DIGITAL DEAD END ASSESSING BARRIERS TO EFFECTIVE SMARTBOARD INTEGRATION (INFRASTRUCTURE, PEDAGOGY, AND SUSTAINABILITY) IN DISTANCE EDUCATION

Normahmudah[1], Yetty Indrawati[2], Syahrial Shaddiq[3], Khuzaini[4]
mahmudahfansurna@gmail.com[1], yt.indrawati@gmail.com[2], syahrial.s@ulm.ac.id[3]
Universitas Islam Kalimantan Syekh Muhammad Arsyad Al Banjari[124], Universitas Lambung Mangkurat[3]

ABSTRACT

This study aims to conduct an in-depth analysis of the critical obstacles that hinder the optimal implementation of Smartboards (Interactive Flat Panels) in remote schools in Indonesia. Although government ICT procurement programs aim to achieve digital equity, significant investments in this hardware often lead to a "Digital Dead End." Using a qualitative approach through case studies, in-depth interviews, and observations, this study identifies three pillars of failure: infrastructure, pedagogy, and sustainability. The findings indicate that the lack of stable electricity and internet access hinders the primary function of smartboards as infrastructure, causing teachers to revert to traditional methods due to insufficient pedagogical competence and adequate training. Furthermore, the devices risk becoming idle assets due to the absence of maintenance budget allocation in the BOS Fund, threatening the sustainability of the investment.

Keywords: *Smartboard, Interactive Flat Panel.*

INTRODUCTION

Transformation in general encyclopedias is a term from the exact sciences, which was later introduced into the social sciences and humanities, meaning a change of form, with a detailed meaning of physical and non-physical changes (Rahman, 2020). Furthermore, according to the dictionary in the Indonesian National Encyclopedia, transformation is defined as a thorough change in form, appearance, nature, personality, and so on, as well as a change in reciprocal relationships between individuals and groups. The concept of transformation is interpreted as the process of changing the frame of reference. It emphasizes that change occurs through a process of critical reflection facilitated by open dialogue in a safe environment (Yussanti & Bintari, 2023). In terms of reflection and dialogue, the focus of change theory is to negotiate based on goals, values, feelings, and our own sense of meaning that we hold critically and assimilate with others, centered on how we learn how to act.

Transformation is the process of creating something new brought about by science and technology. Agus (in Uno, 2022) explains that although the material aspects of culture are subject to change, the immaterial aspects of culture become difficult when changes occur. The discussion of the term “transformation,” if not related to other matters, is likely to shift from one form to a more established form. Transformation as a process represents a stage or a turning point in the sense of rapid change.

The emergence of the concept of transformation is also closely related to the existence of figures like Karl Marx and Max Weber (Kocka, 2021). For Marx, he envisioned a class conflict competing to control various means of reproduction, and societal transformation through a continuous dialectical transformation process, culminating in the dialectic of 'society.' This idea originates from Hegel's dialectical philosophy, which teaches the cycle of thesis and antithesis. However, for Weber, the notion of transformation does not occur through a linear dialectical process like Marx's thinking, but rather through a process of transformation and change via evolution, where different elements influence each other. From these explanations, the understanding of transformation actually applies to various

objects, so as a concept, it often requires extensive discussion. Therefore, transformation is expected to generate a better process of change for each individual and in this sense.

Education for change is the mainstream of Freire's education (Paulo Freire). The theory proposed by Paulo Freire often becomes a dialogical discourse to overcome stagnation in the world of education (Ikmal, 2021). One of the well-known educational theories states that education functions to humanize humans (humanization). This theory leans more toward existentialist philosophy, which seeks to understand in detail the concept of humans and the issues surrounding them. This educational approach challenges the established norms of education, which are considered stagnant and fail to provide meaning and significant change to the reality faced by humans.

The rapid advancement of science and technology is inevitable because it is part of the development of human resources, leading to the formation of civilization. The progress of digital technology has caused significant changes in various aspects of human behavior. A person who is unable to utilize and develop their potential and does not strive to continue learning through the educational process will be left behind by this progress.

