Redefining Teacher-Student Interaction in the Digital Era: A Case Study of Hybrid Learning Models in Primary Education

Erika Puspitasari
IAIN Kediri, Indonesia
Email: puspitasarier20202@iainkediri.ac.id

Abstract

This study aims to explore the dynamics of teacher-student interactions in the context of hybrid learning in elementary schools. Data were collected through classroom observations, interviews with teachers, and analysis of digital platforms used through a case study approach. Findings indicate that although digital technology provides flexibility in time and space and a variety of interactive tools, student engagement in online sessions tends to be low. Non-verbal communication is also limited, affecting the quality of interpersonal interactions. Digital literacy is key; teachers who can utilize technology well can improve student interaction and engagement, and the challenge of unequal access to technology widens the gap in learning. The implications of this study emphasize the need to improve digital literacy for teachers and students, as well as solutions to overcome technological barriers to support effective hybrid learning in the future.

Keywords: *Hybrid Learning, Teacher-Student Interaction, Digital Literacy, Elementary Education, Educational Technology.*

– – – – – – – – – – ◆ – – – – – – – – – –

A. INTRODUCTION

The development of digital technology has had a significant impact on various aspects of life, including the world of education. Rapid advances in information and communication technology have changed the way teaching and learning take place, by introducing more flexible and interactive methods (Attard & Holmes, 2022; Munday, 2022). Technology has now become an inseparable element in the educational process, allowing teachers and students to connect through various digital platforms, even when separated by physical distance. This change has become increasingly apparent since the global pandemic, where distance learning and hybrid learning models have become the main solutions to maintain educational continuity. The use of learning software, video conferencing platforms, and online class management applications have facilitated interactions between teachers and students, changing the dynamics of traditional classrooms into more dynamic virtual learning spaces, technology is not just a tool, but also a key factor in maintaining the quality of learning amidst unprecedented global challenges (Katal et al., 2023).

The development of this technology also provides an opportunity for education to transform to be more inclusive and adaptive to the needs of various groups of students. With the presence of the internet and digital devices, access to learning resources has become wider and is no longer limited to textbooks or physical classrooms. Students can now access learning materials from various

sources, take online classes, and interact with teachers through interactive educational applications. Technology also allows for the personalization of learning, where students can learn according to their own pace and learning style through customized digital content (Ayman et al., 2022).

The development of technology in education also brings new challenges, and not all students have equal access to adequate devices and internet connections, leading to a digital divide. Teachers are also faced with the need to master various digital tools and adapt their teaching methods to remain effective in a virtual environment (Thirkell & Munday, 2023). The global pandemic has accelerated the adoption of technology in education, but it has also highlighted the importance of developing supportive educational infrastructure, as well as training for teachers so that they can optimize technology in learning, technology remains a critical component that continues to drive innovation in global education systems amidst these challenges (Mitev et al., 2024).

Elementary education plays a crucial role in laying the foundation for students' cognitive, social, and emotional development, students not only learn basic skills such as reading, writing, and arithmetic but also build core values and life skills that they will carry into adulthood. The importance of elementary education cannot be overstated, as this phase lays the foundation for future learning, and technology is integrated into elementary education to enrich the learning process, providing a variety of tools and methods that can enhance students' understanding of the material (Racheva & Peytcheva-Forsyth, 2024).

The application of technology in elementary education brings new opportunities for teachers and students, technology allows teachers to present learning materials more creatively and interactively, through the use of learning applications, educational animated videos, to interactive simulations, students can learn in a way that is more interesting and relevant to their daily lives (Baldassarre et al., 2021; Impedovo & Tan, 2023). Technology also helps introduce students to new concepts, such as basic programming or critical thinking skills, which are easier to understand through the use of digital devices. E-learning and distance learning platforms also allow for more equitable access to education, especially in areas that are difficult to reach by conventional education (Kim, 2022).

The implementation of technology in primary education also presents challenges. One of the main challenges is the digital divide, where not all students have equal access to technological devices or adequate internet connections, and this can lead to disparities in academic achievement between students who have access to technology and those who do not. In addition, excessive use of technology can also affect students' social interactions, reducing the time spent interacting directly with peers and teachers. Teachers also face the challenge of continually developing their digital skills to be able to integrate technology effectively into their teaching, while ensuring that the use of technology continues to support learning, not replace it.

Technology in primary education also brings opportunities to increase inclusivity and broaden the scope of learning, students with special needs can more easily access educational materials tailored to their needs through technology. Technology also allows for a more adaptive learning process, where students can learn at their own pace, receive faster feedback, and gain access to a variety of educational resources from around the world, technology in primary education can be a powerful tool to improve the quality and accessibility of education with proper management.

Technology has drastically changed the way teachers and students interact, which was previously dominated by face-to-face communication in the classroom. Teacher-student interactions occur face-to-face, allowing for rich verbal and non-verbal communication, and building close personal relationships in the classroom environment in the traditional model (Baxtiyorovna, 2022). With the development of technology and the use of digital platforms, this pattern of interaction has undergone a significant transformation. Communication is no longer limited by space and time, allowing teachers and students to interact outside the physical boundaries of the classroom, whether through text messages, emails, video calls, or online discussion forums through online and hybrid learning.

