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## LEVELS OF DIGITAL POVERTY AMONG RURAL STUDENTS: EVIDENCE FROM SCHOOLS IN KEDAH, MALAYSIA


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### Abstract:

Digital technologies are increasingly central to contemporary education, shaping how students access learning resources and engage in academic activities. However, unequal access to digital infrastructure, devices, and digital skills perpetuates disparities, especially among students in rural areas. This study examines the level of digital poverty among students in rural schools in Kedah, Malaysia. This qualitative study collected data through semi-structured interviews with 55 students from nine rural schools in the districts of Sik, Baling, and Pulau Tuba. Data were analysed thematically and interpreted using Barrantes' digital poverty framework, which conceptualizes digital inclusion as a continuum rather than a binary condition. Most students demonstrated basic digital capabilities but faced constraints in device availability and reliable internet access. A smaller group experienced severe digital deprivation, with minimal exposure to technology. Few students had adequate access but limited digital skills, and no cases of voluntary nonuse were observed. Findings suggest that rural students are generally willing to engage with digital learning; however, structural barriers such as economic limitations and inadequate infrastructure

restrict their participation. These results underscore the need for targeted interventions to improve digital access and infrastructure, promoting more equitable participation in rural education.

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Digital Divide, Digital Learning, Digital Poverty, Rural Education, Rural Students



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## Introduction

Digital technologies have become an important component of modern education, influencing how students access information, communicate with teachers and peers, and participate in learning activities. The increasing availability of digital platforms, online resources, and learning management systems has enabled new approaches to teaching and learning in many countries. In Malaysia, educational institutions have progressively integrated information and communication technologies (ICT) into teaching practices to support flexible learning environments and improve access to knowledge (Adams et al., 2018; Azar et al., 2022).

However, the benefits of digital technologies are not experienced equally by all students. Differences in access to devices, internet connectivity, and digital competencies continue to shape students' ability to participate in digitally supported learning environments. These disparities are commonly discussed in relation to the digital divide, which refers to inequalities in access to and use of digital technologies across different social groups (Aissaoui, 2022; Van Dijk, 2017). While digital technologies can support more inclusive education, unequal access may instead reinforce existing educational inequalities.

The transition toward digital learning accelerated significantly during the COVID-19 pandemic. Beginning in early 2020, schools in many countries were required to close temporarily or limit physical attendance in order to control the spread of the virus. During this period, education systems shifted rapidly toward remote learning, relying heavily on digital platforms and online communication tools. In Malaysia, home-based teaching and learning (Pengajaran dan Pembelajaran di Rumah – PdPR) was implemented for an extended period of time, requiring students to rely on digital devices and internet connectivity to continue their education. Although many schools have since returned to face-to-face learning, digital

technologies remain an integral part of educational practices, including online learning materials, digital communication, and blended learning approaches.

The extended period of remote learning highlighted important disparities in students' access to digital resources. Students in rural areas often faced greater challenges due to unstable internet connectivity, limited access to digital devices, and fewer opportunities to develop digital skills. These challenges reflect what has been described as digital poverty, a multidimensional condition that involves limited access to digital infrastructure, insufficient digital skills, and restricted ability to use digital technologies productively (Barrantes, 2007; Barrantes, 2014). Digital poverty therefore reflects broader socioeconomic conditions that influence individuals' participation in digital environments.

In Malaysia, studies have shown that differences in digital literacy, technological familiarity, and access to digital infrastructure can affect students' ability to engage effectively in digital learning environments (Ishak & Yamin, 2016; Ayob et al., 2022). Students from disadvantaged or rural backgrounds may experience additional barriers that limit their ability to benefit from digital educational resources. These challenges suggest that understanding digital inequality requires examining both technological access and the broader social contexts in which students interact with digital technologies.