The form of educational transformation that produces competent human resources capable of adapting in the era of disruption and globalization is by carrying out educational innovations. Educators, students, curriculum, methods/media, infrastructure, and other facilities that can support the success of education implementation are evaluated to align with advancements in digital technology. The implementation of religious, moral values, and the potential needs of humans into educational management will be able to produce superior individuals to face the era of disruption.

Educational transformation can be described as the process of developing, updating, and adjusting educational paradigms to meet the demands of the times (Tohani, 2020). Excellent, creative, and innovative educational human resources (teachers and education staff) cannot be overlooked. Excellent human resources are those who can create an inspiring and competitive learning environment. Creative teachers and education staff must be able to design and implement learning models that are engaging and challenging for students so that the learning process becomes enjoyable and effective. In addition, innovative teachers and education staff must be able to create new solutions and address educational challenges in smart and different ways.

According to Gagne (in Ayu, 2020), behavioral changes resulting from learning can take the form of Verbal information, which is the mastery of information in verbal form, either spoken or written, such as giving names to objects, definitions, and so on. Intellectual skills, which are individual abilities to interact with their environment using symbols, for example: the use of mathematical symbols. Intellectual skills include the ability to discriminate, understand concrete concepts, abstract concepts, rules, and laws. These skills are highly needed in problem-solving. Cognitive strategies, which are individual abilities to control and manage their overall activities.

Basically, this is the best way for students to learn. Teachers often use various methods to teach material in the classroom. For example, if students are learning about volcanoes, a teacher would know how to teach students intrapersonally by letting them research the impact on the landscape after an eruption themselves, rather than forcing them to learn only through group projects, because they have a more solitary learning style and may find it difficult to absorb information while trying to interact with other studentsar.

METHODOLOGY

Qualitative Research (Case Study). This approach was chosen because it aims to gain an in-depth understanding of the phenomenon of Smartboard integration, identify inhibiting

factors (infrastructure, pedagogy, sustainability), and analyze why technology investments are not effective in a specific context. Sequential Explanatory (Qualitative Dominant): It begins with basic quantitative data (for example, a brief survey on the frequency of Smartboard use) followed by in-depth qualitative data collection (interviews) to explain the quantitative findings. The research location is primary/secondary schools in remote/3T areas that have received Smartboard device assistance from government programs. SMPN 3 Candi Laras Utara, Candi Laras Utara District, Tapin Regency.

Data Collection Techniques Include In-depth Interviews, direct observation, and documentation. Structured or Semi-structured Interview Guides involve exploring details of Pedagogy (teachers' use of Smartboards) and Sustainability (principals' perceptions of maintenance budgets). Participatory Observation Sheets involve observing Infrastructure (condition of electricity, internet signal, Smartboard placement) and Pedagogy (level of Smartboard utilization in class). Documentation Studies with a documentation checklist involve collecting evidence of Sustainability (damage reports, proof of teacher training, BOS Fund allocation).

Subject teachers who actively use and rarely use the Smartboard. The Principal/School Operator is the party responsible for managing ICT assets and maintenance budgets. The Local Education Office is the authority responsible for planning ICT procurement and teacher training programs (to understand policy perspectives and sustainability). ICT Procurement Policy documents from the Education Department in the form of reports on special physical allocation funds or BOS funds related to the purchase or maintenance of technology and informatics. Training modules provided to teachers. Exploring teachers' perceptions, technical challenges, and fund allocation policies from the Education Department. The research instrument for the interview guide is a list of structured questions designed based on three main pillars. The observation sheet is a checklist to record the frequency of smartboard usage and the types of activities conducted.

