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Transformation of Science Learning in Madrasah Ibtidaiyah Post-Pandemic: A Case Study of Teacher and Student Adaptation to Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok

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ABSTRACT
The Covid-19 pandemic has marked a turning point in the transformation of educational systems, including at the level of primary Islamic schools (madrasah ibtidaiyah), which are now required to adapt to more flexible learning models. Blended Learning, as a combination of face-to-face and online instruction, has emerged as a strategic approach in the post-pandemic context to address the challenges of sustainable learning. This study aims to explore the adaptation processes of teachers and students to the implementation of Blended Learning in science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok, Central Lombok Regency. Employing a qualitative approach through a case study method, data were collected via observations, interviews, and documentation. The findings indicate that teachers have experienced a paradigm shift in designing learning strategies that are more adaptive and responsive to students' needs. Meanwhile, students face challenges in managing their study time, limited access to technology, and fluctuating motivation to learn. Nevertheless, the majority of students reported that blended learning provides a more varied and enjoyable learning experience. These findings reinforce previous studies that emphasise the importance of infrastructure readiness and the active role of teachers in supporting the effectiveness of learning. The implications of this research underscore the necessity of enhancing teachers' digital competencies and the support of school policies in the sustainable and contextual implementation of Blended Learning.

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INTRODUCTION

The Covid-19 pandemic has significantly impacted the education system in Indonesia, including at the Madrasah Ibtidaiyah (MI) level, which possesses distinct learning characteristics and resources compared to general schools (Nahdi, Ramdhani, Yuliatin, & Hadi, 2020; Nugroho & Hadiwinarto, 2020). This global crisis compelled all educational institutions to abruptly transition to online learning, which, while serving as an emergency

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solution, also revealed various issues ranging from disparities in access to technology to the low digital literacy of both teachers and students. In the context of Natural Sciences (IPA) education at MI, this situation presents unique challenges due to the nature of IPA learning, which demands direct engagement, experimentation, and observation (Aisyah, Arisanti, & Yaqin, 2023).

As the emergency phase of the pandemic comes to an end, the education system is beginning to navigate a transition towards a more flexible and sustainable learning model. Blended Learning has emerged as an alternative approach that combines the strengths of face-to-face and online learning (Huriyati, 2020; Nugroho & Hadiwinarto, 2020). Locally, Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok in Central Lombok serves as a concrete example of how educational institutions in rural areas strive to adapt to these dynamics. Through this case study, the researcher highlights the ongoing adaptation process, particularly in IPA education, to understand the extent to which teachers and students are able to respond to the transformation of learning in the post-pandemic era.

The transformation of learning in the post-pandemic period involves not only technical changes but also fundamental aspects of teachers' pedagogical practices and students' learning dynamics (Saputri, Almira Rahma Ruja & Kurniawan, 2024). In the context of Madrasah Ibtidaiyah, especially in the subject of Natural Sciences (IPA), which requires an active and contextual approach, the implementation of Blended Learning presents a distinct challenge that necessitates comprehensive adaptation. Therefore, this research aims to examine how teachers at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok adjust their methods, strategies, and approaches to effectively integrate offline and online learning.

On the other hand, understanding students' responses and adaptations to this learning model is crucial to ascertain the extent to which Blended Learning meets the needs and characteristics of learners at the primary level. This research also seeks to identify the main challenges faced by both teachers and students during the blended IPA learning process, as well as the strategies or solutions developed to address these contextual obstacles.

Reflecting on the complexities of learning dynamics during and post-pandemic, this study aims to describe the transformation of IPA learning in Madrasah Ibtidaiyah as a response to changes in the global education landscape. The primary focus is directed towards the concrete efforts of teachers and students to adapt to the Blended Learning model, which combines the advantages of face-to-face and online learning. This research specifically seeks to investigate the forms of adaptation undertaken by teachers in designing and implementing more flexible, contextual, and student-centred learning strategies. Additionally, this study aims to understand students' responses and adaptation patterns in participating in blended IPA learning, including the challenges they face and how they overcome them. By presenting a case study at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok, this research is expected to provide an empirical depiction that can serve as a reference for the development of post-pandemic learning policies in primary madrasahs, particularly in the field of science.