These changes have made interactions more complex and flexible. Technology has introduced tools that allow teachers to provide real-time feedback, distribute materials digitally, and monitor student progress through learning management platforms (LMS) (Baxtiyorovna, 2022). Students also have more channels to communicate with teachers, both individually and in groups. For example, platforms such as Google Classroom, Zoom, or Microsoft Teams allow for more intensive discussions, both synchronously and asynchronously. Data from UNESCO shows that during the COVID-19 pandemic, more than 1.5 billion students worldwide were affected by school closures, forcing around 91% of global education systems to switch to online or hybrid learning.

Communication through digital platforms can lose the emotional elements and non-verbal nuances that are common in face-to-face interactions, even though technology provides greater flexibility in how interactions are conducted, and this can affect the clarity of messages delivered and reduce student engagement. Students who are less experienced in using technology may feel alienated, while teachers face a new learning curve to effectively use technology to support meaningful interactions, and the transformation of teacher-student interactions in the digital age requires adjustments and innovations in how communication is organized and facilitated (Topuzov et al., 2022).

The hybrid learning model presents significant challenges for teachers and students, especially in maintaining the quality of interactions despite physical distance. One of the main challenges is maintaining student engagement when learning occurs online and in-person simultaneously. In this situation, teachers must manage classes that are divided between students who attend in person and those who follow from home, making it difficult to ensure that all students receive

adequate attention and can actively participate. The quality of interactions can also decrease due to technological limitations that hinder effective communication, such as slow internet connections, device glitches, or barriers to using the digital platform used for learning (Asfahani et al., 2023).

Access to technology is a critical issue in hybrid learning. Not all students have the proper devices or stable internet connections to engage in remote learning, creating gaps in their learning experience. Mastering technology and adapting teaching methods for a hybrid environment is also a challenge for teachers. They must adapt to new digital tools while ensuring that the methods they use to reach and engage students in both online and in-person formats equivalently.

Adapting to digital platforms is another challenge that needs to be addressed. Teachers and students must get used to a variety of different learning software, and often, not all platforms are designed with user-friendly interfaces, especially for primary education. Difficulty adapting to these technologies can affect the quality of learning and cause students to lose interest or become confused in following instructions (Chelliq et al., 2023; Herbert Sathish & BK, 2024). These challenges require innovation in teaching, as well as better support in terms of training and technological infrastructure to ensure hybrid learning can run effectively.

There is a stark gap between face-to-face and digital interactions in hybrid learning. Face-to-face interactions allow teachers and students to communicate directly, involving body language, facial expressions, and intonation of voice that support the full delivery of emotions and message intent. Digital interactions tend to be more limited in this regard. Non-verbal aspects of communication are often neglected, so that messages delivered can lose meaning or become less personal on online platforms, students may feel less emotionally involved and have difficulty staying focused or understanding the material well, these limitations can impact students' active participation in discussions, as well as reduce their involvement in the learning process as a whole, which ultimately affects learning outcomes.

Research on hybrid learning models and teacher-student interactions in this context is essential to conduct as this model has become one of the main methods in education, especially after the global pandemic. This research will contribute to the understanding of how technology can be integrated more effectively into the learning process, while also revealing the challenges that exist in maintaining the quality of interactions. It is also practically relevant as there is an urgent need to find solutions that can support high-quality interactions in the digital era. By understanding how interaction gaps can affect student engagement and understanding, this research can provide recommendations for teachers and educational institutions to develop more inclusive and adaptive teaching strategies, and improve students' learning experiences, both in the classroom and on digital platforms.

B. LITERATURE REVIEW

1. Hybrid Learning Concept

Hybrid learning is a method that combines traditional face-to-face learning with online learning, giving students the flexibility to learn in a physical classroom while accessing materials and assignments online, in this model, part of the teaching and learning process takes place in the classroom, while the other part uses a digital platform that allows students to participate remotely (Chelliq et al., 2023; Herbert Sathish & BK, 2024). Hybrid learning is designed to take advantage of the advantages of both methods, namely the direct interaction that occurs in face-to-face learning and the flexibility offered by online learning. This is different from traditional learning methods that rely entirely on physical presence in the classroom, where teachers and students interact directly all the time, online learning is entirely technology-based, where students and teachers are not in the same room, and all learning activities are carried out through digital devices.

Previous research shows that hybrid learning has great potential in improving the effectiveness of learning. For example, a study conducted by Garrison and Kanuka (2004) explained that the hybrid model not only increases access to education but also encourages active student involvement through the use of technology. In elementary education, research conducted by (Kim, 2022) revealed that hybrid learning can overcome the limitations of traditional face-to-face learning by providing flexibility in arranging the time and place of learning, while still maintaining personal interaction between teachers and students. In addition, research from (Baxtiyorovna, 2022) also supports the idea that this learning model is effective in improving student learning outcomes because it can balance the need for synchronous and asynchronous learning.

