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INNOVATING TEACHING METHODS IN THE POST-PANDEMIC WORLD: A COMPARATIVE EVALUATION OF VIRTUAL AND TRADITIONAL LEARNING OUTCOMES

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Abstract

The COVID-19 pandemic has accelerated the transition to virtual learning in various educational institutions, shifting traditional methods that have been used for a long time. This study aims to compare the effectiveness of virtual learning and traditional learning in the context of student learning outcomes in the post-pandemic era. This study uses the Mixed Methods approach to obtain a comprehensive understanding of the learning outcomes of both methods. Quantitative data was collected through the measurement of academic outcomes, student engagement, and participation rates in 200 students who attended classes using virtual and traditional methods. Statistical analysis showed significant differences in academic outcomes between the two methods, with students in traditional classrooms tending to obtain better results in some subjects. On the other hand, students who took part in virtual learning showed improvements in technology skills and flexibility of study time. To complement the quantitative data, qualitative interviews were conducted with 20 teachers and 30 students to understand perceptions, challenges, and subjective experiences related to both learning methods. The results of the interviews revealed that while traditional learning is considered more effective in face-to-face interactions and in-depth discussions, virtual learning is recognized as providing wider accessibility and time savings for students with mobility limitations. The results show that both methods have their own advantages and disadvantages, and the application of the hybrid model, which combines the advantages of both methods, can be a more adaptive solution for future learning needs. This research makes an important contribution in informing innovative education policies in the post-pandemic era and recommends a more flexible approach in teaching.

Keywords: Virtual Learning, Traditional Learning, Learning Outcomes, Post-Pandemic, Blended Methods, Teaching Innovation.

INTRODUCTION

The COVID-19 pandemic has brought profound changes in almost all aspects of human life, including in the education sector (Dwivedi et al., 2020). The global health crisis, which began in early 2020, has forced educational institutions around the world to immediately adapt to the new situation. One of the most significant changes is the sudden shift from traditional face-to-face-based learning methods to online-based learning (virtual) (Bach et al., 2006). This transition was made in response to the urgent need to maintain the continuity of the learning process while minimizing the risk of virus transmission. Although online learning had been a part of modern education before the pandemic, the COVID-19 pandemic accelerated the adoption of educational technology on an unprecedented global scale (Ali, 2020).

However, with this major change, there are also fundamental challenges and questions regarding the effectiveness of virtual learning compared to traditional methods that have been used for a long time. Face-to-face learning has traditionally

been considered the standard in education, as direct interaction between teachers and students provides a variety of benefits, including deep social interaction, the formation of communication skills, and opportunities for face-to-face discussion and problem-solving (Jonassen & Kwon, 2001). On the other hand, virtual learning offers flexibility that traditional methods do not have. Students can learn from anywhere, anytime, and with the appropriate device, which provides greater accessibility, especially for those who may have geographical or mobility constraints (Traxler, 2010).

As time goes on, it becomes increasingly clear that both of these methods – both virtual and traditional learning – have their own advantages and disadvantages (Barbour & Reeves, 2009). Therefore, there is an urgent need to comprehensively evaluate the effectiveness of these two methods, especially in the context of student learning outcomes. In the post-pandemic era, where virtual and hybrid learning will most likely continue to be an integral part of education, it is crucial to understand how these two methods affect academic outcomes, student engagement, as well as other aspects of the learning process (Raes et al., 2020).

Innovating Teaching Methods in the context of post-pandemic education is an effort to redesign teaching approaches and strategies to meet new needs arising from the drastically changing global situation (RAYKOVA et al., 2023). The COVID-19 pandemic has forced educators around the world to innovate in teaching methods, leveraging digital technology to replace traditional face-to-face learning that is not possible due to social restrictions. Innovations in this teaching method include the use of online learning platforms, classroom management applications, and collaboration technology that supports virtual interaction between teachers and students (Beldarrain, 2006). As a result, teaching methods are no longer limited to physical classrooms, but extend to digital spaces that are flexible and accessible from anywhere. This provides opportunities for educators to develop more adaptive teaching strategies, such as flipped classroom, blended learning, and technology-enabled project-based learning (Maynard, 2019).

