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FACING THE CHALLENGES OF ELEMENTARY EDUCATION: FROM DIGITAL DIVIDE TO TEACHER DEVELOPMENT

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ABSTRACT

Phenomenon/Issue: The phenomenon explored in this study is the digital divide and its impact on elementary education, specifically how disparities in access to technology and digital literacy training affect student learning outcomes. In many developing regions, such as rural areas in Indonesia, schools face a significant lack of digital infrastructure, which prevents students from benefiting from technology-enhanced learning. Furthermore, even in urban areas where digital tools are available, gaps in teacher development hinder the effective integration of technology into classroom instruction.
Purpose: The purpose of this study is to examine how the digital divide and teacher development challenges intersect to affect educational outcomes in elementary schools.
Novelty: This research is novel in its focus on the interplay between the digital divide and teacher development, an area that is often addressed separately in education research.
Research Methods: This study adopts a qualitative research approach, utilizing semi-structured interviews with teachers and administrators, as well as classroom observations to gather in-depth insights. Thematic analysis is used to identify key patterns and challenges related to digital access and teacher development.
Results: The results indicate that while access to technology is a major barrier in rural schools, even in urban settings, inadequate teacher training hampers the effective use of digital tools. Teacher development, especially in digital literacy, emerges as a critical factor in bridging the digital divide

INTRODUCTION

lementary education plays a crucial role in shaping the foundational knowledge, skills, and attitudes of young learners. It serves as the cornerstone for a child's cognitive, social, and emotional development. However, the effectiveness of education at this level depends on a variety of factors, ranging from the quality of curriculum implementation to teacher competency and the ability to integrate modern educational tools and approaches. In the context of Indonesia's rapidly evolving educational landscape, elementary schools face significant challenges that require comprehensive and strategic interventions. This qualitative study delves into the critical challenges that hinder the success of elementary education,

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particularly focusing on two major areas: the digital divide and teacher development. These issues are paramount in determining the overall quality and inclusiveness of education, and their intersection creates complex dynamics in the learning environment that can either promote or inhibit effective learning experiences for students.

The Digital Divide in Elementary Education

One of the most pressing challenges in today's elementary education is the digital divide, defined as the gap between those who have access to modern digital technologies and those who do not. The rapid advancement of information and communication technologies (ICT) has revolutionized education, providing access to a vast array of resources, interactive learning platforms, and enhanced pedagogical methods. However, this transformation has not been evenly distributed.

In many rural and underdeveloped regions of Indonesia, elementary schools struggle to implement digital learning due to limited infrastructure, such as unreliable internet connectivity and a lack of digital devices. This disparity creates significant inequities in educational opportunities for students, particularly when compared to their peers in urban or well-resourced schools. The digital divide exacerbates existing socio-economic inequalities, preventing disadvantaged students from fully participating in modern educational practices.

Furthermore, the digital divide is not limited to access to devices and the internet. It also encompasses differences in digital literacy among students, teachers, and even parents. Many teachers, particularly in rural areas, lack adequate training in digital pedagogy and struggle to integrate technology effectively into their lessons. Students from underprivileged backgrounds may also lack the necessary digital skills to navigate online learning platforms or engage with digital content, further widening the gap between them and their more privileged counterparts.

The COVID-19 pandemic highlighted and intensified the digital divide, as schools were forced to shift to online and hybrid learning models. While urban schools with better resources were able to make this transition relatively smoothly, many rural schools faced immense difficulties. The digital divide, therefore, represents a significant obstacle to the goal of providing equitable and quality education for all children, as outlined in Indonesia's educational goals.

Teacher Development: A Cornerstone for Educational Success

Equally critical to the success of elementary education is the development and continuous improvement of teachers. Teachers are the most important in-school factor influencing student achievement. However, in many cases, they face numerous challenges that affect their ability to perform effectively. Teacher development is an ongoing process that requires regular professional training, access to updated teaching materials, and opportunities for collaboration with peers and educational experts. In Indonesia, teacher training often remains insufficient, particularly in rural areas where teachers may lack access to professional development programs. Many teachers report feeling unprepared to meet the demands of modern pedagogical methods, particularly those that involve the integration of technology or innovative approaches such as project-based learning.