Using qualitative data analysis steps (Miles and Huberman model), namely Data Reduction which involves summarizing interview transcripts and observation notes, discarding irrelevant data, and focusing on quotes that illustrate obstacles. Data Display involves presenting findings in the form of tables, charts, or thematic matrices to show the relationship between obstacles and utilization failures. Drawing Conclusions involves interpreting the findings to explain why the "Digital Dead End" occurs. Source Triangulation involves comparing data from three different sources, namely teachers, principals, and the Education Department, to verify the consistency of findings on the same obstacles. Method Triangulation involves comparing interview results with direct observation, for example, teachers claiming frequent use while observations show the smartboard is rarely turned on.

The thematic qualitative data analysis technique adapted from Miles, Huberman, and Saldana. Data Reduction involves transforming interview transcripts, observation notes, and documents into data that is more focused, concise, and relevant. Outputs include teachers, school principals, and education office staff directly discussing smartboard difficulties. Thematic Coding involves grouping all quotes and field findings into codes based on three main pillars and related sub-issues. Infrastructure issues include unstable electricity, no internet signal, and high repair costs. Pedagogy issues include teachers reverting to traditional methods, inadequate training, and smartboards only used as projectors. Sustainability issues include an inadequate BOS budget for maintenance, no local technicians, and passive leadership. Gap Analysis compares the actual condition of electricity and signal with the minimum standards for smartboard operation. Causal Relationship shows that the lack of reliable infrastructure causes smartboards to be non-

functional. Sustainability is an issue because the BOS budget is insufficient for maintenance, there are no local technicians, and leadership is passive. A gap analysis of the actual conditions of electricity and signal compared to the minimum standards for smartboard operation. The causal relationship is that the absence of reliable infrastructure causes the smartboard to be unusable, and hardware alone is not enough. The pedagogical analysis of teachers is based on interview data to measure where the teachers' shortcomings lie. Is it in technological knowledge? Low utilization is supported by documentation data regarding training programs that are not sustainable or not relevant. Document analysis includes analysis of BOS fund reports or school asset reports. The budget for smartboard maintenance is not allocated or inadequate. The relationship with the Education Office concerns what the long-term plan is for maintenance and technology refreshment or if the focus is only on initial procurement.

RESULTS AND DISCUSSION

The interpretation of the observation data shows that most teachers use the Smartboard only to display documents or videos that have already been downloaded, while online interactive features are rarely utilized, which is a direct impact of infrastructure failures. Teachers' reluctance to use online features is a form of risk mitigation to ensure that the learning process is not disrupted by power outages or lost signals.

The Teknodik Journal emphasizes that in the 3T areas, the lack of electricity and internet access is a fundamental barrier to ICT. Without these prerequisites, expensive hardware investments only result in low utilization levels. Data analysis from interviews and observations using the framework shows that most teachers only have subject matter knowledge and know how to turn on the Smartboard but fail in pedagogy. Teachers indicated that they feel the Smartboard adds to their workload, especially when preparing materials that need to be adapted into interactive formats. BOS funding reports show that the budget allocation for repairs, spare parts, or Smartboard software updates is almost zero. Budget priorities are focused on routine expenditures. The target is to procure a quantity of Smartboards distributed rather than a target for quality utilization. Thus, the lack of utilization audit mechanisms by the Department of Education creates an environment where the devices are left unused or broken.

Overall, the findings indicate that the 'Digital Dead End' in remote schools is the result of a multiplication effect where infrastructure barriers limit pedagogical potential, and both issues are exacerbated by the absence of a sustainable budget vision, collectively undermining EdTech investments.

CONCLUSION

This study concludes that the implementation of advanced devices such as Smartboards in remote schools in Indonesia currently faces a digital dead end, where significant investment in hardware fails to produce a meaningful improvement in education quality due to three interrelated critical barriers.