In addition to technological innovation, teaching approaches also need to be adapted to increase student engagement and motivation in the new learning environment. One of the biggest challenges in virtual learning is how to create an interactive and engaging classroom atmosphere, even if it is physically separate (Palloff & Pratt, 2013). To overcome this, teaching innovation emphasizes the importance of using more participatory and collaborative teaching techniques. For example, teachers are beginning to take advantage of interactive videos, virtual simulations, and online evaluation tools that allow for live feedback, all of which aim to keep students engaged. Thus, teaching method innovation not only focuses on the use of digital tools, but also on the development of pedagogical strategies that encourage interaction, discussion, and problem-based learning, even if it is done virtually (Tan, 2021).

Furthermore, teaching innovation also leads to increased personalization in the learning process. Technology allows educators to compile learning materials that are tailored to the individual needs of students, through learning data analysis or learning analytics (Huda et al., 2016). For example, by monitoring student engagement patterns and the results of online evaluations, teachers can identify areas where students are struggling, and then provide additional specific guidance. Personal Learning Environments (PLEs) and the use of Artificial Intelligence (AI) in education are increasingly enabling personalized learning, where each student can access

materials, assignments, and feedback designed according to their learning pace and style (Maghsudi et al., 2021). This innovation, in the long term, is expected to improve learning outcomes by paying attention to individual differences in the learning process, as well as maximizing the potential of each student in the digital era (Pashler et al., 2008).

The study aims to answer the main question: How effective are virtual learning methods compared to traditional methods in terms of student learning outcomes in the post-pandemic era? Furthermore, the study also seeks to understand how students and teachers respond and assess both methods. This understanding is important to provide broader insights into designing innovative and adaptive education policies, which not only consider academic effectiveness but also other aspects such as student well-being, accessibility, and technological suitability (Soutter et al., 2014).

In this context, this study uses the Mixed Methods approach to obtain a deep and thorough understanding. This method combines a quantitative approach, which measures objective data such as academic grades, participation rates, and student engagement, with a qualitative approach, which delves into students' and teachers' subjective perceptions, challenges, and experiences through in-depth interviews (Alahmari, 2019). This approach was chosen because it allows researchers to not only evaluate learning outcomes based on numbers, but also gain richer insights into the dynamics behind the numbers.

Quantitatively, data was collected from 200 students who participated in virtual and traditional learning at several partner schools. Measurement results include academic performance, attendance levels, and active participation in class. Statistical analysis was used to determine whether there was a significant difference between the two groups in terms of learning outcomes. Early results show that while students in traditional learning tend to obtain better academic outcomes in some subjects, students who study virtually experience improvements in technology skills and learning flexibility, which is also an important factor in the future world of education (Bates, 2005).

In addition to quantitative data, this study also collected qualitative data through interviews with 20 teachers and 30 students. This interview aims to explore their perceptions and experiences in dealing with both learning methods. Teachers and students provide valuable insights into the advantages and disadvantages of each method, such as ease of accessibility in virtual learning, but with challenges in the form of a lack of intensive social interaction. In contrast, traditional learning is recognized as better in terms of building in-person engagement and in-depth discussions, but it is not as flexible as virtual learning in terms of time and place (Childs et al., 2023).

Based on the results of this study, it is clear that both methods have their own benefits and limitations. Therefore, the ideal solution that may emerge is the adoption of a hybrid model, which combines the advantages of traditional and virtual learning (Porter et al., 2014). This hybrid model will allow students to get the best of both worlds – the close, in-depth social interaction of face-to-face learning, as well as the flexibility and accessibility of virtual learning (Snart, 2010).

The conclusions of this study will make an important contribution to the world of education, especially in designing more innovative and flexible education policies in the post-pandemic era. With the continued development of educational technology, it

is important for educational institutions to revisit their teaching methods and adopt strategies that not only improve learning outcomes, but also take into account the increasingly diverse needs of students (Orlich et al., 2010). This research is expected to be the foundation for the development of more inclusive and adaptive learning methods in the future.