This research is anticipated to contribute to two primary domains: theoretical and practical. Theoretically, the findings from this study can enrich the body of educational

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literature, particularly concerning the transformation of post-pandemic learning within Madrasah Ibtidaiyah contexts. By focusing on the adaptation of IPA learning through the Blended Learning approach, this research adds empirical references regarding teachers' responses and adaptive strategies, as well as students' learning experiences at the primary level. Meanwhile, practically, the results of this research are expected to provide applicable recommendations for educators, especially IPA teachers, in designing more flexible and responsive learning that aligns with the conditions and needs of learners. Furthermore, the findings of this study may serve as valuable input for policymakers at the madrasah level in formulating policy directions and strengthening institutional capacity to support the sustainable and contextual implementation of Blended Learning. Thus, this research is not only descriptive but also transformative for the development of educational practices in madrasahs post-pandemic.

Natural Sciences (IPA) education in Madrasah Ibtidaiyah plays a crucial role in shaping students' fundamental understanding of natural phenomena and developing critical thinking skills as well as experimental abilities. The characteristics of IPA learning at the primary level demand an interactive and contextual approach, enabling students to relate scientific concepts to their real-life experiences (Hardianti, 2023; Rosi, 2020; Sufiyanto, Khairunisa, & Hefni, 2022). The primary objective of IPA education in Madrasah Ibtidaiyah is not solely focused on mastering material but also on fostering scientific attitudes and a high sense of curiosity. Therefore, learning strategies must be designed adaptively and innovatively to meet the needs and characteristics of learners in an increasingly dynamic era.

Blended Learning, as a model that integrates face-to-face and online learning, has become a strategic solution in addressing the challenges of post-pandemic education (Afriadi & Fatih, 2024; Aisyah et al., 2023; Hikmawati, Ayub, & Busyairi, 2023). Models of Blended Learning, such as station rotation and flipped classroom, allow for methodological variations that can enhance student engagement and learning effectiveness. The strengths of this approach lie in its flexibility and ability to adapt to infrastructure conditions and the needs of learners in primary education. However, its implementation also faces obstacles, particularly concerning teacher readiness, technology access, and student motivation. Previous studies have underscored the importance of the teacher's role as an adaptive facilitator and students' readiness to use technology as key factors for the success of blended learning. This transformation demands comprehensive adaptation in terms of methods, technology, and policy support to create a sustainable and contextual learning ecosystem.

METHOD

This study employs a descriptive qualitative approach with a case study method to gain an understanding of the transformation of science learning through Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok (Kielmann, Cataldo, & Seeley, 2012; Mack, Woodsong, Macqueen, Guest, & Namey, 2005; Oranga & Matere, 2023). The research location was selected purposively as this madrasah represents a context of basic education that has undergone significant changes post-pandemic. The subjects of the study include

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science teachers, students from grades IV to VI, as well as the head of the madrasah, with the potential involvement of parents as additional data sources if necessary. This approach allows for a comprehensive exploration of the experiences, perceptions, and adaptation strategies employed by various stakeholders in the blended learning process (Creswell, 2018; Maxwell, 2013; Suryadmaja, 2025; Suryadmaja & Saearani, 2025).

Data collection was conducted through several techniques, namely classroom observations of science lessons both in-person and online to capture the dynamics of learning directly, interviews with teachers, students, and the head of the madrasah to uncover their subjective perspectives, as well as documentation in the form of Lesson Plans (RPP), teaching materials, and student learning outcomes as supporting analysis material. The collected data were then analysed using the Miles and Huberman model, which includes data reduction, data presentation, and systematic conclusion drawing (Ningsih, Apriawan, Suryadmaja, & Rahmadi, 2024; Ningsih, Saputra, & Suryadmaja, 2025; Sa'o, Mei, Bito, & Mei, 2022; Situmorang, Fatchuroji, Arianti, & Oktariani, 2023). The validity of the data was maintained through source and technique triangulation to ensure the accuracy and credibility of the research findings, thereby producing an authentic and holistic depiction of the adaptation process of science learning through Blended Learning at the madrasah.

RESULTS AND DISCCUSION

The Blended Learning Model Implemented

The implementation of Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok post-Covid-19 pandemic demonstrates a learning pattern that integrates face-to-face (offline) methods with online learning. The Science teachers consistently employ a combination of offline and hybrid approaches as the primary strategy to adapt to the changing dynamics of learning. In this model, face-to-face learning is conducted periodically for materials that require direct interaction and experimental practice, while online sessions are utilised for theoretical explanations and more flexible discussions. This approach has been chosen to optimise time and resources, whilst also considering the technological access limitations faced by some students.