Previous Research on Hybrid Learning in Elementary Education In the context of elementary education, the implementation of hybrid learning brings challenges and opportunities. A study conducted by (Hidayat et al., 2021) found that elementary school students who participated in hybrid learning tended to have higher engagement compared to students who only studied fully online. They also showed that the integration of digital and face-to-face components can improve students' understanding of the material because they get direct guidance from teachers and the flexibility to access additional materials independently. In Indonesia, a study by (Topuzov et al., 2022) examined the implementation of hybrid learning in elementary schools during the COVID-19 pandemic, which revealed that despite obstacles to accessing technology, most students and teachers felt the benefits of combining the two methods, especially in terms of more flexible and continuous interactions. Existing literature shows that hybrid learning in elementary education can provide solutions to various challenges of traditional learning, especially in facing the digital era. The success of implementing this model is highly dependent on the readiness of technology, school infrastructure, and the digital competence of teachers and students.

2. Teacher-Student Interaction in a Digital Context

Educational interaction theories have long emphasized the importance of communication between teachers and students in creating effective learning environments. One of the most relevant theories is Vygotsky's Social Constructivism, which states that learning occurs through social interaction, with the teacher acting as a facilitator who helps students construct new understandings through dialogue and guidance. This interaction occurs face-to-face, allowing for verbal and non-verbal communication, and providing an opportunity for teachers to directly assess students' understanding, with the advancement of technology, this form of interaction has undergone significant changes, especially with the shift to digital platforms.

Technology in education has expanded the form of interaction between teachers and students, from direct interaction to communication through digital devices. In digital or hybrid learning models, interactions are no longer limited by physical classrooms but can occur through various online platforms such as video conferencing, text messaging, discussion forums, and classroom management applications. Moore's (1993) Transactional Distance theory suggests that with increasing physical distance between teachers and students, there is the potential for an increase in "transactional distance," which refers to a lack of emotional involvement and direct interaction. This means that the greater the use of technology in learning, the greater the challenge in maintaining close relationships and effective communication between teachers and students (Asfahani et al., 2023).

(Loizou, 2022) research on The Community of Inquiry emphasizes that teacher-student interactions in digital learning must be supported by three important elements: cognitive, social, and instructional presence. Cognitive presence refers to students' ability to build understanding through the material presented online, while social presence refers to their ability to interact meaningfully with classmates and teachers. Technology can help strengthen this presence through the use of interactive platforms such as video conferencing, which allows for direct discussion, technology also has limitations in terms of delivering non-verbal communication, which is important in building emotional connections and creating an inclusive learning environment.

Research by (Chelliq et al., 2023) shows that technology can facilitate teacher-student interactions, but only if the platforms used are designed inclusively and support students' various learning styles. This study emphasizes the importance of personalization in digital interactions, where technology allows teachers to provide more detailed and tailored feedback to each student's needs. (Herbert Sathish & BK, 2024) also cautions that while technology can expand access and flexibility, effective digital interactions still depend on teachers' ability to use technology well and on adequate infrastructure support.

Technology has changed the way teachers and students interact, introducing new forms of communication that are more flexible but also more complex. Educational interaction theories provide a relevant framework for analyzing these

changes, but challenges remain, especially in maintaining emotional closeness and student engagement through digital platforms.

3. Basic Education in the Digital Era

The role of technology in primary education is significant and increasingly profound. Technology has not only changed the way information is delivered but has also influenced teaching, learning and assessment methods. Digital tools, such as computers, tablets and educational apps, have become an integral part of the learning environment, allowing students to access information more quickly and easily. The use of technology in primary education helps facilitate more interactive and engaging learning, which can increase student motivation and engagement (Herbert Sathish & BK, 2024; Loizou, 2022).

One of the positive impacts of implementing technology in elementary education is its ability to support more personalized and adaptive learning. With the help of learning applications that use algorithms to adjust content to each student's abilities, teachers can provide materials that are more appropriate to individual needs. Research by (Xie et al., 2021) shows that students who engage in technology-based learning tend to show improved learning outcomes, especially when technology is used to provide immediate and relevant feedback. Technology also opens up access to wider learning resources, including educational videos, articles, and interactive simulations, which can enrich students' learning experiences.

It is not only the benefits that technology brings to primary education. Research by Selwyn (2016) shows that despite the increase in accessibility of technology, there are also challenges to be faced, including the digital divide which results in inequities in access to educational resources. Students from disadvantaged economic backgrounds may not have the same access to technological devices and the internet, so they have difficulty in following technology-dependent learning.

Research by (Gerosa & Manciaracina, 2023) emphasizes that while technology can enhance learning, the success of its implementation is highly dependent on how teachers utilize these tools in the teaching process. If teachers are not well trained in using technology, or if technology is used only as a substitute for traditional teaching methods without deep thought, then its impact on student learning may not be optimal, and this shows the importance of training and support for teachers to integrate technology effectively into the curriculum.