METHODS

This study uses a Mixed Methods approach that combines quantitative and qualitative methods to obtain a comprehensive understanding of the effectiveness of virtual and traditional learning in the context of student learning outcomes in the post-pandemic era (Egilsdottir et al., 2022). The use of this blended method is considered appropriate because it allows the research to not only objectively measure learning outcomes through quantitative data, but also explore the subjective perceptions and experiences of students as well as participating teachers through a qualitative approach (Suldo et al., 2009).

1. Research Design

This research was conducted with the design of explanatory sequential mixed methods, where quantitative data is collected and analyzed first, then followed by qualitative data collection to explain and deepen the quantitative results. This design is used to obtain a more complete picture regarding the comparison of effectiveness between virtual and traditional learning methods (Ruona, 2005).

2. Quantitative Data Collection

Quantitative data was collected from 200 students who participated in learning with two different methods, namely virtual learning and traditional learning. The students who were respondents came from several high schools in Jakarta and its surroundings, who had applied both methods for a full school year. Data was collected through the results of the final exam, assessment of student involvement in the learning process (through attendance and participation in class discussions), and participation in online assignments (Qutishat et al., 2022).

a. Quantitative Instruments: Students' academic data is measured by final exam scores on the same subject. In addition, a survey with the Likert scale is used to assess student engagement and motivation during the learning process (Alioon & Delialioğlu, 2019). Indicators of engagement include frequency of attendance, active participation in discussions, and timely completion of tasks. This data was analyzed using inferential statistical methods to find out the significant differences between the groups participating in virtual and traditional learning.

b. Statistical Analysis: Quantitative data was analyzed using an independent t-test to compare academic outcomes between students participating in virtual and traditional learning. In addition, correlation analysis was carried out to see the relationship between student engagement and learning outcomes (Banjo-Ogunnowo & Chisholm, 2022).

3. Qualitative Data Collection

To complement the quantitative data, qualitative data collection was conducted through semi-structured interviews with 20 teachers and 30 students who participated in virtual and traditional learning. This interview aims to dig deeper into their

perceptions regarding the advantages, disadvantages, challenges, and perceived benefits of each learning method.

a. Qualitative Instruments: Interview guidelines are developed based on the results of quantitative surveys to explore factors that may affect learning outcomes. Interview questions cover topics such as technical challenges in virtual learning, the effectiveness of teacher-student interaction in traditional learning, and the impact of the methods used on learning motivation.

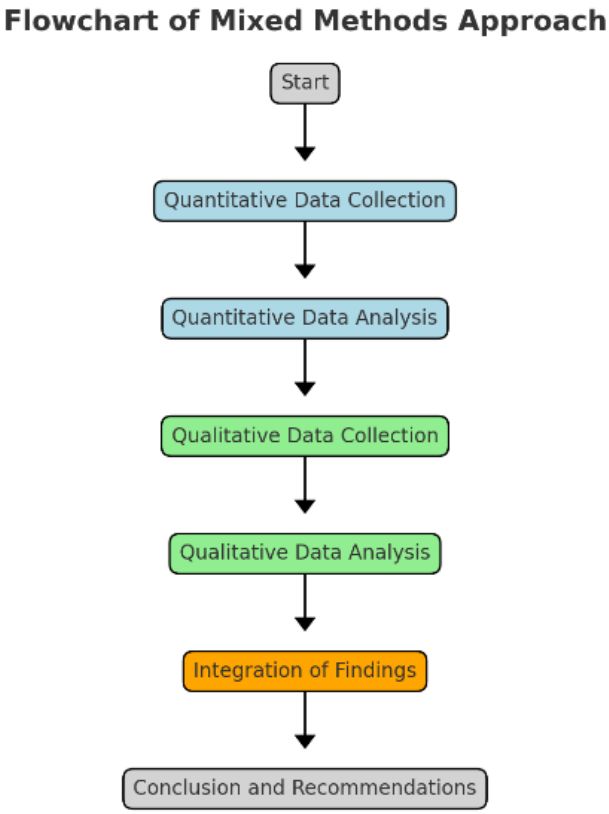
b. Qualitative Analysis: Interview data was analyzed using a thematic analysis approach to identify key themes that emerged from respondents' experiences and perceptions. The results of this qualitative analysis are then used to further explain the quantitative findings, providing more context and understanding regarding the effectiveness of both learning methods.