The use of digital platforms such as WhatsApp and Zoom has become a primary supporting instrument in the execution of online learning. WhatsApp is utilised for quick communication, material distribution, and task coordination, while Zoom is employed for virtual meetings that facilitate real-time interaction between teachers and students. The combination of these two applications demonstrates ease of access and effectiveness in maintaining the continuity of learning, even under constrained conditions. The presence of supporting materials such as printed Student Worksheets (LKS) also constitutes an important element in the Blended Learning model, particularly for students who experience internet connectivity issues, thereby enabling them to participate in learning without complete reliance on digital devices.

This learning model requires teachers to be more creative in designing materials and delivery methods to accommodate two different learning environments simultaneously

(Huriyati, 2020; Wahana, Ilmiah, & Vol, 2020). The Science teachers at Madrasah Nurul Ulum have developed flexible and adaptive learning strategies, including the use of audio-visual and animation-based learning media to enhance the appeal of online materials. Furthermore, teachers also utilise face-to-face sessions to directly evaluate students' understanding and provide intensive support in aspects of practical science that cannot be conducted online.

From the students' perspective, this Blended Learning model offers a more varied and enjoyable learning experience. However, there are challenges related to time management and motivation, particularly when learning occurs online. Students need to balance independent study at home with face-to-face learning at the madrasah. Uncertainty in scheduling and technical disruptions are factors that may hinder learning consistency. Nevertheless, the majority of students express that they feel more independent in managing their studies, while also gaining opportunities for more intensive interaction with teachers and peers during face-to-face sessions.

Technical constraints also represent one of the challenges faced in this Blended Learning model at the madrasah. Some students encounter limitations in accessing stable internet connections and adequate devices for online learning. This has prompted teachers and madrasah administrators to provide learning materials in formats accessible offline, such as printed worksheets and downloadable teaching materials. This strategy is deemed effective in bridging the technological gap and ensuring that no student is left behind in the learning process.

In this context, the role of the teacher is central as a facilitator and motivator in the adaptation of blended learning. Teachers are not only responsible for delivering content but also for monitoring students' learning progress through various media and methods. Teachers' adaptation includes enhancing digital competencies and the ability to design learning scenarios that harmoniously integrate both online and offline elements. This transformation of role signifies a paradigm shift from conventional learning to a more dynamic and responsive learning model that addresses the needs of students.

Moreover, the Blended Learning model at Madrasah Nurul Ulum is also characterised by parental involvement as supporters of the learning process at home. Intensive communication through WhatsApp enables teachers to convey students' progress and challenges to parents while also soliciting their support in creating a conducive learning environment. This involvement is key to overcoming various obstacles that arise, especially for students who require additional assistance during online learning.

These findings underscore the importance of infrastructure readiness and policy support from the madrasah in facilitating effective and sustainable Blended Learning implementation. The madrasah must continue to strengthen technological facilities, provide ongoing training for teachers, and formulate policies that are responsive to the evolving learning needs post-pandemic. Thus, the Blended Learning model implemented is not merely an emergency response but can evolve into an innovative and adaptive learning model for the future of education at Madrasah Ibtidaiyah.

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The Blended Learning model at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok reflects a complex and multidimensional transformation process in learning. Through the combination of offline and online learning tailored to the characteristics of the students and local conditions, this madrasah has succeeded in creating an inclusive and dynamic learning environment. Despite the ongoing challenges, particularly concerning technological access and the management of students' learning motivation, this research indicates that with the active role of teachers and stakeholder support, Blended Learning can serve as an effective solution in supporting the sustainability of science learning post-pandemic.

Teacher Adaptation

The adaptation of teachers to Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok post-pandemic necessitates a paradigm shift in the planning and execution of science education. Teachers are no longer merely transmitters of knowledge; they now serve as facilitators capable of harmoniously integrating face-to-face and online methods. This shift requires mastery of digital learning technologies and creativity in designing learning activities that are responsive to students' needs across two distinct domains.