Despite increasing attention to digital inequality, relatively limited research has focused on the level of digital poverty experienced by rural school students in Malaysia. Many existing studies focus primarily on digital literacy or ICT usage without examining how different dimensions of digital deprivation intersect within rural educational contexts. Therefore, this study aims to examine the level of digital poverty among rural students in Kedah, Malaysia. By exploring how economic conditions, technological access, digital knowledge, and social support influence students' digital experiences, this study seeks to provide a clearer understanding of digital inequality in rural education. The findings may contribute to the development of more targeted strategies to support equitable digital participation among students in rural communities.

## Literature Review

### *Digital Divide and Digital Poverty*

The concept of the digital divide has been widely used to describe inequalities in access to information and communication technologies. Early discussions of the digital divide primarily focused on physical access to computers and internet connectivity. However, more recent research recognises that digital inequality extends beyond access to include differences in digital skills, patterns of technology use, and the ability to benefit from digital technologies (Aissaoui, 2022; Van Dijk, 2017).

Barrantes (2007, 2014) introduced the concept of digital poverty to capture the multidimensional nature of digital exclusion. According to this framework, digital poverty refers to conditions in which individuals face limitations in accessing digital infrastructure, owning digital devices, developing digital skills, and using technology in meaningful ways. The digital poverty perspective highlights that individuals may experience varying levels of digital participation rather than simply being categorised as digitally connected or disconnected.

Similarly, Van Dijk (2017) proposed a layered model of digital access that includes motivational access, material access, skills access, and usage access. This model suggests that digital inclusion involves several stages. Even when individuals have access to digital devices and internet connectivity, they may still experience digital exclusion if they lack the motivation, skills, or opportunities to use digital technologies effectively. These theoretical perspectives emphasise that digital inequality is influenced by a combination of technological, social, and economic factors.

### ***Socioeconomic Factors and Digital Inequality***

Socioeconomic conditions play an important role in shaping individuals' access to digital technologies and their ability to use these technologies effectively. Individuals from lower-income households often face greater challenges in acquiring digital devices, maintaining reliable internet connectivity, and accessing digital learning resources (Holmes & Burgess, 2022). These barriers can limit participation in digital activities such as online learning, communication, and information access.

Digital inequality is also closely linked to broader patterns of social and economic inequality. Research has shown that limited access to digital technologies can reinforce existing disadvantages by restricting opportunities for education, information access, and economic participation (Dzator et al., 2023). Expanding digital accessibility has therefore been recognised as an important factor in supporting broader development and poverty reduction initiatives (Acheampong et al., 2025).

In rural areas, these challenges may be intensified by infrastructural limitations and geographical conditions. Limited broadband coverage, higher connectivity costs, and reduced availability of digital learning resources can contribute to disparities in digital access between rural and urban populations (Dawood et al., 2019). As a result, students in rural communities may face greater difficulties in participating in digital learning environments.

### ***Digital Literacy and Technology Use in Education***

Digital literacy is another important factor influencing students' participation in digital learning environments. Digital literacy refers to the ability to access, evaluate, and use digital technologies effectively for learning and communication purposes. Even when students have access to devices and internet connectivity, differences in digital skills may influence their ability to use digital tools productively (Aissaoui, 2022).

Studies conducted among Malaysian students indicate that digital competence varies across different student groups. Yamin and Ishak (2016) found that differences in digital skills among university students affect their ability to use online learning systems effectively. Similarly, research by Ishak and Yamin (2020) demonstrated that students' acceptance of digital learning tools is influenced by their familiarity with digital technologies and their perceptions of the usefulness of these tools in learning activities.

The integration of digital learning platforms and interactive technologies can enhance students' engagement and support more flexible learning environments (Azar et al., 2022). However, the effectiveness of these technologies depends on students having sufficient access to digital

infrastructure and adequate digital skills. Without these conditions, digital learning initiatives may unintentionally widen existing educational inequalities.

### ***Research Gap***

Although issues related to the digital divide and digital literacy have been widely discussed in the literature, relatively limited research has examined digital poverty among school students in rural Malaysia. Many existing studies focus primarily on individual aspects of digital inequality, such as access to ICT infrastructure, students' digital skills, or technology acceptance in learning environments (Aissaoui, 2022; Ishak & Yamin, 2016). While these studies provide useful insights, they often examine these dimensions separately rather than considering how multiple forms of digital disadvantage interact within students' daily learning experiences.

