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Effectiveness of Hybrid Learning Using Streaming Technology in Education

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Abstract— *This study aims to evaluate the effectiveness of hybrid learning at Madrasah Aliyah Negeri 4 Kediri, focusing on instructional design and the quality of streaming technology. The research method employed is qualitative with a case study approach to explore the experiences of students and faculty regarding hybrid learning. The subjects of the study include 20 students and 10 faculty members involved in the hybrid learning program at the university. Data collection techniques included semi-structured interviews and participatory observations. The collected data were analyzed using thematic analysis to identify patterns and key themes related to the impact of instructional design and technical issues on student engagement. The results indicate that interactive instructional design contributes to increased student engagement, while technical problems such as buffering and poor video quality significantly hinder the effectiveness of learning. These findings underscore the importance of integrating high-quality streaming technology with effective instructional design to enhance the learning experience in hybrid education.*

Keywords— *Hybrid Learning, Streaming Technology, Higher Education*

1 Introduction

The hybrid learning method, which combines the use of digital technology and face-to-face interaction, is becoming increasingly important in the rapidly evolving digital era. This is particularly relevant to education. Hybrid learning allows students to learn both in person and through digital platforms, distinguishing it from conventional approaches [1]. One technology supporting this method is streaming, which enables material to be delivered live over the internet [2]. Hybrid learning can address access limitations and enhance educational efficiency by combining various approaches and resources [3][4]. However, there are several issues that online formats may face, such as technological limitations, differences in student access, and the quality of teacher-student interactions [5].

Previous studies provide important insights into the effectiveness and challenges of hybrid learning. For instance, research by [6] shows that hybrid methods can improve student learning outcomes compared to fully face-to-face or fully online learning. Furthermore, a study by [7] discusses how appropriate instructional design can maximize the benefits of hybrid learning. Meanwhile, [8] identifies that student engagement in hybrid learning is greatly influenced by the quality of the materials and interactions provided. In the specific context of streaming, research by [9] reveals that streaming can enhance learning accessibility and flexibility but also faces challenges related to technological limitations and technical issues. Finally, a study by [10] emphasizes the importance of integrating online and face-to-face learning to achieve optimal educational outcomes.

This study provides insights into how hybrid learning supported by streaming technology has been successful in Indonesian schools [11][12]. There is limited international research on how streaming technology affects academic outcomes and student learning experiences in Indonesian schools. This study aims to fill this gap by thoroughly

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analyzing the impact of using streaming in hybrid learning. Additionally, the study explores how elements such as technology access and virtual interactions affect the quality of learning [13].

The study aims to evaluate the effectiveness of hybrid learning using streaming technology in education and identify factors influencing its successful implementation. It provides practical recommendations for educational institutions in designing and implementing more effective and inclusive hybrid learning models [14].

The research indicates that hybrid learning using streaming technology can improve academic outcomes and student learning compared to traditional learning methods. However, this method needs to consider and apply supporting elements such as technology access and effective instructional design [15][16]. This argument is based on the idea that streaming technology can enhance educational flexibility, improve access, and support a more interactive and engaged learning experience.

2 Method

This study uses a qualitative approach and case study design to assess the effectiveness of hybrid learning at Madrasah Aliyah Negeri 4 Kediri. The goal is to gain a deeper understanding of the experiences of students and teachers related to the quality of streaming technology and instructional design. The population for this study includes teachers and students using hybrid learning across various programs in the institution. Purposive sampling was used, with the study sample consisting of twenty students and ten teachers with direct experience in hybrid learning. Data were collected through participatory observation and semi-structured interviews [17].

The research instruments included interview guides designed to explore participants' perceptions of instructional design and technical issues they encountered [18]. Observations were conducted to capture classroom dynamics and interactions between students and teachers in the context of hybrid learning. The research process began with participant selection, followed by interviews and observations to identify classroom dynamics and interactions between students and teachers in hybrid learning. The collected data were then analyzed thematically to identify patterns and key themes related to the effectiveness of hybrid learning. The analysis results are expected to provide a clear picture of the components affecting student engagement and the effectiveness of streaming technology in the hybrid learning context at Madrasah Aliyah Negeri 4 Kediri.