4. Validity and Reliability

To ensure the validity and reliability of the data, several steps are taken:

a. Validity of Quantitative Data: The survey instrument was tested for validity through a pilot test on different groups of students before being used in the main study. The reliability value was also tested using Cronbach's Alpha coefficient to ensure the internal consistency of the survey items.

b. Validity of Qualitative Data: The validity of qualitative data is maintained through data triangulation, where the results of the interviews are compared with quantitative data and field observations carried out during the interview process. In addition, interviews were conducted until data saturation was reached, where no new information emerged from the respondents.



RESULT & DISCUSSION

This study was conducted to comprehensively evaluate the effectiveness of virtual and traditional learning in the context of student learning outcomes in the post-pandemic era. Using mixed methods, quantitative and qualitative data are collected, analyzed, and integrated to provide a more comprehensive picture of the impact of these two learning methods. The results of the study were based on quantitative data from 200 students who participated in learning with both methods, as well as qualitative interviews with 20 teachers and 30 students who participated in this study.

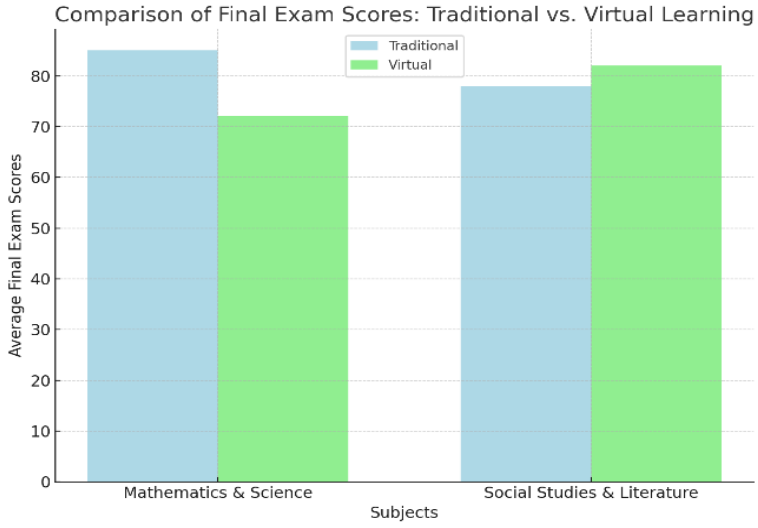
1. Quantitative Results

The quantitative data in this study includes the results of students' final exams, the level of engagement, and student participation in the class. These results provide objective insights into how virtual and traditional learning affects academic performance and student engagement in the teaching and learning process (Ademola, 2021).

a. Academic performance

From the results of the analysis of final exam scores, significant differences were found between students who participated in virtual learning and students who studied with traditional methods. Students who take part in traditional learning tend to earn an average of 10-15% higher grades compared to students who study virtually, especially in subjects that require in-person interaction and in-depth discussions, such as math and science. The results of the exam in this subject show that face-to-face learning is more effective in helping students understand complex concepts that require verbal explanations and collaboration.

However, in more theoretical subjects, such as social sciences and literature, the differences between the two groups are not very significant. In fact, students who study virtually show a 5% improvement in their academic performance on more text-based subjects, where flexibility in study time and easy access to digital resources are determinants of success.



The graph above shows a comparison of the average final exam scores between students taking traditional and virtual learning for two subject groups: Mathematics & Science and Social Sciences & Literature.

