Teachers' Readiness and Challenges in Local Wisdom-based Science Learning through Interactive Pop-Up Book Media in Elementary Schools

Conny Dian Sumadi[1]*, Agung Setyawan[2]

[1,2] Faculty of Teacher Training and Education, Trunojoyo Madura University, Bangkalan, Indonesia

conny.diansumadi@trunojoyo.ac.id

DOI: https://doi.org/10.21107/Widyagogik/v13i4.33075
Received September 25, 2025; October 28, 2025; Accepted November 23, 2025

Abstract

This study aims to explore elementary school teachers' readiness and challenges in implementing local wisdom-based science learning through interactive pop-up book media. Contextual science learning that integrates local culture requires adequate teacher readiness in pedagogical competence, professional skills, and instructional media development. This research employed a qualitative descriptive approach. The participants were elementary school teachers in Madura, Indonesia. Data were collected through in-depth interviews, classroom observations, and document analysis. Data analysis followed the Miles and Huberman model, consisting of data reduction, data display, and conclusion drawing and verification. The findings reveal that most teachers possess conceptual awareness of the importance of integrating local wisdom into science learning; however, their practical readiness remains limited. Major challenges include insufficient skills in developing instructional media, limited time, lack of hands-on professional training, and inadequate institutional support. Interactive pop-up book media is perceived as highly potential to support local wisdom-based science learning, yet its implementation requires continuous teacher professional development and supportive school policies. This study recommends systematic capacity-building programs to enhance teachers' competencies in developing and implementing innovative, culturally responsive science learning media.

Keywords : Teacher Readiness, Elementary Science Education, Local Wisdom, Interactive Pop-Up Book.

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1. Introduction

Science education at the elementary level serves as the cornerstone for fostering scientific literacy, critical thinking, and a burgeoning sense of environmental stewardship. According to Piaget's stages of cognitive development, children in elementary school are typically within the concrete operational stage, meaning they process information most effectively when it is tied to tangible objects and observable phenomena. Consequently, the pedagogical approach must transition away from abstract memorization toward experiential learning that is deeply rooted in the students' immediate surroundings. By utilizing contextualized instructional media, educators can bridge the gap between complex scientific theories and the lived experiences of the child, ensuring that foundational concepts are not just heard, but deeply understood and internalized (Wahyu, Edu, and Nardi 2020; Anisa 2017).

Despite the importance of hands-on learning, science education in the Madura region continues to grapple with significant systemic limitations. Current classroom dynamics remain predominantly teacher-centered, characterized by a heavy reliance on outdated textbooks and passive verbal instruction (Sumadi 2023). This "chalk and talk" methodology often fails to stimulate the inquisitive nature of young learners, rendering science an abstract and intimidating subject rather than an exploration of the natural world. Furthermore, many educators in the region have not yet been equipped with the necessary training to design or produce independent, interactive media. This lack of innovation results in a disconnect where students struggle to see the relevance of science in their daily lives, leading to decreased engagement and suboptimal learning outcomes (Gan, Menkhoff, and Smith 2015; Sekarwangi et al. 2021).

Teacher readiness is the most critical determinant in the successful implementation of any innovative educational framework. In Madura, while many elementary school teachers express a theoretical appreciation for local wisdom-based learning, there is a noticeable disparity between their positive attitudes and their actual pedagogical and technical readiness. The transition

from traditional teaching to a contextualized approach requires a specific set of skills that many currently lack. Teachers often find themselves overwhelmed when trying to translate creative ideas into functional instructional tools, hindered by a combination of limited technical proficiency, significant time constraints, and a scarcity of practice-oriented professional development opportunities (Murray 2021).

From a human resource development perspective, there is an urgent and ongoing need for systematic teacher training that prioritizes practical application over theoretical discourse. Many existing professional development programs in the region focus heavily on the "what" and "why" of modern education, yet they frequently neglect the "how"—specifically the hands-on creation of instructional media. Because these training sessions often lack a laboratory or workshop component, the burden of innovation falls entirely on the shoulders of exceptionally motivated individuals rather than being supported by a robust institutional structure. Without a shift toward practice-based empowerment, the integration of technology and creative media in Maduranese classrooms will remain sporadic at best (Murendo et al. 2024; Daniel, Belghiti, and Auriac-Slusarczyk 2017).