3 Findings and Discussion

Impact of Streaming Quality on Hybrid Learning Effectiveness

One crucial element determining the effectiveness of teaching and learning processes is hybrid learning and streaming quality [19]. The research findings indicate that technical quality of streaming, including issues such as lag, buffering, and poor image quality, significantly affects students' learning experiences. As shown by in-depth interviews, these technical issues often disrupt students' focus and make it harder for them to understand the material. Abd. Ghani expressed that “Poor streaming quality often makes it difficult to follow the lecture material. I frequently experience buffering, which disrupts the learning process. When the image or sound is out of sync, I struggle to follow the teacher's explanation, which affects my understanding.” On the other hand, Muhammad Iqbal, as an educator, explained that “Technical problems such as buffering and poor image quality disrupt the flow of the lecture. This causes students to struggle with focusing and engaging in online sessions.”

Table 1. Issues and Impact on Learning

Technical Issue	Impact on Learning Experience
Buffering	Disruptions in following lectures, loss of concentration
Image Quality	Difficulty understanding material, reduced teaching effectiveness
Audio-Video Synchronization	Difficulty following explanations, confusion with the material

Based on the table showing the impact of technical issues on the learning experience, this study confirms that streaming quality has a significant effect on the effectiveness of hybrid learning. Technical problems such as buffering, poor image quality, and audio-video synchronization directly impact students' learning experiences and academic outcomes [20][21].

Firstly, buffering often occurs due to unstable internet speeds or inadequate server capacity, disrupting the flow of audio and video [22]. Students must wait for the content to reload due to this issue, interrupting the lecture flow and reducing their concentration. Continuous delays can cause students to lose focus and have difficulty following material explanations. If students frequently experience buffering during learning sessions, the impact will be worse, leading to inconsistent and frustrating learning experiences [23].

Secondly, poor image quality and audio-video synchronization issues, where poor image quality like low resolution or blurry visuals make text and diagrams on lecture slides hard to read [24]. This reduces the effectiveness of material visualization and can make it harder for students to understand complex information. Additionally, audio-video synchronization problems, where sound is out of sync with the image, can make it difficult for students to accurately follow the teacher’s explanations [25][26]. This mismatch can cause confusion and disrupt effective learning processes.

Thirdly, the impact on material comprehension: When students encounter technical problems during streaming, their ability to understand the material is also affected. Ideal learning processes require smooth information flow and effective interaction between teachers and students [27][28]. Technical issues disrupt this process, so students may not capture information well, participate in discussions, or complete tasks with a deep understanding [29].

By improving the technical quality of streaming, educational institutions can ensure that students follow lessons better, understand material effectively, and actively participate in the learning process [30][31]. Therefore, enhancing streaming technical quality is not just about fixing technical aspects but also about improving the overall learning experience, which in turn supports students' academic achievement and the success of hybrid learning.

Impact of Instructional Design on Student Engagement

Instructional design is a crucial factor in ensuring student engagement in hybrid learning. Research indicates that teachers who implement interactive instructional designs and provide regular Q&A sessions tend to be more successful in maintaining student engagement. Mudarris, as an educator, states, "I always strive to include interactive elements in my streaming lectures, such as quizzes and small group discussions. This helps students stay engaged and active." On the other hand, Saiful Bahri explains that, "Q&A sessions and interactive materials make me feel more engaged in learning. It helps me understand the material better."

Figure 1. Interactive Elements

From the interviews, it was found that instructional designs integrating interactive elements have a very positive impact on student engagement. 1) Interactive Materials, Quizzes and discussions integrated into the instructional design help students be more active in the learning process. Materials presented not just passively but with elements requiring interaction enhance their understanding and make them feel more connected to the material [32]. 2) Q&A Sessions, Students feel that regular Q&A sessions increase their engagement. The opportunity to ask questions directly to the teacher and discuss material with classmates allows them to clarify concepts they do not understand and receive useful feedback [33]. 3) Online Discussions, Small group discussions conducted online help students share knowledge and deepen their understanding of topics[34]. This shows that interaction with classmates also contributes to greater engagement.

