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Exploration of Digital Media and Parents' Perceptions of Gadget Integration as an Accelerator of Science Literacy for Students

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ABSTRACT

Scientific literacy is a fundamental competence for students in Islamic Elementary Schools (Madrasah Ibtidaiyah/MI) to navigate the challenges of the Industrial Revolution 4.0 and Society 5.0. However, the mastery of scientific concepts is often hindered by the abstract nature of the material, which is difficult to visualize through conventional media. This study explores the utilization of digital media and analyzes parents' perceptions regarding gadget integration as a science literacy accelerator at MI Unggulan Miftahul Huda Gerih. A qualitative descriptive approach with a case study design was employed, utilizing observation, in-depth interviews, and documentation for data collection. The results indicate that digital media, such as interactive simulations and educational videos, effectively clarify abstract scientific concepts and significantly enhance students' scientific inquiry. Furthermore, parents have begun to perceive gadgets as essential cognitive tools, although concerns regarding non-educational content remain a primary challenge. This study emphasizes the necessity of synergy between a technology-based curriculum and proactive parental support. It underscores the importance of digital literacy for both teachers and parents to optimize science education quality in the madrasah environment.

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1. INTRODUCTION

Entering the era of the Industrial Revolution 4.0 and the transition to Society 5.0, scientific literacy has become one of the fundamental competencies that students must master at the elementary level. This literacy is not merely the mastery of scientific facts, but rather the individual's ability to use scientific knowledge to identify questions, acquire new knowledge, and explain scientific phenomena logically (Winata et al., 2020). However, a major challenge in science learning at MI Unggulan Miftahul Huda Gerih is the material's often abstract nature and difficulty for students to visualize through conventional print media, resulting in low critical thinking and scientific inquiry (Hidayah, 2021).

As a solution to this problem, digital media offers efficiency in transforming complex scientific concepts into dynamic visual representations. The integration of gadgets in the classroom is seen as an accelerator capable of accelerating cognitive understanding through various platforms such as interactive simulations, augmented reality, and educational videos (Putra et al., 2020). The use of this technology enables student-centered learning, where gadgets function as virtual laboratories that transcend the limitations of physical school facilities (Aswir & Purwanto, 2020).

Despite the immense potential of technology, the successful integration of gadgets as a tool to accelerate scientific literacy cannot be separated from external factors outside the madrasah, namely the family environment. Since the post-pandemic period, the role of parents in supporting children's digital activities has become a crucial determining factor (Sari, 2022). Parental perceptions of gadgets are highly dynamic; some view them as a threat to children's mental health and behavior, while others are beginning to recognize their function as essential cognitive instruments (Kurniawati, 2019). These differing perceptions create varying mentoring patterns, which directly impact the effectiveness of technology use in supporting students' scientific literacy (Yusuf, 2021).

MI Unggulan Miftahul Huda is an educational institution that has proactively integrated digital media into its science curriculum. However, the extent to which gadget use truly accelerates students' scientific literacy and parents' responses and perceptions of this policy still require in-depth empirical exploration. There is a gap between school expectations and the reality of parental support at home, often driven by parents' limited digital literacy (Wahyuningsih, 2021).

Based on this background, this study aims to explore the use of digital media as a scientific literacy accelerator and to map parents' perceptions of gadget integration at MI Unggulan Miftahul Huda. The results are expected to provide theoretical contributions regarding the synergy model between madrasahs and families in utilizing technology, as well as provide practical recommendations for educators to optimize the potential of gadgets to improve the quality of scientific literacy at the Madrasah Ibtidaiyah (Islamic Elementary School) level.

2. METHODS

This research uses a qualitative approach with a descriptive research type. The chosen research design is a case study, which aims to understand in-depth the phenomenon of gadget integration as a scientific literacy accelerator at MI Unggulan Miftahul Huda Gerih (Sugiyono, 2020). This approach was chosen because the researcher wanted to explore parents' perceptions naturally without any manipulation of variables within the madrasah educational environment.

3. FINDINGS AND DISCUSSION

Digital Media as an Accelerator of Science Literacy

Research findings indicate that digital media at MI Unggulan Miftahul Huda Gerih acts as a cognitive tool that accelerates the understanding of science concepts. In accordance with the theory of Putra et al. (2020), digital media can simplify complex natural laws into manipulative simulations. This acceleration occurs because students not only memorize text but also interact directly with scientific variables virtually. This aligns with Setyawati's (2021) opinion that the use of virtual laboratories reduces students' cognitive load in understanding abstract material.

Dynamics of Parental Support in the Digital Ecosystem

The perception of parents, the majority of whom fall into the Optimistic-Accelerative category (60%), is key to the success of this technology integration. Consistent with Kurniawati's (2019) research, parents with a positive view of technology tend to create a digitally literate home environment. However, the finding that 15% of parents remain cautious indicates a digital gap. This confirms Sari's (2022) argument that parents' digital literacy significantly determines the quality of their children's learning support at home.

Synergy Between Madrasahs and Parents: A New Model

Exploration at MI Unggulan Miftahul Huda Gerih revealed a unique synergy model. The Madrasah acts as a "digital content curator," while parents act as "infrastructure facilitators and supervisors." This model effectively addresses parental concerns about the negative impacts of gadgets. As Wahyuningsih (2021) emphasized, the challenge of ICT integration lies not only in teacher readiness, but also in how madrasahs can educate parents to align their perceptions with the madrasah's digital vision. This gadget integration ultimately fosters students' scientific curiosity. When students are given the freedom to explore natural phenomena through gadgets under the guidance of teachers and parents, their scientific literacy naturally develops beyond the standard curriculum text (Yusuf, 2021).