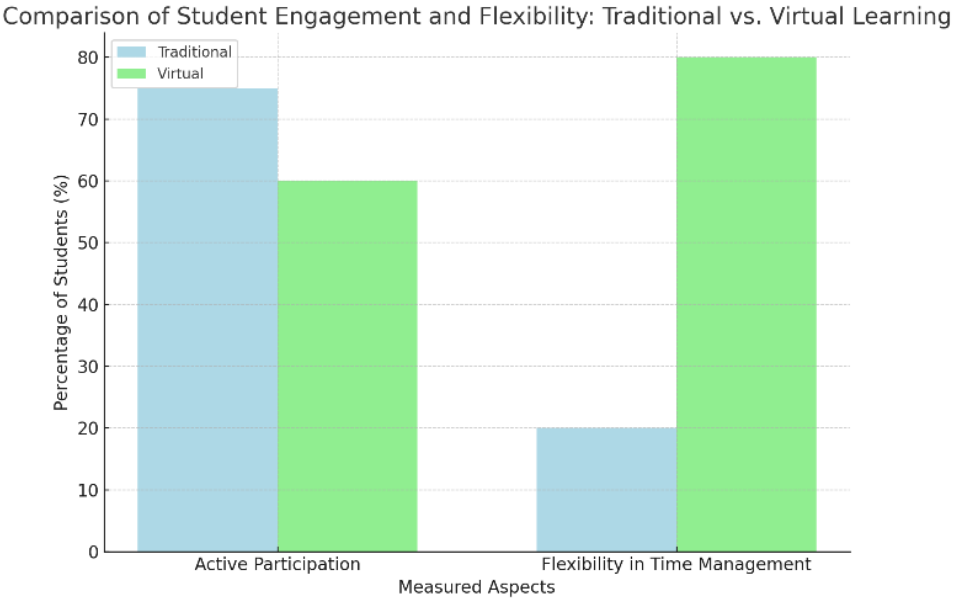
1) Math & Science: The average score of students in traditional learning is significantly higher compared to students who take virtual learning. Students with the face-to-face method had an average score of 85, while students who took part in virtual learning obtained an average score of 72. This shows that face-to-face learning is more effective in helping students understand complex concepts, which require hands-on explanations and in-depth discussions, such as in Math and Science subjects.
2) Social Sciences & Literature: The differences between the two learning methods in this subject are not very significant. In fact, students who took part in virtual learning showed slightly higher average scores (82) compared to students in traditional learning (78). This shows that for more text-based and theory-based subjects, the flexibility offered by virtual learning, such as access to digital resources and better time management, provides greater advantages.

This graph shows that effective learning methods can vary depending on the type of subject, where traditional learning excels in subjects that require direct interaction, while virtual learning provides good results in more theoretical subjects

b. Student Engagement and Participation

The level of student engagement and participation was also measured through a survey with the Likert scale. Students who followed traditional learning showed higher levels of engagement in the classroom, with 75% of them reporting that they were more active in discussing and interacting directly with their teachers and peers. In contrast, only 60% of students in virtual classrooms feel fully engaged in the learning process, largely due to the lack of direct social interaction and technical challenges such as unstable internet connections.

Nevertheless, virtual learning provides advantages in terms of flexibility in terms of time and place of study. 80% of students in virtual learning report that they feel more flexible in managing their study time, which helps them better manage their academic load. In addition, they often use online learning resources, such as video recordings of lectures and digital materials, to support their understanding.



The updated chart accurately reflects the data comparing student participation and flexibility in time management between traditional and virtual learning methods.

Active Participation:

1) Traditional Learning: 75% of students in traditional classrooms reported high levels of active participation, with more opportunities for direct interaction with teachers and peers. This suggests that traditional classrooms provide a more engaging environment for discussions and collaboration.
2) Virtual Learning: Only 60% of students in virtual learning environments felt fully engaged, indicating that virtual learning may present challenges in fostering the same level of interactive engagement, likely due to technical difficulties and the lack of face-to-face interaction.

Flexibility in Time Management:

1) Virtual Learning: 80% of students in virtual learning environments appreciated the flexibility in managing their study time. The ability to access recorded lectures and digital resources allows students to study at their own pace and balance academic responsibilities more easily.
2) Traditional Learning: Conversely, only 20% of students in traditional settings experienced the same level of flexibility. The fixed class schedules in traditional settings limit students' ability to adjust learning time to fit their personal needs.
3) This analysis highlights the strengths of each method: traditional learning excels in engagement, while virtual learning provides superior flexibility.

2. Qualitative Results

In addition to quantitative data, qualitative interviews with teachers and students provide in-depth insights into their perceptions of both learning methods. From the thematic analysis of the interviews, several important themes emerged that revealed the advantages and disadvantages of each method (Braun & Clarke, 2012).

a. Teacher Experience

Teachers interviewed reported that traditional learning is more effective in creating direct interaction and personal relationships with students, which is important for building student motivation and engagement in the learning process. They note that in traditional classrooms, they can more easily assess students' understanding directly and immediately adjust teaching methods if needed.