The adaptation process begins with enhancing teachers' digital competencies, which serve as the primary foundation for operating various learning platforms such as WhatsApp, Zoom, and Google Classroom. Both internal and external training sessions are conducted periodically to ensure that teachers possess adequate technical skills. This also triggers a change in teachers' attitudes towards technology, transitioning from viewing it as merely a supportive tool to recognising it as an essential component of the teaching and learning process. This awareness encourages teachers to continuously seek innovation in presenting science material to make it more engaging and comprehensible for students.

In addition to technical aspects, teachers are also adapting their teaching strategies to be more student-centred. In the context of Blended Learning, teachers adjust their approaches by providing space for students to learn independently online while simultaneously offering intensive support during face-to-face sessions. This adjustment aims to address issues of motivation and time management that often arise in online learning. Teachers utilise scaffolding techniques to support a gradual learning process, ensuring that students can optimally follow the material even in a mixed format.

Furthermore, teachers develop varied and interactive learning materials to enhance student engagement. The use of multimedia, experimental videos, and online quizzes becomes part of the strategies implemented to maintain classroom dynamics. During face-to-face sessions, teachers delve deeper into the material and conduct practical activities that cannot be performed online. This approach not only improves understanding of science concepts but also helps to holistically strengthen students' scientific process competencies.

Intensive communication with students and parents is also a crucial part of teachers' adaptation. Through WhatsApp groups and online meetings, teachers regularly provide guidance, feedback, and motivation to students and parents to ensure the smoothness of the learning process. Parental involvement in supporting learning at home becomes one of the

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keys to success in implementing Blended Learning. Teachers recognise that this collaboration needs to be maintained and developed so that the synergy between the madrasah and families can positively impact students' learning outcomes.

In facing various technical and non-technical challenges, teachers adjust learning schedules and evaluation methods to be more flexible. For instance, rescheduling online sessions according to network conditions and students' readiness, as well as applying varied formative assessments to comprehensively measure understanding. This flexibility is essential to ensure that every student has an equal opportunity to participate in the learning process without being burdened by unforeseen technical constraints.

Teachers also experience significant changes in their social roles both in and out of the classroom. They are not only educators but also companions and motivators who can understand students' psychological conditions during the post-pandemic transition. Attention to these emotional and social aspects becomes a focus in the teachers' adaptation process, as students' mental conditions greatly influence the effectiveness of Blended Learning. With a more empathetic approach, teachers strive to create a comfortable learning environment that supports students' character development.

The findings of this research confirm that teacher adaptation is a key factor in the successful implementation of Blended Learning at Madrasah Nurul Ulum. The transformation of the teacher's role from conventional instructor to facilitator of simultaneous digital and face-to-face learning opens opportunities for enhancing educational quality. However, this adaptation process requires ongoing support in the form of training, facilities, and madrasah policies that are responsive to the changing needs of modern education.

Teachers' adaptation in science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok reflects the dynamic changes in education post-pandemic, which demand flexibility, innovation, and active collaboration between teachers, students, and parents. The success of the Blended Learning model heavily relies on teachers' readiness and ability to face both technical and pedagogical challenges, making the strengthening of competencies and systematic support a strategic priority for the sustainability of educational transformation in the digital era.

Student Response and Adaptation

Students' responses to the implementation of Blended Learning in science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok demonstrate a complex dynamic influenced by the readiness of technological devices, learning interest, and family environmental support. Most students have made efforts to adapt to the new learning pattern that combines face-to-face and online sessions. However, the readiness of devices such as smartphones and stable internet connections remains a primary determining factor in students' successful adaptation to Blended Learning.

Connectivity issues are a significant barrier faced by students, particularly for those living in areas with limited internet access. Often, signal disruptions hinder the smooth flow of online learning, causing students to repeatedly postpone or follow the material

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suboptimally. This condition affects their concentration and motivation to learn, necessitating teachers and the madrasah to provide alternative solutions, such as the use of printed worksheets and materials that can be accessed offline.

Moreover, students' interest and motivation to learn have also fluctuated during the adaptation period. In interviews, some students expressed that they found the varied and interactive learning methods in Blended Learning more engaging, especially when teachers used multimedia and practical face-to-face activities. However, there are also students who struggle with managing their independent learning time at home, resulting in decreased consistency in their studies and academic achievement.

Parental support is a crucial aspect in assisting students to adapt to Blended Learning. Parents who actively monitor and accompany their children during online sessions contribute positively to the smoothness of the learning process. Conversely, some parents' limited time and technological knowledge hinder optimal support at home. Therefore, collaboration between the madrasah and families must be continuously strengthened to ensure that students receive maximum support in their learning.

