet connectivity significantly impacts tertiary students in various ways, as highlighted through the narratives gathered. These experiences shed light on the extensive effects of internet connectivity issues on the tertiary students of the municipality. The figure (referenced as Figure 2) illustrates the impact of internet connectivity on tertiary students in Palimbang. The quality of internet connection influences how these students utilize online educational resources and collaborative learning. Based on the responses of the tertiary students, the internet connection in Palimbang had both positive and negative effects on students' access to educational resources. On one hand, it has transformed student learning despite its instability. On the other hand, it delayed task submissions and consumed more time. Regarding collaborative learning, the unreliable internet connection in Palimbang has caused communication disruptions and task delays.

3.2 Access to Educational Resources

The results of this study delve into the profound impact of internet connectivity on accessing educational resources, particularly in the context of Palimbang. As the participants highlighted, internet connection quality plays a crucial role in the efficiency of accessing resources and conducting research.

Time-Consuming

Based on the narratives shared by the participants when the internet connection was poor, as observed in Palimbang, it significantly prolongs the time required for these tasks due to the sluggish data transmission rates. This sentiment was supported by recent research conducted by Wang and Ang (2020), who found that inadequate internet connectivity hinders educational access and research productivity, particularly in rural areas. According to the participant, this:

“There was a significant impact on accessing educational resources. For example, when the internet connection was abysmal, accessing resources and conducting research consumed much time because the internet connection was weak. Conversely, when the connection is strong, it is better because it allows easier access to educational resources”. [IDI, P6-BSAB]

“Sometimes, I just cry because it is already late, and the Internet consumes so much time. I would spend 2 to 3 hours and still be unable to access the Internet”. [IDI, P4-BEED]

The participants pointed out that the inconsistent internet connection in Palimbang obstructs access to the educational resources necessary for their coursework. Due to this unstable connectivity, they spend significant time using the Internet for academic purposes. As emphasized, a strong internet connection alleviates these effects on students and enhances the accessibility of educational resources. This sentiment resonates with findings from a study by Goyal and Singh (2019), which underscored the positive correlation between robust internet connectivity and improved access to educational materials. Therefore, it becomes evident that the stability of internet connectivity plays a pivotal role in facilitating efficient access to educational resources, ultimately influencing the academic productivity and learning outcomes of tertiary students in Palimbang.

Delayed Tasks Submission

The participants shared that an unstable internet connection affected their browsing experiences in Palimbang. This poor connectivity has led to delays in submitting their academic-related tasks. A survey conducted in the Philippines found that between 57 and 66 percent of respondents reported that their academic performance was impacted by irregular internet connectivity. Additionally, around a quarter of teachers and students face more severe consequences, encountering this issue daily (Malipot, 2021). A participant shared that:

“This affects us, like when searching for our sources, Sir. For example, in our research papers, sometimes the slow Internet becomes a disruption, Sir. It becomes a reason why sometimes our submissions get delayed, hampers our communication within our respective groups.” [IDI, P7-BSAB]

“Due to the feeble signal here in Palimbang, sometimes we cannot submit our tasks, assignments, or projects by their deadlines. Our submissions get delayed because the signal could be more robust on days without signal, so we cannot access the Internet.” [IDI, P5-BEED]

The participants added that the obstacles presented by slow Internet significantly interrupt the search for academic sources, especially during the preparation of research papers. This hindrance holds incredible significance for tertiary students who depend heavily on the Internet, especially considering the world's advancement towards advanced technology. The viewpoint of Wang and Ang (2020) also highlights the negative impact of insufficient internet connectivity on research productivity, leading to delays in submitting the academic work of the students. Other participants also expressed frustration over the sluggish internet connection, highlighting its correlation with Smith's study (2020), which underscores how unreliable internet access could profoundly affect academic productivity, especially for students heavily reliant on online resources. Such connectivity issues may impede progress in school-related tasks, underscoring the significance of reliable Internet for academic success. The participant added:

"We cannot immediately access educational resources, especially the files we need, because it depends on the data connection in Palimbang. Our submissions, especially our tasks, get delayed because the internet connection in Palimbang could be more robust. Like in our college, we can only submit the necessary tasks given by the professor from time to time, and due to the Internet, the submission of our tasks gets delayed." [IDI, P3-BEED]

The participants highlighted how a weak internet connection delays the completion of school academic tasks. This suggests a direct correlation between technological infrastructure and educational outcomes, emphasizing the impact of internet connection on college students in rural areas when navigating online learning environments in the presence of unreliable internet connectivity. Moreover, the participants' narrative underscores how these connectivity issues hinder timely access to educational resources. The delay in submitting assignments due to slow Internet affects individual academic progress and impacts collaborative efforts within research teams.