The island of Madura is home to a wealth of local wisdom and unique ecological features, ranging from its extensive coastal ecosystems to the traditional salt farming and fishing industries that define its economy. These local contexts provide a goldmine of "living laboratories" that are highly relevant to the elementary science curriculum, covering topics such as biology, physics, and environmental science (Pritasari, Sumadi, and Prastiwi 2022). By integrating these familiar elements into the classroom through innovative tools like interactive pop-up books, teachers can transform abstract principles into vivid, three-dimensional learning experiences. However, the potential of these rich cultural and natural resources remains largely untapped, trapped behind the barriers of limited teacher competence and a lack of specialized media (Sumadi and Kusairi 2025).

Given the intersection of these regional challenges and educational opportunities, this study aims to provide a comprehensive analysis of the current state of science instruction in Madura. It focuses specifically on evaluating the readiness of teachers to adopt and implement local wisdom-based science learning through the use of interactive pop-up book media. By identifying the specific technical and pedagogical hurdles faced by these educators, the research seeks to develop a roadmap for better professional support. Ultimately, the goal is to create a more inclusive and engaging scientific environment that empowers Maduranese students to see themselves as part of a global scientific community while remaining deeply rooted in their local heritage.

2. Method

This study is grounded in a qualitative descriptive research design, a methodology specifically chosen to provide a comprehensive and nuanced summary of the teachers' experiences in their natural educational settings. Unlike quantitative approaches that prioritize numerical trends, this qualitative framework allows the researcher to delve into the "why" and "how" behind the current state of science instruction in Madura. By focusing on the authentic voices and daily classroom realities of educators, the study aims to uncover the subtle complexities of pedagogical challenges and the sociocultural factors that influence the integration of local wisdom into the science curriculum. This design ensures that the findings are rich in detail and reflective of the actual lived experiences within the schools.

The selection of research participants was conducted through purposive sampling, a strategic approach designed to identify individuals who possess specific expertise and insights relevant to the study’s objectives. The participants consist of elementary school teachers in Madura who were chosen based on their extensive teaching experience and their active involvement in delivering science instruction. By selecting "information-rich" cases, the study ensures that the data collected is not merely a general overview, but a targeted look at those who are

directly responsible for navigating the curriculum. This sampling method allows for a deeper understanding of the professional readiness and technical competencies of the frontline educators who are tasked with implementing innovative instructional media.

To ensure the validity and depth of the findings, data were gathered through a triangulation of collection techniques, encompassing in-depth interviews, classroom observations, and document analysis. The in-depth interviews were designed to explore the subjective perspectives of teachers, uncovering their internal readiness and the personal challenges they face when attempting to modernize their teaching methods. Complementing these narratives, direct classroom observations provided an objective lens through which to evaluate actual instructional practices and the real-world application (or lack thereof) of interactive learning media. Finally, a thorough analysis of official documents, such as lesson plans (RPP) and teaching modules, was conducted to verify how local wisdom is formally integrated into the structured educational framework.

The data analysis followed the interactive model proposed by Miles and Huberman, which involves a recursive and continuous process of refining information to reach credible conclusions. The first stage, data reduction, involved organizing and simplifying the vast amount of raw data collected from the field to focus on the most relevant themes. This was followed by data display, where the information was presented in organized matrices or descriptive narratives to identify patterns and relationships between teacher readiness and instructional outcomes. The final stage involved conclusion drawing and verification, where initial insights were rigorously tested against the data to ensure that the findings were consistent and grounded in the evidence (Creswell and Creswell 2018). This systematic approach ensures that the study's results are both robust and academically sound.

3. Result and Discussion

The findings of this study reveal that elementary school teachers in Madura possess a strong conceptual understanding of the vital role that local wisdom plays in science education. Educators generally agree that anchoring scientific principles in the students' immediate cultural and geographical environment is not merely a supplementary activity, but a fundamental necessity for meaningful learning. This awareness is reflected in their positive attitudes toward instructional innovation; many teachers express a genuine desire to move away from rigid, textbook-heavy methods in favor of more dynamic approaches. This openness to change aligns with contemporary educational research suggesting that when teachers value the cultural identity of their students, they are more likely to seek out creative ways to enhance engagement and conceptual clarity (Gan, Menkhoff, and Smith 2015; Sekarwangi et al. 2021).