Furthermore, research on digital inequality in Malaysia frequently focuses on higher education students or general populations, with fewer studies examining rural school students specifically. Yet rural communities often face additional challenges related to infrastructure, economic conditions, and geographical location that may influence students' digital access and usage (Dawood et al., 2019). As a result, the level and nature of digital poverty experienced by rural students may differ from that observed in other educational contexts.

Another limitation in existing research is the lack of studies that apply a structured framework to assess varying levels of digital deprivation. The digital poverty framework proposed by Barrantes (2007, 2014) highlights that digital inclusion exists along a continuum, ranging from complete digital exclusion to productive digital participation. However, empirical studies applying this framework to examine students' digital experiences in rural Malaysian schools remain limited.

Therefore, this study seeks to address these gaps by examining the level of digital poverty among rural students in Kedah, Malaysia using Barrantes' digital poverty framework. By analysing multiple dimensions of digital access, digital knowledge, and technology use, this study provides a more comprehensive understanding of digital inequality within rural educational settings. The findings are expected to contribute to the discussion on digital inclusion in education and provide evidence that may inform policies and initiatives aimed at supporting equitable digital participation among rural students.

### **Research Methodology**

#### ***Research Design***

This study adopted a qualitative research design to explore the levels of digital poverty experienced by students in rural schools in Kedah, Malaysia. A qualitative approach was considered appropriate because the study aims to understand students lived experiences, perceptions, and contextual challenges related to digital access and digital learning practices. Unlike quantitative approaches that emphasise measurement and statistical generalisation, qualitative inquiry allows researchers to obtain deeper insights into how individuals interpret their experiences within specific social and environmental contexts.

Digital poverty is widely recognised as a complex and multidimensional phenomenon that involves not only access to digital technologies but also economic capacity, digital knowledge, and the availability of social support. These dimensions interact in ways that may vary across different communities and educational environments. Therefore, qualitative methods were selected to capture the nuanced realities of students' digital experiences in rural areas. This approach enables the identification of patterns, meanings, and contextual factors that may not be fully captured through structured survey instruments.

### ***Research Context and Participants***

The study was conducted in nine rural schools in Kedah, consisting of six primary schools and three secondary schools. The schools were located in three districts: Sik, Baling, and Pulau Tuba (Langkawi). These locations were selected to represent different rural contexts within the state.

Sik and Baling are inland districts that are characterised by relatively higher poverty rates and limited infrastructural development compared to urban areas. Communities in these districts often experience challenges related to transportation, economic opportunities, and digital connectivity. In contrast, Pulau Tuba represents an island community where geographical isolation, and infrastructural constraints may further affect access to digital technologies and internet services.

A total of 55 students participated in the study. Participants were selected with the assistance of school administrators to ensure representation across different school levels and age groups. The selection process aimed to include students with diverse backgrounds and experiences related to digital access and digital learning environments. Participation was voluntary, and informed consent was obtained from the relevant authorities, school administrators, and participants prior to data collection.

### ***Data Collection Procedure***

Data were collected through semi-structured interviews. This method was selected because it allows researchers to explore participants' experiences while maintaining sufficient flexibility to probe deeper into issues that emerge during the conversation. Semi-structured interviews are particularly suitable for studies that aim to understand perceptions, experiences, and contextual challenges.

The interview protocol was designed to explore several aspects of students' digital experiences, including:

- access to digital devices such as smartphones, tablets, or computers
- availability and reliability of internet connectivity
- experiences with digital learning activities and online platforms
- levels of digital knowledge and technological skills
- the role of family members, teachers, and community support in facilitating digital learning

Interviews were conducted in a manner appropriate to the students' age and communication abilities to encourage open and comfortable discussions. In some cases, simplified language and follow-up questions were used to ensure that participants clearly understood the questions and were able to express their experiences effectively.

All interviews were conducted with permission from participants and were audio-recorded for accuracy. The recordings were subsequently transcribed to facilitate systematic analysis of the data.