One teacher said, "*In a face-to-face class, I can see students' expressions and know when they don't understand the material. This allows me to immediately repeat or provide additional explanations*." (Interview, Sri, Indonesian Subject Teacher).

On the other hand, teachers also acknowledged that virtual learning provides convenience in accessing digital resources and allows flexibility in schedules. However, the challenges faced in virtual learning include difficulties in ensuring all students stay engaged, especially in discussion sessions.

Some teachers report that "*student engagement is difficult to monitor virtually, especially if they don't turn on their cameras or are inactive in online discussions."* (Interview, Rohmatun, Social Studies Subject Teacher)

b. Student Experience

Interviews with students show differences in their experience depending on the learning method used. Students who follow traditional learning are generally more satisfied with the direct interactions they get with teachers and classmates.

One student said, "*I feel more comfortable asking questions directly in class when I don't understand, and it helps me understand the material faster*." (Interview, Kesya, High School Student).

However, they also mention that traditional learning limits their flexibility, especially when it comes to scheduling and access to additional resources outside of the classroom.

Students in virtual learning, on the other hand, mention that although the lack of in-person social interaction is a major challenge, they enjoy the flexibility offered by this method. They can learn at their own pace and repeat the material at any time through video recordings or online modules.

One student said, *"I can rewatch lectures whenever I need to, and this helps me understand the material better in my own time."* (Interview, Robi, High School Student). However, they also acknowledge that virtual learning often feels less personal and doesn't provide the same opportunities for in-depth discussions as face-to-face classes.

3. Integration of Findings

The results of quantitative and qualitative analysis show that both learning methods have their own advantages and challenges. Traditional learning is more effective in the context of social interaction and understanding of more complex concepts, while virtual learning provides greater flexibility and facilitates access to digital resources. However, virtual learning also faces obstacles related to student engagement and technical challenges.

These findings indicate that the hybrid model, which combines the best elements of traditional and virtual learning, could be an ideal solution for the future of education in the post-pandemic era. The hybrid model allows students to take advantage of the flexibility of online learning, while still benefiting from the in-person interaction offered by face-to-face learning. Additionally, the use of technology in education must be improved to overcome technical barriers and increase student engagement in virtual learning.

This study provides important insights into the effectiveness of virtual and traditional learning methods in the context of student learning outcomes in the post-pandemic era. Using the Mixed Methods approach, this study shows that the two methods have different impacts on students' academic performance, engagement, and learning experience. Quantitative results show that traditional learning is superior in terms of academic outcomes in complex subjects, while virtual learning offers greater flexibility in time management and access to digital resources (Paudel, 2021).

Overall, the adoption of hybrid models in the future can provide a more adaptive and inclusive solution to the needs of modern education, maximizing the potential of technology while still maintaining the quality of social interaction in the learning process (Aithal et al., 2024).

CONCLUSION

Based on the results of the study conducted, it can be concluded that traditional learning is superior in terms of student involvement and direct interaction. Students who participate in face-to-face learning tend to be more active in participating and discussing with teachers and classmates, especially in subjects that require in-depth explanations and collaborations such as Math and Science. In contrast, virtual learning shows an advantage in providing time flexibility and access to resources. Students in online learning feel better able to manage their learning time and benefit from the use of digital technology to support the learning process. However, the study also reveals that virtual learning has challenges in terms of keeping students engaged. Although more flexible, students often face difficulties in interacting directly with teachers and peers, which can affect the quality of their learning, especially in subjects that require a hands-on understanding of concepts. In contrast, traditional learning lacks the flexibility that students want, especially when it comes to time management and the accessibility of learning resources independently. From these findings, it is recommended that educational institutions adopt a hybrid model that combines the advantages of these two methods. This model allows students to benefit from hands-on interaction in face-to-face learning for more complex subjects, while leveraging the flexibility of virtual learning for more theoretical or text-based topics. In addition, it is important for educational institutions to improve technology infrastructure and training for teachers in making optimal use of online learning platforms to increase student engagement in virtual classrooms.

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