The role of technology in primary education is broad and varied, bringing with it many opportunities and challenges. Previous research has shown that when used appropriately, technology can improve the quality of learning and the accessibility of education, and to achieve its full potential, attention must be paid to the digital divide and the importance of teacher training in using technology effectively (Das, 2021).

C. METHOD

This study uses a case study approach to analyze interactions in hybrid learning in elementary education settings. Case studies are chosen because they provide an in-depth understanding of complex phenomena and their specific contexts. By focusing on real-world experiences, this approach allows researchers to collect rich and diverse data on how interactions between teachers and students occur in the context of hybrid learning. This study aims to explore various factors that influence interactions, such as the use of technology, teaching methods, and student responses to the learning model applied through case studies.

The research participants consist of elementary school teachers and students involved in the hybrid learning model. This study will involve two classroom teachers and approximately 30 students from an elementary school in an urban area in Kediri, where access to technology and educational infrastructure is relatively good. The research location was chosen because the school has been implementing hybrid learning since the pandemic, although it has only been implemented for a short time, providing a relevant context to explore interactions in this new learning environment. The students involved are diverse in terms of social and economic backgrounds, providing a broader perspective on their experiences in hybrid learning.

Data collection will be conducted through several methods to ensure the validity and accuracy of the information obtained. The first method is classroom observation, where researchers will observe interactions between teachers and students during hybrid learning sessions. These observations will focus on communication dynamics, student engagement, and the use of technology in learning. Semi-structured interviews with teachers will be conducted to gain insight into their experiences in managing interactions in a hybrid context, the challenges faced, and the strategies used to increase student engagement. Surveys will also be distributed to students to measure their perceptions of the learning experience and interactions with teachers in the hybrid learning environment. Analysis of the digital platforms used, such as classroom management applications and online learning tools, will be conducted to evaluate features that support teacher-student interactions.

The collected data will be analyzed using a qualitative approach to understand the interaction patterns and effectiveness of hybrid learning. Data analysis will be conducted thematically, where researchers will identify key themes that emerge from observations, interviews, and surveys, this analysis process includes coding data, grouping information into relevant categories, and drawing conclusions based on the patterns found. Data triangulation will be conducted by comparing the results of various data collection methods to ensure the accuracy and credibility of the findings. The results of the analysis are expected to provide a clear picture of how interactions between teachers and students are formed in hybrid learning, as well as the factors that influence the effectiveness of this model.

D. RESULT AND DISCUSSION

The results of this study reveal several key findings related to teacher-student interactions in hybrid learning in elementary schools. Based on classroom observations, it is apparent that although technology supports the continuity of the learning process, direct interactions between teachers and students in class remain more intense and personal compared to online sessions. In face-to-face sessions, students are more active in asking questions and engaging in class discussions, while in online sessions, many students tend to be passive and do not provide significant responses, this is due to several factors, such as limited access to technology and the lack of in-depth face-to-face interactions on digital platforms.

From interviews with teachers, it was later discovered that the biggest challenge they faced in the hybrid learning model was maintaining student engagement in online sessions, one informant stated that:

> *"The biggest challenge we face in hybrid learning is keeping students engaged, especially in online sessions. Although digital platforms like Google Classroom or Zoom offer features like discussion forums and interactive quizzes, many students do not make the most of them. They are often passive or do not respond as expected.,"* said one of the teachers involved in this research.

This interview excerpt illustrates how despite the powerful tools technology provides, student engagement remains a major challenge in hybrid learning. Teachers expressed that, while digital platforms provide a range of features to support learning, such as discussion forums and interactive quizzes, students often do not fully utilize them. Survey data supports this finding, with 60% of students reporting feeling less motivated when engaging in online learning compared to being in a physical classroom. Conversely, 75% of teachers reported that interactions in a physical classroom were more efficient in helping them assess student understanding directly through facial expressions and body language, as shown in the following figure:

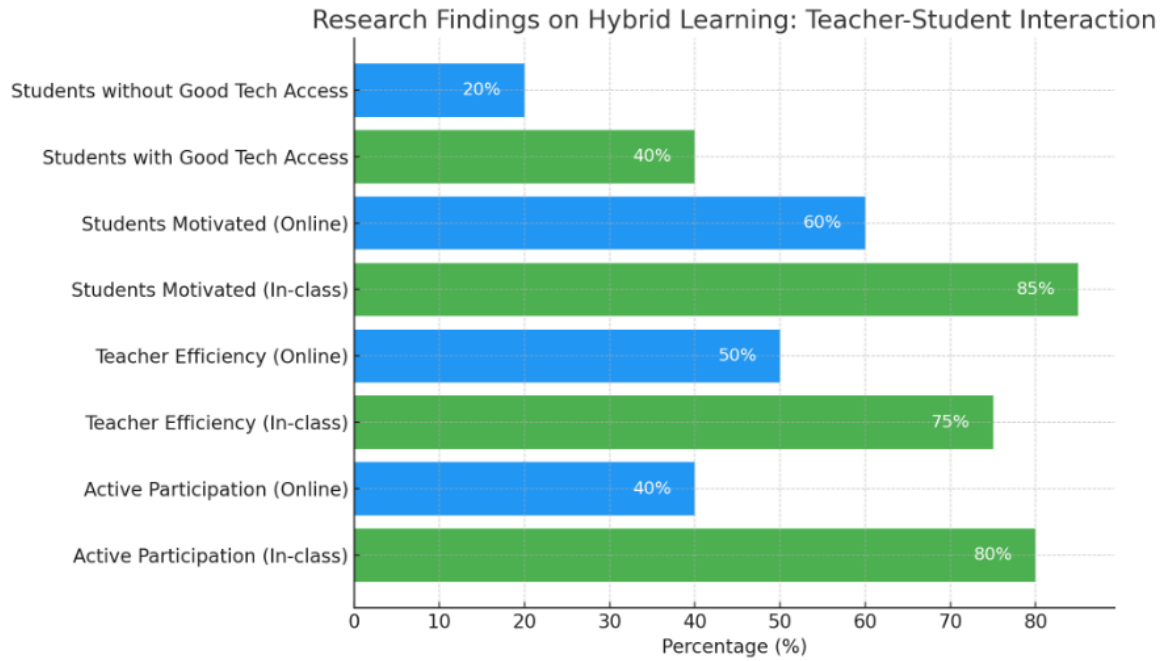

Figure 1. Teacher-Student Interaction

Source: data proceed

From the bar chart shown, it can be seen that there is a significant difference in the level of active participation of students in face-to-face classes and online sessions. Active participation of students in physical classes reaches 80%, while participation in online sessions is only around 40%. This shows that face-to-face interactions in the classroom are more effective in facilitating student engagement. One of the main reasons identified is the physical classroom environment that allows students to interact directly and spontaneously with teachers and peers. In contrast, in online learning, technological constraints and limitations of non-verbal interactions can reduce active student engagement.

The findings show that teacher efficiency in teaching in physical classrooms reaches 75% in terms of teacher efficiency, while in online sessions, the efficiency drops to 50%. Teachers reported that they were better able to read students' expressions and responses directly in physical classrooms, which allowed them to adjust their teaching methods in real time. Despite the presence of digital communication tools, teacher-student interactions become more structured and formal, reducing teachers' ability to provide responsive and personalized teaching.

The data also shows that student motivation in face-to-face learning is higher, with 85% of students feeling motivated in a physical classroom setting, compared to 60% in online sessions. One factor that contributes to low motivation in the online environment is the limited social and emotional interaction that is usually present in face-to-face learning. In addition, technological challenges, such as internet connection disruptions or difficulty operating digital platforms, also contribute to lowering students' enthusiasm for learning.

The diagram shows a significant difference between students with good and limited access to technology. Students with adequate access to technology (around

40%) tend to be more actively involved in online learning, while students with limited access only reach 20% in participation. This reflects a significant digital divide, where access to quality devices and the internet affects the quality and intensity of student engagement in online sessions. These data show that although hybrid learning provides flexibility, several challenges require special attention, especially related to maintaining student motivation and ensuring optimal quality of interaction in a digital environment. These findings also emphasize the need for more inclusive solutions to address the digital divide and maximize the potential of technology in basic education.

Further analysis of the digital platforms used in hybrid learning shows that although these tools are designed to improve communication, there is still a significant gap in terms of social and emotional interaction between teachers and students. Classroom management platforms such as Google Classroom or Microsoft Teams allow teachers to easily share materials and assignments, but they are less able to provide the spontaneous interaction that usually occurs in a physical classroom. For example, observations show that students interact more formally in online sessions, while in face-to-face classes, they are more free to express ideas or questions spontaneously.

The study also found that students''with'better access to technology tended to be more active in digital interactions. Around 40% of students from more economically advantaged backgrounds, who had access to devices and a stable internet connection, were more frequently involved in online discussions, while students with limited access tended to lag in participation, this suggests a digital divide that magnifies disparities in students' learning experiences in hybrid learning.

The findings of this study Indicate that although technology provides flexibility in hybrid learning, the effectiveness of interactions between teachers and students is still influenced by various factors, such as the quality of technology access and the design of the learning platform. Teachers also play an important role in creating a supportive learning environment, both in face-to-face and online sessions, this suggests the need for a more comprehensive approach to integrating technology into basic education so that quality interactions can be maintained, even in a hybrid learning model.

2. Dynamics of Digital Interaction

The roles of teachers and students have changed significantly because interactions through digital platforms present new dynamics in hybrid learning, teacher-student interactions mainly occur directly in the classroom, with verbal and non-verbal communication occurring spontaneously before digital technology. The role of teachers is increasingly transforming from being merely a teacher to a facilitator in the context of digital learning. Teachers not only transfer knowledge but also manage the learning process through online devices and platforms. They must be able to master technology and ensure that the material presented can be accessed and understood by students even without physical presence.