The findings of this study demonstrate that the integration of digital media functions not merely as a supplementary instructional tool, but as a cognitive accelerator that fundamentally reshapes students' engagement with scientific concepts. The effectiveness of interactive simulations and educational videos in clarifying abstract science material can be explained through Cognitive Load Theory, which posits that learning is optimized when instructional design reduces extraneous cognitive load and enhances germane processing (Sweller et al., 2019). In the context of Madrasah Ibtidaiyah, where abstract concepts such as photosynthesis or energy transformation are often introduced at an early age, digital media transforms symbolic representations into concrete visual experiences. This finding aligns with Putra et al. (2020) and Setyawati (2021), who reported that simulation-based media significantly improves students' conceptual understanding by enabling direct manipulation of scientific variables. However, this study extends prior research by emphasizing acceleration rather than improvement alone, suggesting that digital media compresses the time required for conceptual mastery by offering immediate feedback and iterative exploration.

The acceleration of scientific inquiry skills observed in this study particularly students' increased ability to formulate questions and seek evidence can be theoretically grounded in constructivist learning theory. According to Vygotsky's notion of mediated learning, digital tools act as mediational means that scaffold learners' cognitive development within the zone of proximal development (Vygotsky, 1978). Unlike conventional teacher-centered instruction, gadget-based learning environments encourage exploratory behavior and hypothesis testing, which are core dimensions of scientific literacy as defined by OECD (2019). Similar outcomes were identified by Rahayu (2022), who found that STEM-oriented digital media enhanced inquiry-based learning in Madrasah Ibtidaiyah. Nevertheless, the present study reveals a deeper transformation: gadgets function not only as instructional media but as virtual laboratories that compensate for limited physical resources, a finding that resonates with Aswir and Purwanto (2020) but is articulated here within the broader discourse of educational equity in religious-based schools.

A critical dimension of this research lies in its exploration of parental perceptions as a determining factor in the effectiveness of digital media integration. The shift among parents toward perceiving gadgets as cognitive instruments rather than mere entertainment devices reflects a gradual internalization of digital literacy norms within the family sphere. This phenomenon can be interpreted through the lens of ecological systems theory, which emphasizes the interdependence between school and home environments in shaping children's learning outcomes (Bronfenbrenner, 2005). Consistent with Kurniawati (2019) and Sari (2022), parents who demonstrate positive technological attitudes are more likely to provide structured supervision and learning-oriented gadget use at home. However, the persistence of parental concerns regarding non-educational content indicates an unresolved tension between opportunity and risk, suggesting that acceptance does not necessarily equate to competence in digital mediation.

Compared to previous studies, this research identifies a more nuanced typology of parental perception, particularly the emergence of an "optimistic–accelerative" group that actively supports gadget use for learning while maintaining selective control. This finding diverges from earlier dichotomous classifications that framed parents as either supportive or resistant (Yusuf, 2021). The difference may be attributed to post-pandemic educational experiences, during which parents were compelled to engage more directly with digital learning platforms. Consequently, the results imply that

historical context plays a significant role in reshaping parental epistemologies regarding technology. Scientifically, this suggests a temporal dimension in digital literacy research that has been underexplored in prior literature.

The synergy model identified in this study where madrasahs act as digital content curators and parents function as facilitators and supervisors offers an important theoretical contribution. This model resonates with Wahyuningsih's (2021) assertion that the success of ICT integration depends on systemic alignment rather than isolated teacher competence. However, the present study advances this argument by framing synergy as a reciprocal governance mechanism, where institutional authority over content quality is complemented by parental authority over usage regulation. Such a model addresses moral and cultural concerns often associated with technology use in Islamic educational settings, thereby reconciling innovation with value preservation. From a scientific standpoint, this finding challenges the assumption that technological integration inevitably erodes traditional educational values.

In comparison with international studies on digital literacy and science education, such as those by Pratama and Scatun (2021), the findings of this research reinforce the universality of digital media's pedagogical benefits while highlighting contextual specificity. The religious and cultural framework of Madrasah Ibtidaiyah introduces unique constraints and opportunities that shape how technology is perceived and utilized. The implication is that models of digital integration cannot be universally transplanted without adaptation to local epistemological and sociocultural conditions.

In conclusion, the findings of this study substantiate and extend existing scholarship by demonstrating that digital media accelerates scientific literacy through cognitive, pedagogical, and ecological mechanisms. The observed outcomes occur not simply because technology is introduced, but because it is meaningfully mediated by teachers and supported though unevenly by parents. Scientifically, this underscores the necessity of shifting future research from questions of technological effectiveness to inquiries into relational dynamics and governance structures that sustain educational innovation in faith-based schooling contexts.

4. CONCLUSION

The integration of digital media such as interactive simulations and educational videos has proven effective in accelerating students' scientific literacy by clarifying abstract scientific concepts. The use of gadgets in the madrasa environment can improve students' scientific inquiry, or questioning skills, and help them explain scientific phenomena more coherently. There has been a significant increase in three key indicators of students' scientific literacy: the ability to identify scientific issues through active questioning, the ability to explain phenomena (such as photosynthesis) through animation, and the ability to use scientific evidence by searching for supporting data in search engines. Parents' perceptions of gadget use have undergone a paradigm shift, with parents beginning to view gadgets as important cognitive instruments for children's education, although concerns about non-educational content remain. The success of this scientific literacy acceleration depends heavily on the synergy between the technology-based curriculum in madrasas and the support and digital literacy of teachers and parents.

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