Transform Student Learning

Even though there were negative effects of accessing internet connection in Palimbang, participants expressed their sentiments regarding the significance of internet connectivity for their academic pursuits. The students acknowledged the Internet's substantial assistance in accelerating their studies, particularly in research tasks. The participants expressed that:

"As a college student, this is a big help for me as a self-support in my studies. It helps speed up my studies, especially in research, although it has its opposing advantage because our Internet here could be more vital. Sometimes, I need help with my studies, especially when doing a case study or other urgent school work, so I find it difficult. However, it also has its positive advantage because, as a student, it makes my tasks here at school more manageable and makes the tasks given by the teacher easier." [IDI, P8-BSAB]

"The Internet is helpful because it makes life easier for students. You no longer have to go to the library and read books individually. The Internet is just one click away, and now many sites, like AI, make students' work even more straightforward." [IDI, P1-BEED]

3.3 Collaborative Learning

Collaborative learning, particularly online, has been recognized as a significant factor in enhancing academic performance. It involves a joint intellectual effort by students or students and teachers, where they develop their knowledge by interacting. This interaction enables individual students to combine their expertise, experience, and ability to accomplish a mutual learning goal (Han & Ellis, 2021; Singh et al., 2020). In the context of Palimbang, the importance of collaborative learning using stable Internet was more pronounced as tertiary students showed great significance in accessing Internet connection. Education experts in the Philippines have revealed that a decent gadget and a stable internet connection are two of the most important things that all students and teachers should have to engage and rise above the challenges in the country's new distance learning techniques (Domingo, 2020).

Disruption in Communication

According to the participants' narratives, one of the effects of internet-based collaborative learning was the interruption in communication caused by unstable internet connections. The lack of a stable internet connection can pose challenges to online learning. Collaborative learning using a stable internet connection is vital in enhancing students' academic performance. It promotes active participation, arouses interest in exploring concepts, and helps overcome geographical barriers, democratizing student access to information and educational

content (World Economic Forum, 2019). However, the effectiveness of collaborative learning was highly dependent on the stability of the internet connection, making it an essential factor in the successful implementation of online collaborative learning strategies (Malipot, 2021). It also could make the learning experience isolating and hinder the effectiveness of collaborative activities (Wang, 2021). Therefore, ensuring a stable internet connection was crucial to facilitate effective collaborative learning, especially in areas like Palimbang. As stated by the participants:

"My communication and interaction with classmates are affected because we are not just in one barangay. My classmates live in areas like Domolol, where there is no signal. They only use Wi-Fi, but it is feeble when they connect to it. So, that is what happens. It feels like a huge burden because it is hard to communicate and collaborate online." [IDI, P4-BEED]

"The Internet has both positive and negative aspects, Sir. The positive aspect is that when I collaborate with my group, we share our thoughts and ideas through Internet research. However, sometimes it also has a negative impact because some of my group members rely on me... just because I have an internet connection; they tend to neglect their tasks that should be shared among the group." [IDI, P8-BSAB]

Through the participants' perspectives, the Internet has revolutionized how they learn and collaborate. It allows for seamless sharing of ideas and resources, making collaborative tasks more efficient. For instance, in group work, students could share their thoughts and findings from their research with their group members, regardless of where they were located. However, due to the inconsistent internet connectivity in Palimbang, most tertiary students needed help collaborating effectively and utilizing the Internet as their primary mode of online communication. It led to less-than-optimal results in their collaborative efforts. If the Internet were stable and reliable, it could be possible. However, in Palimbang, the unstable Internet prevents students from fully engaging in collaborative learning. The only effective collaboration happens face-to-face, as online collaboration outside of school is virtually impossible due to the poor internet connection. In addition, the study by Perez et al. (2024) investigated how students' attitudes and interactions with peers affected their engagement in collaborative and gamified online learning tasks. The findings affirmed that both students' individual attitudes and social interactions played a significant role in encouraging participation in these activities.

Moreover, the research demonstrated that involvement in such activities correlates positively with the emotions students experience about their classes and assessments (Perez et al., 2024). It was profound to state that collaborative learning through Internet access is necessary for students' learning development. Hence, it affirmed the beneficial influence of contemporary technology through using the Internet on collaborative learning (Vali, 2023). As experienced by the tertiary students of Palimbang, it could sometimes lead to an imbalance in group participation. Other participants added that:

"When the Internet is weak... because the primary source of our information and our means of connecting is through the Internet, so its effect when it's weak... sometimes when we video call or call my other group mates for group projects, if the Internet is weak, our communication gets cut off due to the weak Internet". [IDI, P10-BSAB]

"Our communication within my group gets delayed, and sometimes, my other group members would say that I'm not contributing because of the weak internet access; the communication gets delayed due to the Internet." [IDI, P2-BEED]

The participants expressed the effects of the Internet they faced when their internet connection was weak. They rely on the Internet as their primary source of information and communication, especially for group projects. However, when the internet connection is weak, it disrupts their communication, particularly during video calls, which hampers their collaborative work. It highlights the importance of a stable internet connection for effective online collaboration and learning. It was coherent in the study of Goyal and Singh (2019), which underscores the critical role of seamless internet access in fostering effective communication and collaboration among students. In today's interconnected world, where digital platforms are essential mediums for interaction and cooperation, reliable internet connectivity is indispensable for facilitating meaningful student engagement.