One of the main challenges in digital interactions is keeping students actively engaged. In a physical classroom environment, teachers can easily spot students who may be confused or disengaged and provide immediate assistance. However, in online sessions, this aspect becomes more difficult as students tend to be more passive. Digital interaction features, such as forums or chats, are often not used to their full potential by students, which can reduce active participation. In addition, non-verbal communication, such as facial expressions or body language, which are important indicators in traditional learning, becomes difficult to observe in a digital environment, potentially reducing the effectiveness of teaching.

Digital interaction also has several advantages. One of them is the flexibility of time and place, where students can learn and interact with teachers at any time through digital platforms. In addition, technology allows for more interactive delivery of materials, such as the use of videos, online quizzes, or gamification, which can increase the appeal of learning for students. Teachers can also track student progress in more detail through data analysis provided by the learning platform, such as attendance, participation, or assignment results in real-time.

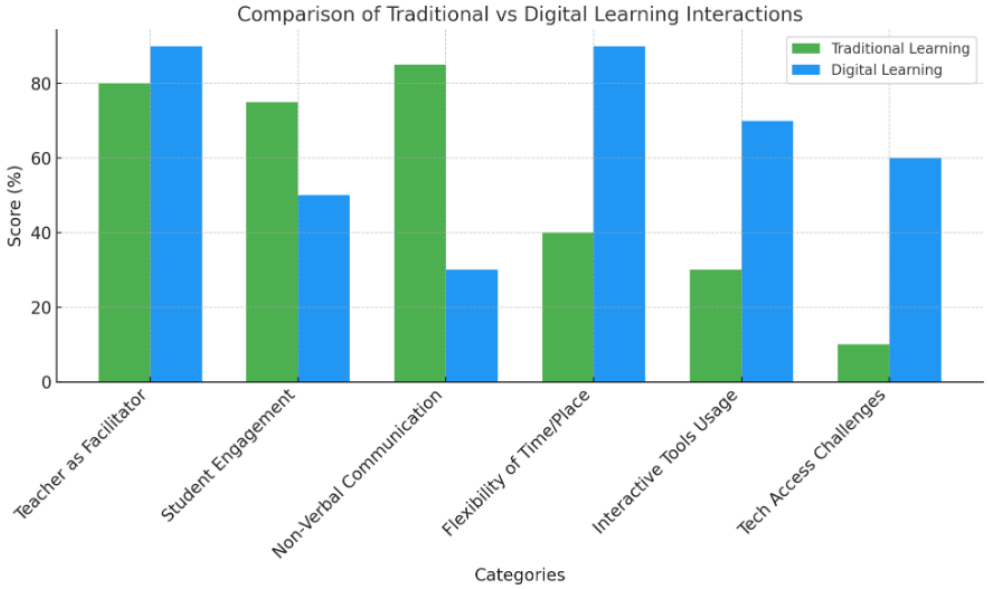

Figure 2. Comparison of Traditional vs Digital Learning Interaction

Source: data proceed

There are significant differences between traditional and digital learning in various aspects of interaction. One of the main findings is the role of teachers as facilitators. In the context of digital learning, this role increases to 90%, compared to 80% in traditional learning. Teachers no longer only deliver material but also have to ensure the smooth use of technology and manage various digital platforms used to support learning.

The main challenge In digital learning lies In student engagement. In traditional learning, active student engagement reaches 75%, while in digital learning, only about 50% of students are actively involved. This shows that although digital technology offers many interactive features, such as quizzes or discussion

forums, many students do not fully utilize these opportunities to actively engage in learning.

Data shows a sharp decline in the use of non-verbal communication in digital learning, reaching only 30%, compared to 85% in face-to-face learning. This aspect is one of the biggest drawbacks of online learning, where body language, facial expressions and other non-verbal signals are difficult to translate through the screen, thereby reducing emotional understanding and connection between teachers and students.

Flexibility of time and place in digital learning is the main advantage with a score of 90%, far above traditional learning which is only 40%. The ability for students and teachers to learn and teach from anywhere provides unprecedented convenience and flexibility. The use of interactive tools increases significantly in digital learning (70%) compared to traditional learning (30%). Technology such as videos, online quizzes, and gamification are important elements that can enrich students' learning experiences.

There are also technology challenges that remain a major issue, with 60% of students in digital learning facing barriers to accessing technology. This creates a significant gap compared to traditional learning, which is more stable and less affected by access to technology. These limitations can impact students' learning experiences, especially for those who do not have adequate devices or internet access. This data suggests that while digital learning offers many benefits, such as flexibility and the use of interactive tools, challenges in student engagement and gaps in access to technology need to be addressed to maximize the potential of hybrid learning.

Limited access to technology remains a major challenge. Students with unstable internet access or inadequate devices often struggle to fully engage in digital learning sessions, and this can create a gap in the quality of interactions, with students with better access experiencing a more optimal learning experience than those less fortunate. Digital interactions in hybrid learning offer unique opportunities and challenges. The role of teachers increasingly demands mastery of technology and adaptive pedagogical approaches, while students are required to be more proactive in using digital platforms and to maximize the potential of hybrid learning, efforts are needed to address these challenges, such as improving digital literacy and expanding access to technology for all students.