Students' responses also reflect psychological adaptations to the changes in learning patterns. Some students report feeling more independent and responsible for their learning process, while others experience anxiety and boredom due to monotonous online learning. Social factors, such as limited interaction with peers, also affect students' enthusiasm for learning, making face-to-face activities an important need to support their social and emotional aspects.

In addressing these challenges, students develop various adaptation strategies, such as organising their study schedules more disciplinedly and utilising face-to-face time to deepen their understanding of material they have not grasped. Students' initiatives to actively communicate with teachers through online platforms also indicate the success of the adaptation that is beginning to take shape. This demonstrates that self-management and digital communication skills are integral parts of Blended Learning.

These findings reinforce previous studies emphasising the importance of technological infrastructure readiness and the active role of the surrounding environment in supporting the effectiveness of Blended Learning (Hardianti, 2023; Rosi, 2020; Sufiyanto et al., 2022). Students' adaptation is not solely dependent on technical aspects but also on the emotional and social support they receive from teachers, families, and peers. Thus, a holistic approach to learning is key to optimising science learning outcomes in the post-pandemic period. Students' responses and adaptations to Blended Learning at Madrasah Nurul Ulum demonstrate positive developments despite various challenges. A more varied and enjoyable learning experience serves as the primary motivator for students to remain actively engaged in their education. The challenges that arise also provide valuable lessons for the madrasah in formulating more inclusive and adaptive learning policies and strategies.

The implications of these results underscore the need for equitable enhancement of technological facilities, continuous learning support, and strengthened communication between teachers, students, and parents. Comprehensive support will expedite students'

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adaptation processes and reinforce the effectiveness of Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok. Consequently, the objectives of transforming science education post-pandemic can be optimally and sustainably realised.

Supporting and Hindering Factors

The implementation of Blended Learning at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok is significantly influenced by various interrelated supporting and hindering factors. One of the main supporting factors is the presence of competent and adaptive human resources (HR), particularly the role of teachers who actively develop digital competencies and innovative learning strategies. Teachers who are technologically prepared and creative in presenting material both online and offline contribute significantly to the success of this educational transformation.

In addition to HR, facilities and infrastructure are crucial factors in supporting the smoothness of Blended Learning. The availability of technological devices such as computers, smartphones, and adequate internet connectivity is vital for the effectiveness of the teaching and learning process. Madrasah Nurul Ulum has endeavoured to provide these facilities, although it still faces limitations, particularly regarding internet access in certain locations. The availability of printed teaching materials, such as worksheets, also serves as a practical solution to address the limitations of online access for students facing technological constraints.

Madrasah policies also play an important supporting role in the implementation of Blended Learning. Clear and directed policy support from the head of the madrasah fosters the creation of a conducive learning environment. These policies include regular teacher training, curriculum adjustments, and adaptive learning evaluation mechanisms in response to pandemic and post-pandemic situations. Policies that are responsive to real needs on the ground strengthen the commitment of all parties to optimise science education through blended approaches.

he family environment also serves as both a supporting and hindering factor in students' adaptation processes. Parental support in providing guidance, motivation, and learning facilities at home greatly assists students in participating in blended learning. However, in some cases, parents' lack of understanding of technology or their limited time can hinder the effectiveness of online learning. This necessitates the madrasah to communicate more intensively and build synergy with students' families.

On the other hand, several hindering factors disrupt the smooth implementation of Blended Learning. The limitations of technological devices available to students are a primary obstacle, followed by uneven internet connectivity issues, particularly in rural areas. These barriers lead to disparities in access to information and learning materials, which adversely affect students' overall learning achievements. This condition highlights the need for further intervention to improve digital educational infrastructure.

Psychological factors and students' motivation also represent significant hindrances in the adaptation process of blended learning. Fluctuations in learning motivation, boredom due

to an imbalance between online and face-to-face learning, and a lack of direct social interaction with peers negatively impact students' enthusiasm for learning. This underscores the importance of a humanistic and enjoyable approach to learning, as well as the provision of emotional support from teachers and the school environment.

The supporting and hindering factors identified in this study affirm that the success of transforming science education through Blended Learning heavily relies on the balance between HR readiness, infrastructure, madrasah policies, and family support. Ongoing efforts to address these challenges will strengthen the foundation of education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok while simultaneously opening opportunities for optimising post-pandemic learning that is inclusive and sustainable.