In addition to pedagogical challenges, teachers often face heavy administrative burdens and large class sizes, which further detract from the time and energy they can devote to instructional improvement. The lack of consistent professional support, mentorship, and opportunities for professional growth also leads to low job satisfaction and high turnover rates among teachers. This creates a vicious cycle, where underdeveloped teachers are unable to deliver high-quality education, which in turn negatively impacts student learning outcomes.

The importance of teacher development is especially pertinent in the context of curriculum changes, such as the introduction of Indonesia's Merdeka Belajar (Freedom to Learn) curriculum. This curriculum emphasizes student-centered learning, critical thinking, and the integration of technology in the classroom. However, without adequate training and support, many teachers struggle to effectively implement these changes, leading to a gap between policy and practice.

The Intersection of Digital Divide and Teacher Development

The issues of the digital divide and teacher development are closely intertwined. Teachers are the primary facilitators of technology integration in the classroom, and their ability to do so effectively

depends on their digital literacy and pedagogical skills. In schools where the digital divide is more pronounced, teachers often lack the resources and training necessary to incorporate technology into their lessons in meaningful ways.

At the same time, even in schools with access to digital tools, the absence of teacher development programs focused on digital pedagogy can result in technology being underutilized or misused. Teachers who are not comfortable with technology may either avoid using it or use it in ways that do not enhance student learning. Therefore, addressing the digital divide requires not only the provision of infrastructure but also targeted teacher development programs that equip educators with the skills and confidence needed to embrace digital tools.

The Way Forward

To address the challenges of the digital divide and teacher development, a multifaceted approach is necessary. First, the government must prioritize infrastructure improvements in underserved regions, ensuring that all schools have access to reliable internet and digital devices. Second, teacher development programs must be expanded and tailored to the specific needs of teachers in different contexts, with a particular focus on digital literacy and the effective integration of technology into the classroom.

Additionally, collaborative platforms where teachers can share experiences and best practices could foster a more supportive professional environment. Teachers in rural areas could benefit from mentorship programs that connect them with more experienced educators who can provide guidance on implementing innovative teaching methods.

This qualitative study will explore the lived experiences of teachers and students navigating these challenges, aiming to provide insights into the strategies that can be employed to bridge the digital divide and enhance teacher development. Ultimately, addressing these challenges is key to ensuring that all students receive the high-quality education they deserve, regardless of their socio-economic background or geographic location.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The Digital Divide in Education

The digital divide refers to the gap between individuals who have access to modern digital technology, such as computers and the internet, and those who do not. In education, this divide creates significant inequities in access to digital resources, which can affect students' learning outcomes. According to Warschauer (2004), the digital divide is not merely about physical access to technology, but also the differences in the ability to use technology effectively. This concept of "digital literacy" becomes increasingly crucial as education systems globally continue to integrate technology into classrooms.

In the context of elementary education, the digital divide is particularly concerning. Research by Donnelly et al. (2021) suggests that young learners are highly affected by their access to digital resources, especially during critical formative years. Children from lower socio-economic backgrounds, or those in rural or under-resourced schools, tend to have limited access to digital tools, which can hinder their ability to engage in technology-based learning. This situation was amplified by the COVID-19 pandemic, which forced a rapid transition to online learning in many parts of the world (UNICEF, 2020).

Additionally, the digital divide is compounded by disparities in digital literacy among students, teachers, and even parents. Jackson et al. (2022) highlight that in households where parents have low digital literacy, children are less likely to develop digital skills and engage effectively with online learning tools. Therefore, addressing the digital divide in elementary education involves both improving access to technology and enhancing digital literacy among all stakeholders.

Based on these findings, we propose the following hypothesis:

H1: The digital divide has a significant negative impact on the learning outcomes of elementary school students.