The findings of this study reveal several important implications regarding the quality and effectiveness of interactions in hybrid learning in elementary schools. One of the main implications is that, although technology offers flexibility and access to wider learning resources, the quality of interactions between teachers and students in online sessions remains a challenge. Student engagement in hybrid learning, especially in online sessions, tends to be lower compared to face-to-face learning, and this suggests that the hybrid model requires a more strategic approach to creating meaningful interactions in the digital environment.

Decreased student engagement in online sessions can have implications for the overall effectiveness of learning. Since active participation is a key element in understanding and mastering the material, low engagement can have a negative impact on student learning outcomes. Teachers need to adopt more creative and adaptive approaches to increase student engagement, such as utilizing gamification features or more structured group collaboration in digital platforms.

The findings that non-verbal communication is very limited in the digital environment have major implications for teacher-student relationships, as non-verbal communication plays a vital role in creating emotional connections and ensuring that students understand instructions well in traditional learning. The absence of this element in digital learning can reduce the quality of interactions, which in turn can affect student motivation and engagement, teachers may need to compensate for this by increasing more personalized verbal feedback or strengthening interactions through more frequent video discussions.

The flexibility offered by hybrid learning, on the other hand, is one of its most prominent advantages. Students and teachers are no longer limited by time and place, which gives them the freedom to organize their learning schedules. Findings on the technology access gap highlight that not all students can benefit from this flexibility equally. Students who have limited access to devices or stable internet may be left behind, which can widen the gap in academic achievement (Mormando, 2022).

These findings suggest that hybrid learning can be an effective solution in the context of primary education, provided that existing challenges, such as student engagement, non-verbal communication, and the digital divide, are well addressed. Further research and innovation in teaching methods are needed to ensure that hybrid learning can create quality interactions and support student's academic success in the digital age.

The results of this study highlight the importance of digital literacy as one of the key elements in the success of hybrid learning, both for teachers and students. Digital literacy is not only related to the technical ability to use digital devices and platforms, but also includes the skills to understand, manage, and utilize technology effectively in the learning process. It is clear that the low engagement of students in online learning, as well as challenges in utilizing interactive features, indicate a digital literacy gap from the findings of this study, Teachers and students who do not have adequate digital literacy tend to face difficulties in maximizing the potential of hybrid learning.

Digital literacy for teachers is very important. As facilitators in a hybrid model, teachers need to have a deep understanding of how various technological tools work, as well as the ability to design and manage interactive and engaging learning in a digital environment. Previous research by (Mormando, 2022) showed that teachers with higher digital literacy tend to be more effective in implementing technology-based learning, and this is in line with the findings of this study, which

showed that student engagement is lower in an online environment if teachers cannot optimally utilize interactive features, this study supports previous literature that emphasizes the importance of digital literacy to improve the quality of interaction in technology-based learning.

Previous research by (Stoloff & Goyette, 2022) stated that students' digital literacy affects their ability to actively participate in the online learning process. Students who are accustomed to using technology in their daily lives may be more adaptable to the hybrid learning model, while students who are less exposed to technology tend to face more difficulties. The findings in this study, which showed that many students did not utilize interactive features on digital platforms, indicate that students' digital literacy still needs to be improved. This supports the theory of digital literacy by (Bartlett, 2022), which emphasizes that digital literacy includes a critical understanding of digital content and the ability to interact effectively in the online world.

This study also shows that limited access to technology is a major barrier to the implementation of digital literacy in its entirety. Limited access, such as inadequate devices or unstable internet connections, can prevent students from using technology to its full potential. Research by (Gnaur et al., 2020) on the digital divide also supports this finding, which shows that students from lower economic backgrounds often have barriers to accessing technology, which ultimately affects their digital literacy, this study is consistent with previous research that emphasizes the importance of equal access to technology as a prerequisite for effective digital literacy. This study confirms the relevance of digital literacy in supporting the success of hybrid learning and improving digital literacy for both teachers and students, as well as overcoming barriers to accessing technology, which are important steps to ensure that interactions in hybrid learning can run effectively and be of high quality.

E. CONCLUSION

The conclusion of this study shows that although hybrid learning offers flexibility and opportunities to enrich interactions between teachers and students through technology, there are still significant challenges in maintaining the quality of interactions, especially in student engagement and non-verbal communication. Digital literacy is a critical factor for the success of this learning model, both for teachers who need to make optimal use of technology and for students who must be able to actively participate in the digital environment. The gap in access to technology is a barrier that needs to be addressed to ensure equity in the learning experience. This study emphasizes the need for a more comprehensive strategy to improve digital literacy and ensure equitable access to support effective hybrid learning in primary education.