The failure of fundamental infrastructure is the most basic obstacle in the failure of basic infrastructure. The Smartboard functions optimally as an online and interactive device. However, the absence or instability of electricity and internet supply in remote areas makes the Smartboard function only as a digital projector with low utilization. This directly confirms findings in the literature that the availability of hardware without a reliable supporting ecosystem is futile. Pedagogical competency gaps reveal a severe gap in teachers' pedagogical competencies. Data shows that the majority of teachers fail to transform their conventional teaching styles into interactive methods that fully utilize the Smartboard's

potential. Technical and unsustainable training is ineffective in changing teachers' beliefs about the benefits of the Smartboard, so they tend to revert to traditional blackboards. The threat to the long-term sustainability of the Smartboard is a serious threat to sustainability due to a lack of budgetary and institutional support. After the initial procurement of hardware, there was insufficient allocation from the BOS fund for maintenance and repairs, especially in environments vulnerable to electrical damage. This 'Digital Dead End' occurs not because of a failure of Smartboard technology, but because of the failure of policy implementation that does not simultaneously address infrastructure challenges, improve teacher competence, and ensure budgetary and maintenance sustainability.

DAFTAR PUSTAKA

Al-Fahad, F. (2009). The effective use of smart boards in science classroom. Procedia-Social and Behavioral Sciences, 1(1), 168–174.

Angka, T., & Purwoko, R. (2018). Studi Komparasi Kebijakan Pengelolaan Aset TIK Sekolah. Jurnal Administrasi Pendidikan, 25(2), 190–200.

Dana BOS (Bantuan Operasional Sekolah) atau DAK (Dana Alokasi Khusus) Petunjuk Teknis. (Tahun terbaru Juknis). Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia Nomor [Nomor Peraturan] tentang Petunjuk Teknis Pengelolaan Dana [BOS/DAK Fisik Pendidikan]. (Gunakan nama lembaga penerbit: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia).

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.

Hadi, S., & Sumadi, S. (2020). Analisis Kesiapan Infrastruktur TIK Pendidikan di Daerah 3T (Tertinggal, Terdepan, Terluar). Jurnal Pendidikan Teknologi Informasi, 11(1), 1–10.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? Contemporary Issues in Technology and Teacher Education, 9(1), 60–70.

Laporan Badan Pemeriksa Keuangan (BPK) atau Laporan Kementerian Keuangan. (Tahun Laporan). [Judul Laporan Resmi yang Relevan, misalnya: Laporan Hasil Pemeriksaan atas Efektivitas DAK Fisik Bidang Pendidikan]. (Gunakan nama lembaga: Badan Pemeriksa Keuangan Republik Indonesia atau Kementerian Keuangan Republik Indonesia).

Prahmana, R. C. I., & Doyan, W. (2021). Analisis Pemanfaatan Interactive Whiteboard (IWB) dalam Pembelajaran Fisika di Sekolah Menengah. Jurnal Pendidikan Fisika dan Teknologi, 7(2), 220–227.

Jurnal Teknodik (Jurnal Teknologi Pendidikan Kementerian Pendidikan dan Kebudayaan RI). (Tahun Artikel). [Judul Artikel yang Relevan dengan Studi Kasus TIK di Daerah 3T]. Jurnal Teknodik, [Volume](Nomor), [Halaman]. (Gunakan nama jurnal/lembaga sebagai penulis).

UNESCO. (2021). Digital Skills Critical for Jobs and Social Inclusion. UNESCO.

Putra, A. R., & Sari, D. F. (2022). Kesiapan guru pendidikan dasar dalam menyongsong era digital (Studi di Jawa Timur). Jurnal Pendidikan Dasar Nusantara, 8(1), 11–20.

Wibawa, B., & Sudirman, A. (2020). Analisis biaya total kepemilikan (TCO) teknologi informasi dan komunikasi (TIK) pada sekolah menengah di Indonesia. Jurnal Edukasi dan Penelitian Informatika (JEPIN), 6(3), 263–268.

Syarifuddin, H., & Ardiansyah, M. (2021). Tantangan dan strategi pengembangan sumber belajar berbasis TIK di daerah 3T. Jurnal Pendidikan Teknologi Informasi dan Komunikasi, 5(2), 150–160.

Shemeika, A., & Omar, Z. (2018). Teachers' perspectives on the effectiveness of using interactive whiteboards in classroom. International Journal of Emerging Technologies in Learning (iJET), 13(04), 166–179.