### ***Data Analysis***

The interview data were analysed using thematic analysis, a widely used qualitative method for identifying, analysing, and interpreting patterns within qualitative data. The analysis followed several systematic stages.

First, the researchers conducted data familiarisation by repeatedly reading the interview transcripts to develop an overall understanding of participants' responses. This stage allowed the researchers to identify initial impressions and recurring issues related to digital access and digital learning experiences.

Second, an initial coding process was conducted to organise the data into meaningful segments. Codes were assigned to statements or excerpts that reflected relevant aspects of students' experiences, such as device sharing, unstable internet connectivity, limited digital skills, or support from family members and teachers.

Third, related codes were grouped into broader themes representing the main dimensions of digital poverty. Through this process, four key themes were identified: economic capacity, physical access to technology, digital knowledge, and social support. These themes reflect the multidimensional nature of digital poverty and correspond with existing conceptualisations of digital inequality discussed in the literature.

To support a more structured interpretation of the findings, Barrantes' digital poverty framework was applied during the analytical stage. Based on this framework, students' experiences were interpreted across four analytical categories representing different levels of digital poverty:

- Category A: Students with limited or no access to digital devices and internet connectivity, accompanied by minimal digital skills.
- Category B: Students with basic digital skills but constrained access to devices or reliable internet due to economic or infrastructural limitations.
- Category C: Students with relatively adequate access to digital resources but limited skills or confidence in using technology effectively for learning purposes.
- Category D: Students who have access to digital technologies and possess sufficient skills but demonstrate limited engagement with digital learning activities.

These categories were used as analytical lenses rather than rigid classifications. Students' categorisation was derived from patterns emerging in the interview data rather than from predefined quantitative thresholds. This approach allows for a flexible interpretation of students' digital experiences within their specific social and geographical contexts.

Overall, the analysis aimed to examine how different combinations of economic, physical, knowledge-related, and social factors shape students' positions along the spectrum of digital poverty in rural schools in Kedah.

## Findings and Discussion

The findings of this study indicate that students' digital experiences in rural schools are shaped by the interaction of several structural and contextual factors. Consistent with the multidimensional perspective of digital poverty proposed by Barrantes (2007, 2014), students' experiences cannot be understood solely in terms of technological access. Instead, their digital participation is influenced by a combination of economic conditions, availability of digital devices, internet connectivity, digital knowledge, and the support available within their learning environment.

When interpreted through Barrantes' digital poverty framework, the findings suggest that rural students in Kedah occupy different positions along a continuum of digital participation rather than fitting into a simple connected–disconnected dichotomy. This observation supports earlier arguments that digital inequality should be understood as a layered and multidimensional phenomenon rather than a binary condition (Van Dijk, 2017).

A substantial proportion of the participants were classified under Category B, representing students who possess basic digital knowledge but experience constraints in accessing reliable digital resources. Many students reported relying on shared devices within their households, particularly smartphones used by parents or older siblings. In several cases, students were only able to use these devices during specific periods, such as after parents returned from work. In addition, internet access was often dependent on mobile data plans with limited quotas. As a result, students could access digital learning materials only intermittently when data availability and connectivity conditions permitted.

The prevalence of Category B students across the three study locations suggests that economic capacity and infrastructural limitations remain key barriers to digital inclusion in rural areas. Even when students demonstrate basic digital competencies and interest in using digital tools for learning, their participation is restricted by limited access to devices and unstable internet connectivity. These findings align with previous studies indicating that socioeconomic conditions significantly influence individuals' ability to access and benefit from digital technologies (Holmes & Burgess, 2022; Dzator et al., 2023). The findings also reinforce the view that digital inequality is closely associated with broader structural inequalities within society.

A smaller group of students was classified under Category A, representing the most severe level of digital poverty observed in the study. Students in this category reported minimal access to digital devices and limited exposure to digital technologies outside the school environment. Their interaction with digital tools typically occurred only during school hours through shared school facilities or teacher-guided activities. This situation was particularly evident in Pulau Tuba, where geographical isolation and infrastructural constraints contribute to limited internet connectivity. These findings are consistent with earlier research indicating that rural and geographically isolated communities often face additional barriers to digital access due to infrastructural limitations (Dawood et al., 2019).