Transformation of Science Education

The transformation of science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok post-pandemic reflects significant changes in the methods of delivering and receiving material. The Blended Learning model, which combines face-to-face and online learning, introduces a new paradigm in the learning process. Teachers are no longer merely transmitters of knowledge but also facilitators who harmoniously integrate digital technology and conventional methods. This approach demands that teachers be more creative in designing interactive and contextual learning activities that can address various student needs and characteristics.

In the implementation of science education, teachers have begun to utilise various digital platforms such as WhatsApp and Zoom to support real-time communication and discussions, while optimally using printed worksheets as self-study materials for students. This change provides flexibility in time and learning space for students, allowing them to access materials anytime and anywhere. Thus, learning is no longer confined to face-to-face classroom time but also occurs through online interactions that broaden students' learning scope.

One aspect that has undergone transformation is the increased role of technology in education. Teachers are required to master various supportive learning applications, from material management and evaluation to communication with students and parents. The use of technology not only facilitates the delivery of material but also enriches the variety of teaching methods, such as the implementation of the flipped classroom model that allows students to learn basic concepts independently before engaging in face-to-face discussions. This encourages students to be more active and responsible for their learning process.

Moreover, the transformation of science education post-pandemic has also impacted the interaction patterns between teachers and students. Blended learning opens up opportunities for more intensive and personal two-way communication through digital channels, which were previously less optimal in conventional face-to-face learning. Teachers can provide immediate or written feedback that helps students understand concepts more deeply. Similarly, students can ask questions and express learning difficulties without being constrained by time and classroom space.

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However, this transformation is not without challenges, particularly regarding time management and students' motivation to learn. Students face the need to discipline themselves in organising independent study schedules outside of face-to-face school hours. This condition necessitates strengthening the self-regulated learning aspect, which is key to the success of blended learning. Teachers also play a role in guiding students to effectively manage their time and learning resources to avoid boredom or study-related stress.

Another significant change is the shift towards a more student-centred learning paradigm. Teachers encourage students to actively seek information, conduct simple experiments, and develop critical and creative thinking skills through varied tasks and projects. This approach aligns with the characteristics of science education, which demands exploration and direct concept discovery by students, enabling them not only to understand theory but also to apply it in everyday life.

This transformation of science education also requires adaptive and sustainable madrasah policies. The head of the madrasah and education managers play a crucial role in providing adequate facilities, training, and technical support for teachers and students. Policies that respond to the dynamics of Blended Learning ensure that the transformation process can proceed smoothly and yield optimal learning outcomes. Thus, the madrasah can maintain continuity and quality of education amidst changes in the post-pandemic learning environment.

The transformation of science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok reflects a holistic adaptation involving changes in methods, teacher roles, student engagement, and policy support. The Blended Learning model is not merely a short-term solution to address the pandemic but also opens up opportunities for the development of more flexible, innovative, and inclusive education in the future. These findings underscore the importance of synergy between technology, human resources, and policy in creating an adaptive and sustainable learning ecosystem.

CONCLUSION

In conclusion, the transformation of science education at Madrasah Ibtidaiyah Nurul Ulum Mertak Tombok post-pandemic demonstrates significant adaptations from both teachers and students in implementing the Blended Learning model. Teachers have successfully shifted paradigms by designing more adaptive and responsive learning strategies, effectively integrating digital technology and face-to-face methods. Meanwhile, students, despite facing various challenges such as limited access to technology and time management issues, have generally been able to adapt and appreciate the benefits of the varied learning experiences offered. The effectiveness of Blended Learning in this local context is evident from increased learning interactions, flexibility in time and place, and the development of digital skills that support the sustainability of the learning process. Based on these findings, it is recommended that teachers continuously engage in training and develop digital competencies to optimise the implementation of Blended Learning. The madrasah should strengthen the necessary information and communication technology (ICT) infrastructure and provide technical support

to ensure that hybrid learning can run smoothly and inclusively. Additionally, further research is recommended to be conducted with a comparative approach across madrasahs in various contexts to enrich understanding of the factors contributing to success and obstacles in the application of Blended Learning. Thus, policies and learning practices can be further tailored to real needs on the ground, strengthening the quality of science education at the madrasah ibtidaiyah level comprehensively.

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