Effective instructional design plays a crucial role in enhancing student engagement in hybrid learning. Interactive elements such as quizzes, discussions, and Q&A sessions have been proven to increase student engagement and understanding [35][36]. Conversely, more passive approaches, such as written materials or videos without interaction, tend to result in lower engagement [37]. Therefore, developing instructional designs that integrate interactive elements is an effective strategy for enhancing engagement and learning outcomes in hybrid learning.

Student Engagement and Its Impact on Learning Outcomes

Student engagement is a critical factor influencing academic outcomes in hybrid learning. Research shows that higher levels of engagement are typically associated with better academic results. However, students report that a lack of face-to-face interaction can affect their motivation and understanding. Hamzah, a student, expresses, "My engagement increases when the teacher includes interactive elements. I feel more motivated and my academic results improve. However, the lack of face-to-face interaction often makes me feel less motivated. Even though I have flexibility with my time, my academic results are not as good as when I have direct interaction."

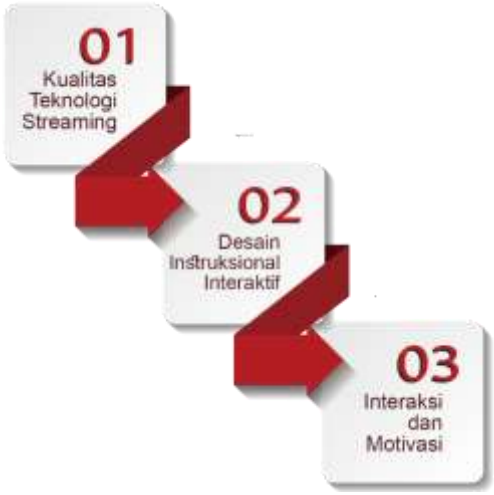

Figure 2. Student Engagement in Hybrid Learning

From the interviews and observations, several key findings related to student engagement in hybrid learning were identified: 1) Streaming Technology Quality, Technical issues such as buffering and poor video quality significantly affect student engagement. Streaming instability disrupts the flow of interactive sessions and reduces the effectiveness of learning activities like discussions and quizzes [38]. Students reported frustration and decreased motivation when faced with technical problems during learning. 2) Interactive Instructional Design, Instructional designs that include interactive elements, such as quizzes, discussions, and Q&A sessions, contribute to higher engagement [39]. Students participating in sessions designed to encourage interaction felt more connected to the material and more motivated to participate. 3) Active Participation, Student engagement tends to increase when they can actively participate in interactive activities. However, if technical problems obstruct their access to these activities, their engagement decreases. Student motivation to learn is influenced by how well technology supports interactive activities [40].

This indicates that student engagement in hybrid learning is affected by both the quality of streaming technology and instructional design. While interactive instructional design contributes to higher engagement, technical issues in streaming can reduce the effectiveness of such designs. To maximize student engagement, it is crucial to ensure that streaming technology effectively supports interactive activities and to implement instructional designs that facilitate active interaction [41]. Improvement in both aspects can help address technical issues and enhance the learning experience in hybrid environments.

4 Conclusion

This study reveals that the quality of streaming technology and interactive instructional design are key factors affecting student engagement in hybrid learning. The most important findings are that technical issues such as buffering and poor video quality significantly disrupt the learning process and reduce student engagement. Conversely, instructional designs involving interactive elements, such as quizzes, discussions, and Q&A sessions, enhance engagement and understanding. A good integration of stable streaming technology and interactive instructional design is essential for achieving effectiveness in hybrid learning.

This study supports an active learning model emphasizing the importance of interaction in the learning process. It reinforces the theory that active student engagement is directly related to instructional design involving interaction and adequate technological support. These findings also indicate that the technical quality of online learning platforms plays an

equally important role as instructional design, suggesting that hybrid learning theories should address both technical and instructional design aspects simultaneously. This expands the understanding of how these elements interact to impact learning outcomes.

The study has some limitations that should be noted. First, the data collected is limited to interviews with a small number of students and teachers from a few institutions, which may not fully reflect the broader student experience across various educational contexts. Second, a more in-depth analysis of variations in streaming quality and instructional design across different platforms or courses has not been conducted, so generalization of the findings may be limited. Third, the study did not consider external factors that could influence student engagement, such as social or economic conditions. Therefore, further research is needed to explore these factors and confirm the findings in a broader context.

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