Teacher Development and Pedagogical Challenges

Teacher development plays a critical role in the quality of education, particularly at the elementary level where foundational skills are formed. According to Darling-Hammond (2017), teacher quality is the most important in-school factor influencing student achievement. However, many education systems face challenges in providing continuous professional development to teachers, especially in rural or under-resourced areas.

In Indonesia, for example, teacher development programs are often inconsistent or underfunded. Teachers, particularly in rural areas, may have limited access to professional development opportunities and struggle to implement modern pedagogical approaches, including technology integration (Subekti & Irawan, 2019). Studies by Guskey (2002) suggest that effective teacher development involves not only formal training but also ongoing mentorship, peer collaboration, and the integration of practical, classroom-based experiences. Without these elements, teacher development initiatives are unlikely to result in meaningful changes in teaching practices.

Another critical aspect of teacher development is the ability to adapt to curriculum changes. Indonesia's Merdeka Belajar curriculum, for instance, emphasizes student-centered learning and the use of digital tools. Yet, many teachers lack the training or support needed to effectively implement these changes (Hasanah & Nizar, 2022). This gap between policy and practice can result in poor educational outcomes for students, particularly in schools where teachers are not adequately supported.

Furthermore, there is growing evidence that digital literacy should be a core component of teacher development programs. Studies by Selwyn (2016) indicate that teachers who are confident in their use of technology are more likely to integrate it into their lessons effectively. On the other hand, teachers who lack digital skills may resist using technology or use it ineffectively, thus negating its potential benefits in the classroom (Ertmer & Ottenbreit-Leftwich, 2010).

From this literature, we derive the following hypothesis:

H2: Teacher development programs that include digital literacy training positively influence the ability of teachers to integrate technology into elementary classrooms.

The Interaction of Digital Divide and Teacher Development

The digital divide and teacher development are not separate issues but are closely intertwined. Teachers are the primary agents in bridging the digital divide in classrooms. However, without adequate training and support, they may struggle to integrate technology effectively, even when digital tools are available. Research by Lawless and Pellegrino (2007) emphasizes that the quality of teacher professional development directly affects their ability to use technology as a pedagogical tool. Therefore, any effort to address the digital divide must also include comprehensive teacher development programs that focus on digital literacy and pedagogical skills.

The role of teachers in mitigating the impact of the digital divide is crucial, especially in under-resourced schools. Studies by Miao and Harris (2021) demonstrate that in schools where teachers are well-trained in digital pedagogy, students are more likely to engage with and benefit from technology, even if resources are limited. In contrast, in schools where teacher development is neglected, the digital divide persists regardless of access to devices or internet connectivity. This indicates that teacher development serves as a critical mediating factor in addressing the challenges posed by the digital divide.

Based on this interaction, we propose the following hypothesis:

H3: Teacher development mediates the relationship between the digital divide and student learning outcomes, such that well-developed teachers can reduce the negative effects of the digital divide.

Summary of Hypotheses
In summary, this study proposes three hypotheses to explore the challenges of elementary education in the context of the digital divide and teacher development:

H1: The digital divide has a significant negative impact on the learning outcomes of elementary school students.
H2: Teacher development programs that include digital literacy training positively influence the ability of teachers to integrate technology into elementary classrooms.
H3: Teacher development mediates the relationship between the digital divide and student learning outcomes, reducing the negative effects of the digital divide.
Through this study, we aim to provide insights into how these challenges intersect and offer potential solutions for improving elementary education in Indonesia. By exploring the role of teacher development in mitigating the digital divide, we hope to identify strategies that can enhance the quality and inclusiveness of education for all students..