Delayed Task

Several participants expressed their struggles with the unstable internet connection in Palimbang. This unreliability hindered them from accomplishing their intended tasks due to difficulties accessing the Internet. As shared by the participants:

"Sometimes, our plans get delayed... like, for example, during a meeting... we've decided to work on our thesis on a certain day, and sometimes we have to reschedule it to coincide with a good signal." [IDI, P7-BSAB]

"Sometimes, I cannot give much attention to my group mates because of the internet connection; it is like I am running out of time for them. When the teacher gives tasks, or something that needs to be searched on the Internet and suddenly the Internet or data dies, we cannot finish what we are doing, and that is the biggest struggle as a group because we start to panic since the Internet is needed for the activities assigned by the teacher." [IDI, P2-BEED]

"When the signal is weak, it is a disadvantage because it is weak in the morning, and not all of us have a signal. So what happens is our activities get delayed." [IDI, P9-BSAB]

The participants described the effects of the Internet on collaborative learning, which they face due to an unstable Internet connection in Palimbang. They mention that their academic plans, such as working on their thesis or completing tasks assigned by their teacher, often must be completed on time. These activities required a stable internet connection for research and collaboration. When the internet connection was weak or suddenly dropped, they could not complete their tasks, leading to panic within the group. It highlights the critical role of a reliable internet connection in facilitating online learning and collaboration. The observed phenomenon corresponds with recent scholarly investigations. One study emphasized the detrimental impacts of sluggish internet connectivity on virtual classes amid the COVID-19 crisis. Another report highlighted the obstacles posed by limited internet availability for students engaged in online education, particularly in Southeast Asia. Moreover, research conducted by a member of the National Research Council of the Philippines underscored that internet accessibility remained a significant hurdle for educators nationwide. These inquiries emphasize the critical role of dependable and widespread internet access in facilitating productive online learning environments and cooperative efforts (The Conversation, 2020; Arayata, 2021).

4.0 Conclusion

The study underscores the profound influence of internet connectivity on the educational experiences of tertiary students in Palimbang. Participants consistently narrated that poor internet connectivity significantly hampers their ability to access educational resources efficiently. This inefficiency manifests in prolonged time spent on academic tasks, leading to frustration and emotional distress, as evidenced by the narratives of students who struggle to complete their work on time due to slow internet speeds. Based on the students' experiences, the findings highlighted the detrimental effects of inadequate internet connectivity on educational access and research productivity. These studies collectively emphasize that stable and robust internet connectivity is not merely a convenience but a necessity for modern education, particularly in rural areas like Palimbang. The participants' experiences reveal that the quality of internet connectivity directly impacts their academic productivity and learning outcomes. With a strong internet connection, students can access resources more quickly, conduct research more efficiently, and submit their academic tasks on time. Conversely, poor connectivity leads to significant delays and increased stress, negatively impacting their academic performance. Therefore, the stability of internet connectivity is crucial for facilitating efficient access to educational resources. Improving the internet infrastructure in Palimbang is essential to enhance its tertiary students' academic productivity and learning outcomes. The study underscores the pressing necessity for specific interventions to tackle connectivity challenges students in rural areas face. With this, it is recommended that:

- a) The local government unit of Palimbang invests in upgrading the internet infrastructure to ensure stable and high-speed internet connectivity. It could involve collaboration with internet service providers and government agencies to enhance the existing network and;
- b) Establish community Wi-Fi hubs in strategic locations such as schools, libraries, and community centers. These hubs can provide students with reliable internet access, especially during peak usage times and;
- c) Implement subsidized Internet plans for students and educators to make high-speed Internet more affordable. It can be achieved through partnerships with telecom companies and government subsidies;
- d) Conducting digital literacy programs to educate students and teachers on optimizing internet usage and managing online resources efficiently. It can help mitigate the impact of slow internet speeds by teaching effective online research and resource management techniques.

5.0 Contributions of Author

The authors conceptualized the outcomes presented in each section of this study equally. This includes everything from the data collection to the analysis of the results.

6.0 Funding

This research did not receive any financial support from external agencies or institutions.

7.0 Conflict of Interests

The authors equally developed this paper's concept, ensuring no conflicts of interest from the authors.

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