REFERENCES

1. Asfahani, A., Sain, Z. H., & Mariana, M. (2023). Comparative Analysis of Educational Policies: A Cross-Country Study on Access and Equity in Primary Education. *EDUJAVARE: International Journal of Educational Research*, *1*(1), 19–28.
2. Attard, C., & Holmes, K. (2022). An exploration of teacher and student perceptions of blended learning in four secondary mathematics classrooms. *Mathematics Education Research Journal*, *34*(4), 719–740.
3. Ayman, D., Mohaseb, M., & El-Bassuony, J. (2022). Using Instructional Scaffolding in hybrid learning environment: A critical Review. *Port Said Journal of Educational Research*, *1*(1), 132–154.
4. Baldassarre, M., Tamborra, V., & Lisimberti, P. (2021). Blended learning and emergency distance learning. How to rethink learning environments at school. *CEUR WORKSHOP PROCEEDINGS*, *2817*.
5. Bartlett, L. (2022). Specifying hybrid models of teachers' work during COVID-19. *Educational Researcher*, *51*(2), 152–155.
6. Baxtiyorovna, E. G. (2022). Factors that Increase Lesson Effectiveness in Primary Education. *European Journal of Innovation in Nonformal Education*, *2*(2), 231–235.
7. Chelliq, I., Anoir, L., Erradi, M., & Khaldi, M. (2023). Transition From Face-to-Face to E-Learning and Pedagogical Model. In *Emerging Trends and Historical Perspectives Surrounding Digital Transformation in Education: Achieving Open and Blended Learning Environments* (pp. 52–77). IGI Global.
8. Das, D. (2021). Redefining Teaching in the Post-Covid-19 Era: A New Age Challenges for Teachers. *E-Learning-Teaching Strategies and Teachers' Stress in Post Covid-19*, 57.
9. Gerosa, G. M., & Manciaracina, A. (2023). L: Space and technology as facilitators of new hybrid learning experiences: the Politecnico di Milano's Innovative Classroom Project. In *MULTIPLE-SCALARITIES Environmental systems as a combination of interior design, services, communication and technologies* (pp. 73–101). Franco Angeli.
10. Gnaur, D., Hindhede, A. L., & Andersen, V. H. (2020). Towards hybrid learning in higher education in the wake of the COVID-19 crisis. *European Conference on E-Learning*, 205–XV.
11. Herbert Sathish, R. A., & BK, A. (2024). Analysis of Student and Teachers Perspective using Hybrid e-Learning Method. *Journal of Advanced Zoology*, *45*(2).
12. Hidayat, H., Sukmawarti, S., & Suwanto, S. (2021). The application of augmented reality in elementary school education. *Research, Society and Development*, *10*(3), e14910312823–e14910312823.
13. Impedovo, M. A., & Tan, S. C. (2023). Learning design for teacher-student co-agency in hybrid spaces. *Revue Internationale Du CRIRES*, *7*(1), 24–38.
14. Katal, A., Upadhyay, J., & Singh, V. K. (2023). Blended learning in COVID-19 era and way-forward. In *Sustainable Blended Learning in STEM Education for Students with Additional Needs* (pp. 55–85). Springer.

15. Kim, J. H. (2022). Preschool participation and students' learning outcomes in primary school: Evidence from national reform of pre-primary education in Ethiopia. *International Journal of Educational Development*, *94*, 102659.
16. Loizou, M. (2022). Digital tools and the flipped classroom approach in primary education. *Frontiers in Education*, *7*, 793450.
17. Mitev, A. Z., Tóth, R., & Vaszkun, B. (2024). Role transition of higher education teachers due to disruptive technological change: Identity reconstruction for a better teacher-student relationship. *The International Journal of Management Education*, *22*(2), 100978.
18. Mormando, S. E. (2022). *Special education itinerant teacher engagement with students enrolled in blended learning classes post pandemic*. Widener University.
19. Munday, D. (2022). Hybrid pedagogy and learning design influences in a higher education context. *Studies in Technology Enhanced Learning*, *2*(2).
20. Racheva, V., & Peytcheva-Forsyth, R. (2024). Navigating the Future: Exploring Synchronous Hybrid Learning in Higher Education Post-COVID. *INTED2024 Proceedings*, 6335–6345.
21. Stoloff, S., & Goyette, N. (2022). Hybrid Teaching in Schools: Pedagogical Innovation and Professional Well-Being in a Time of Pandemic. *Journal of Education and Learning*, *11*(3), 1–13.
22. Thirkell, E., & Munday, D. (2023). Re-imagining hybrid pedagogies: lessons from the pandemic using the Diffusion of Innovation model. In *Building the Post-Pandemic University* (pp. 111–135). Edward Elgar Publishing.
23. Topuzov, O., Bibik, N., Lokshyna, O. I., & Onopriienko, O. (2022). Organisation of primary education at war in Ukraine: results of a survey of primary education specialists. *Education: Modern Discourses*, *5*, 7–18.
24. Xie, Y., Huang, Y., Bai, Y., Luo, W., & Qiu, Y. (2021). Construction of the Teacher-Student Interaction Model in Online Learning Spaces. *Blended Learning: Re-Thinking and Re-Defining the Learning Process. 14th International Conference, ICBL 2021, Nagoya, Japan, August 10–13, 2021, Proceedings 14*, 53–65.