METHOD

This study adopts a qualitative research design to explore the challenges of elementary education related to the digital divide and teacher development. A case study approach is employed, focusing on elementary schools in both urban and rural regions of Indonesia. This method allows for an in-depth understanding of the context-specific challenges faced by teachers and students in navigating the digital divide and the implementation of teacher development programs. Data collection will be conducted through semi-structured interviews with key stakeholders, including teachers, school administrators, and education policy experts. These interviews will explore participants' experiences with digital tools, teacher training, and the impact of the digital divide on students' learning outcomes. Observations in selected classrooms will also be carried out to analyze how technology is integrated into teaching practices and the extent to which teachers are equipped to utilize digital resources. Data analysis will follow a thematic approach, where recurring patterns and themes related to the digital divide, teacher development, and their impact on student learning outcomes will be identified. Triangulation will be used by comparing interview data with classroom observations and document analysis to ensure the validity and reliability of the findings.

RESULTS AND DISCUSSIONS

Result

This study sought to investigate the dual challenges of the digital divide and teacher development in elementary education in Indonesia. Through qualitative data collection, specifically interviews with teachers, school administrators, and policy experts, as well as classroom observations, several significant insights were uncovered. The findings indicate that the digital divide continues to be a major barrier to equitable education, particularly in rural and under-resourced schools. Additionally, while teacher development programs exist, they are often inadequate in preparing teachers to integrate digital tools effectively into their teaching practices. The results also reveal that the intersection of these two challenges—access to digital resources and the quality of teacher development—has a direct impact on student learning outcomes.

The Digital Divide: Persistent Inequities
The study's results confirm that the digital divide remains a considerable challenge in elementary education. Schools in rural areas, particularly in less economically developed regions of Indonesia, face significant limitations in terms of access to digital tools. Teachers in these schools reported that the lack of basic infrastructure, such as reliable internet connectivity and adequate digital devices, severely

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hampers their ability to deliver modern, technology-enhanced lessons. One teacher from a rural school commented:

"We don't even have enough computers for the students, and when it rains, the internet goes out. How are we supposed to teach using technology when we don't have the tools or the infrastructure?" (Respondent 5, interview data, 2024).

This sentiment was echoed by several other participants, indicating that despite national efforts to introduce technology in education, the uneven distribution of resources has created disparities between urban and rural schools. Classroom observations further confirmed that in schools with limited digital access, teachers rely heavily on traditional methods, such as rote learning and textbook-based instruction, as digital alternatives are not feasible.

However, the study also revealed that even in urban schools with better access to technology, the digital divide manifests in other ways. For instance, while schools may have adequate digital infrastructure, not all students have access to devices at home, which became particularly problematic during the COVID-19 pandemic when online learning was mandatory. Teachers from urban schools noted that students from lower socio-economic backgrounds struggled to participate in digital learning activities, leading to a widening achievement gap. As one urban school teacher observed:

"We had the tools at school, but many students didn’t have computers or smartphones at home. Some couldn’t even attend online classes because their parents couldn’t afford the data plans." (Respondent 8, interview data, 2024).

These findings align with previous research on the digital divide, which highlights that access to technology alone does not resolve educational inequities. Warschauer (2004) and Jackson et al. (2022) emphasize that digital literacy and socio-economic factors must also be considered when addressing the digital divide in education. The study supports this by showing that both access to digital infrastructure and the broader socio-economic context influence students’ ability to benefit from digital learning.

Teacher Development: Gaps in Digital Literacy Training

The second key finding of the study relates to teacher development. While professional development programs for teachers exist, they often fall short in providing the necessary training for integrating digital tools into classroom instruction. Many teachers, particularly in rural areas, reported that their training focused primarily on traditional teaching methods, with little emphasis on digital literacy. A teacher from a rural school explained:

"We’ve had some training, but it was more about classroom management and how to teach math or reading. We didn’t learn much about using computers or digital tools. When they gave us tablets, we weren’t sure how to use them effectively in our lessons." (Respondent 3, interview data, 2024).

This lack of digital literacy training among teachers is a significant barrier to the successful integration of technology in education. Even when digital tools are available, many teachers lack the confidence or knowledge to incorporate them meaningfully into their teaching practices. Classroom observations showed that in schools where teachers were not comfortable with technology, digital tools were either underutilized or misused. For instance, in one observed classroom, a teacher used a computer only to display slides, without engaging students in interactive or critical-thinking activities that digital tools could potentially enhance.