Interestingly, the analysis identified only one participant under Category C, representing students who have relatively adequate access to digital resources but limited digital skills. This finding suggests that among rural students in Kedah, access-related constraints appear to be more significant than skill-related limitations. Many students demonstrated basic familiarity with digital tools such as smartphones, messaging applications, and online learning platforms when opportunities were available. This observation supports previous findings that younger users often develop basic digital skills through informal exposure to technology even when formal training is limited (Ishak & Yamin, 2016; Ishak & Yamin, 2020).

Another notable finding is the absence of participants in Category D, which represents voluntary non-use of digital technologies. None of the students reported intentionally avoiding digital tools for learning purposes. Instead, most participants expressed a willingness to use digital technologies and recognised their importance in supporting their studies. This finding suggests that limited digital participation among rural students is largely driven by external constraints rather than lack of motivation or interest. Similar observations have been reported in previous studies indicating that students generally display positive attitudes toward digital learning when adequate resources are available (Azar et al., 2022).

Overall, the findings highlight that digital poverty among rural students in Kedah is primarily shaped by structural conditions such as household economic capacity, access to digital devices, and internet infrastructure. While students generally possess basic digital knowledge and demonstrate positive attitudes toward digital learning, their ability to engage consistently with digital educational resources remains uneven. These results reinforce the importance of addressing not only technological access but also broader socioeconomic and infrastructural factors when designing policies and interventions aimed at improving digital inclusion in rural education.

## Conclusion

This study examined the level of digital poverty among students in rural schools in Kedah, Malaysia by applying Barrantes' digital poverty framework. The findings indicate that students' digital experiences are shaped by a combination of economic conditions, physical access to digital resources, digital knowledge, and the availability of social support. Rather than representing a simple divide between students who are digitally connected and those who are not, the results show that rural students occupy different positions along a continuum of digital participation.

These findings highlight that the primary challenge for rural students in Kedah lies not in their motivation or interest in digital learning, but in the structural conditions that influence their access to digital resources. Economic limitations, infrastructural constraints, and geographical factors continue to shape students' opportunities to participate in digitally supported learning environments. The results therefore reinforce the view that digital inequality in education is closely linked to broader socioeconomic contexts rather than solely to technological capability. The study contributes to the existing literature by providing empirical insights into the levels of digital poverty experienced by rural school students in Malaysia. By applying Barrantes' framework, the study demonstrates the value of examining digital inequality through a multidimensional perspective that considers economic, technological, and social factors simultaneously. This approach offers a more comprehensive understanding of how digital participation is experienced within rural educational settings.

From a practical perspective, the findings suggest that efforts to improve digital inclusion in rural education should focus on strengthening infrastructure, improving access to digital devices, and supporting sustainable internet connectivity for students in disadvantaged communities. Addressing these structural barriers may help create more equitable opportunities for rural students to participate in digitally supported learning.

Overall, understanding the levels of digital poverty among rural students is important for informing policies and initiatives aimed at reducing digital inequality in education. Continued attention to the intersection of economic conditions, infrastructure, and digital capability will be necessary to ensure that the expansion of digital learning technologies benefits students across different geographical and socioeconomic contexts.

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**Author Contribution Statement:** All authors contributed significantly to the development of this manuscript. Fadhilah Mat Yamin led the conceptualization, research design, methodology development, and overall supervision of the study. Wan Hussain Wan Ishak contributed to data collection and the critical revision of the manuscript. Nur Syazwani Mohd. Nawi was involved in data collection and

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preliminary data analysis. Hapini Awang contributed to data interpretation and validation of the findings. Md. Tajudin Haji Morad supported the data collection process and provided contextual insights related to the study setting. All authors contributed to the writing of the manuscript, and all authors reviewed and approved the final version prior to submission.

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