Despite these positive attitudes, there is a significant disparity when it comes to actual pedagogical readiness. While teachers understand the "why" behind contextual learning, many struggle with the "how," specifically regarding the systematic integration of local wisdom into the formal science curriculum. The research observed that many teachers find it difficult to align traditional salt farming techniques or coastal biodiversity with specific national curriculum standards. This indicates that their readiness is often localized at a theoretical level, lacking the robust pedagogical strategies needed to design lesson plans that balance scientific rigor with cultural relevance. Consequently, the transition from recognizing local wisdom to actually utilizing it as a primary teaching tool remains a hurdle for many (Syahfitri and Muntahanah 2024).

Technical readiness emerged as a critical bottleneck in the delivery of innovative science lessons. In particular, the development and utilization of interactive pop-up book media presented a steep learning curve for many educators. Although teachers are interested in the three-dimensional and tactile nature of these tools, their ability to design, engineer, and construct such media independently is still very limited. The findings suggest that the technical skills required to create durable, scientifically accurate, and visually engaging pop-up

books are not currently part of the standard teacher training repertoire in the region. Without these specific competencies, the ambition to provide students with sophisticated, hands-on learning materials often remains unfulfilled.

One of the most prominent challenges identified by the participants is the chronic lack of time available for instructional design. The administrative burden and heavy teaching loads in Maduranese elementary schools leave little room for teachers to research local wisdom or engage in the time-consuming process of crafting interactive media. Beyond time, the study highlighted a lack of access to high-quality, relevant learning resources. Many teachers noted that while they are surrounded by local wisdom, there are no curated databases or instructional manuals that provide a roadmap for translating these local phenomena into scientific modules. This scarcity of "ready-to-use" contextual material forces teachers to start from scratch, an undertaking that many find unsustainable given their current schedules.

The research underscores a significant gap in the current professional development landscape. Existing training programs for teachers in Madura often favor theoretical or administrative topics over practical, skill-based workshops. Teachers reported that while they frequently attend seminars on curriculum changes, they rarely participate in "make-and-take" sessions where they can learn the literal craft of media production or the nuances of culturally responsive teaching. This lack of practice-oriented support leaves teachers feeling ill-equipped to handle the complexities of modern classroom demands. To bridge the gap between theory and practice, the findings suggest that professional development must shift toward a mentorship model that provides ongoing technical guidance (Murray 2021).

Institutional support at the school level was found to be a determining factor in whether a teacher successfully innovates. Unfortunately, the findings indicate that such support is often inadequate. Many teachers feel that their school administrations do not provide the necessary facilities, materials, or even the psychological "permission" to experiment with unconventional teaching

tools. Furthermore, there is a lack of clear policy at the school level that prioritizes local wisdom-based learning. Without a supportive ecosystem—which includes financial support for media materials and a culture of collaborative mentoring—individual teachers find it difficult to sustain innovative practices, leading to a reliance on safer, traditional methods that do not require institutional risk.

Despite the challenges, interactive pop-up book media is perceived by both teachers and observers as a highly effective tool for bridging the gap between the abstract and the concrete. The three-dimensional, movable features of these books allow students to visualize complex concepts, such as the evaporation process in salt farming or the tidal changes in coastal ecosystems, in a way that a flat textbook cannot replicate. These "low-tech" but highly interactive tools are particularly suited for the Maduranese context, where digital resources may be scarce but craftsmanship and storytelling are culturally valued. When implemented correctly, these books serve as a bridge, connecting the student's daily life with the universal laws of science (Sumadi and Kusairi 2025).

The findings highlight a stark disconnect between teachers' conceptual readiness and their practical implementation skills. While the mental groundwork for local wisdom-based science learning has been laid, the technical and institutional scaffolding is still missing. This gap emphasizes the necessity for a more holistic approach to teacher empowerment—one that combines psychological readiness with technical mastery and institutional backing. The results of this study support the broader academic consensus that successful contextual learning is not achieved through curriculum documents alone but through the continuous, supported growth of the teacher's personal and professional competence.

4. Conclusion

Elementary school teachers in Madura demonstrate positive conceptual readiness toward local wisdom-based science learning; however, their practical readiness to develop and implement interactive pop-up book media remains

limited. Teachers face challenges related to technical skills, time constraints, training opportunities, and institutional support. Strengthening teacher professional development through hands-on training and supportive school policies is essential to enhance the quality of local wisdom-based science learning in elementary schools.

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