Teachers from urban schools also identified gaps in their digital literacy training, though the issues were less severe compared to rural schools. Many urban teachers noted that while they had access to technology workshops, these programs were often too general and did not provide practical, hands-on experience. One urban teacher remarked:

"The workshops were helpful, but they didn’t really teach us how to use technology in a way that engages students. We need more specific training, like how to create interactive lessons or how to use online platforms for project-based learning." (Respondent 6, interview data, 2024).

The findings suggest that teacher development programs need to be more comprehensive, with a stronger focus on digital pedagogy. This supports the work of Guskey (2002) and Selwyn (2016), who argue that effective teacher development requires ongoing, targeted training that addresses the specific challenges teachers face in their classrooms. Without such programs, teachers may continue to struggle with integrating technology effectively, even when resources are available.

Intersection of Digital Divide and Teacher Development

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Perhaps the most significant finding from this study is the intersection between the digital divide and teacher development. The results indicate that the two challenges are closely linked: teachers' ability to mitigate the effects of the digital divide depends largely on the quality of their digital literacy training. In schools where teachers had received adequate training, even limited access to digital tools was utilized effectively. For example, in one rural school where teachers had participated in a digital literacy program, students were engaged in project-based learning activities using shared tablets. Despite having fewer resources, the teachers' ability to creatively integrate technology helped bridge the digital divide to some extent.

Conversely, in schools where teacher development programs were lacking, the digital divide was more pronounced, even when digital tools were available. Teachers who were not confident in their use of technology tended to fall back on traditional methods, leaving digital tools underutilized. As a result, students in these schools did not fully benefit from the available technology, further widening the gap between them and students in better-resourced, better-trained environments.

This finding aligns with Lawless and Pellegrino's (2007) argument that teacher development is a critical mediating factor in addressing the challenges posed by the digital divide. Schools cannot simply provide digital tools and expect equitable learning outcomes; they must also invest in comprehensive teacher training that equips educators with the skills to use these tools effectively.

Implications for Policy and Practice

The study's findings have several important implications for policy and practice. First, efforts to bridge the digital divide in elementary education must go beyond providing access to digital tools. Policymakers should focus on ensuring that all students, regardless of their socio-economic background, have access to both digital devices and the internet, both at school and at home. Programs that provide free or subsidized internet access and devices to low-income families could help address the socio-economic aspects of the digital divide.

Second, teacher development programs must be restructured to place a greater emphasis on digital literacy and pedagogical skills. These programs should provide practical, hands-on training that is tailored to the specific needs of teachers in different contexts. In rural areas, where access to digital resources is limited, training should focus on creative ways to integrate technology into lessons, even with minimal resources. In urban areas, more advanced training on interactive and project-based learning using digital tools could enhance the effectiveness of technology in the classroom.

Discussion

H1: The Digital Divide Has a Significant Negative Impact on the Learning Outcomes of Elementary School Students.

Improve Digital Infrastructure in Rural and Underserved Areas

The digital divide, especially in rural and under-resourced schools, hampers students' ability to engage in modern learning practices. Therefore, the government, educational institutions, and stakeholders should focus on:

Expanding broadband internet access: Prioritize schools in rural and underserved areas by developing national initiatives for better internet infrastructure. This will allow students and teachers to access digital learning materials more easily.

Providing affordable devices for students: Implement programs that distribute affordable or subsidized devices like laptops or tablets to students, ensuring they can participate in digital learning both at school and at home. Special attention should be given to low-income households to close the socio-economic gap.

Establish Community Digital Access Centers

For students who lack digital access at home, community learning hubs or digital access centers should be created. These centers would:

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Provide access to internet and technology outside of school hours, especially in rural or low-income areas.
Allow students to engage in digital learning in a supportive environment with necessary technological resources.

H2: Teacher Development Programs That Include Digital Literacy Training Positively Influence the Ability of Teachers to Integrate Technology into Elementary Classrooms.
Revamp Teacher Development Programs to Focus on Digital Literacy
Teacher development programs must be redesigned to include digital literacy and technology integration training as core components. Specifically:
Ongoing digital literacy training: Teachers should be regularly trained in the effective use of digital tools, particularly in delivering interactive, student-centered lessons. These training sessions should be practical and hands-on, allowing teachers to explore how they can implement these tools in various subjects.
Peer mentoring and support systems: Schools should encourage a culture of peer collaboration where more technologically adept teachers can mentor those less familiar with digital tools. This mentorship can occur through workshops or peer-teaching strategies.
Develop a Support System for Continuous Teacher Learning
Professional learning communities (PLCs): Establish PLCs where teachers can meet regularly to discuss challenges, share strategies, and collaborate on integrating technology into their classrooms.
Incentivize professional development: Provide financial incentives or career advancement opportunities for teachers who participate in and implement digital literacy programs in their teaching. This will encourage teachers to prioritize their own professional development in this area.

H3: Teacher Development Mediates the Relationship Between the Digital Divide and Student Learning Outcomes, Reducing the Negative Effects of the Digital Divide.

Provide Integrated Support for Schools Facing Both Digital Divide and Teacher Development Issues. Given that teacher development plays a mediating role in addressing the digital divide, an integrated approach to improving both teacher training and digital access is essential. Key strategies include:
Bundling digital literacy programs with technology infrastructure investments: When rolling out technology in schools, provide simultaneous training and support for teachers to ensure they can use the tools effectively. Without proper training, simply providing technology will not lead to meaningful improvements in learning outcomes.
Contextualized teacher training: Tailor digital literacy training programs to the specific needs of rural and urban schools. Teachers in rural areas, where resources are scarcer, may need training in how to make the most of limited technological resources, while urban teachers might benefit from more advanced training on incorporating digital tools into interactive learning.
Establish Monitoring and Evaluation Systems for Teacher Development and Technology Use
To ensure that both teacher development and technological infrastructure are being used effectively:
Regular monitoring: Implement a system where schools are regularly monitored and evaluated on their integration of digital tools and the effectiveness of teacher training. Schools that are lagging behind can be provided with additional support and resources.

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Data-driven adjustments: Use the data collected from monitoring to adjust teacher development programs and resource allocations. For example, schools that demonstrate lower levels of technology use may need more hands-on support or follow-up training.
Additional Recommendations Based on Holistic Analysis
Foster Parental Involvement in Digital Learning
Parental involvement plays a crucial role in bridging the digital divide outside the classroom. Recommendations to support this include:
Parent digital literacy programs: Schools should offer workshops for parents to help them understand the digital tools their children are using. This can enhance parental support and engagement in the child's digital learning journey.
Collaborate with communities: Schools and local communities should collaborate to ensure that parents and caregivers are informed about and involved in the technology and learning processes of their children.
Increase Government and Private Sector Collaboration
To sustain improvements in both infrastructure and teacher development, governments should collaborate with private companies, NGOs, and other stakeholders to:
Expand funding and resources: Encourage private companies to contribute technology resources and digital training through corporate social responsibility (CSR) programs.
Public-Private Partnerships (PPPs): Foster partnerships where the private sector can assist in funding or providing technological solutions, while the government ensures that these resources reach the most vulnerable schools and teachers.

CONCLUSION

The hypotheses proposed in this study highlight the significant role of both the digital divide and teacher development in shaping elementary education outcomes. Addressing the digital divide requires a multi-faceted approach that involves improving infrastructure, ensuring equitable access to technology, and enhancing teacher capabilities. Additionally, teacher development programs must be comprehensive and sustained to ensure that educators are equipped to mitigate the challenges posed by the digital divide. Through these targeted interventions, it is possible to create a more equitable and effective education system for all elementary students, regardless of their geographic or socio-economic background.

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