

DESIGNING A MULTICULTURAL HYBRID LEARNING FRAMEWORK FOR SOCIAL STUDIES EDUCATION IN A DIVERSE INDONESIAN CLASSROOM

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Abstract

The diversity in Indonesian classrooms presents both opportunities and challenges for social studies education. The evolving cultural and ethnic backgrounds of students necessitate the development of an inclusive and adaptable educational framework. This study explores the design of a multicultural *hybrid learning* framework tailored for social studies education in Indonesia. The primary objective of the research is to develop an effective, culturally responsive teaching model that integrates both traditional and digital learning methods to cater to diverse student needs. A mixed-methods approach was employed, combining qualitative interviews with social studies educators and quantitative surveys of students across different regions. The research findings indicate that the proposed hybrid framework fosters a more engaging and equitable learning environment by incorporating culturally relevant content, interactive digital tools, and collaborative learning strategies. Furthermore, the study highlights the importance of teacher training in multicultural competence and the integration of technology in enhancing students' critical thinking and social awareness. The study concludes that a *hybrid learning* model, when thoughtfully implemented, can significantly improve the inclusivity and effectiveness of social studies education in a multicultural context. This research contributes to the broader field of education by offering a model for adapting social studies teaching in diverse classrooms.

Keywords: Hybrid Learning, Hybrid Learning, Indonesia.



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INTRODUCTION

In contemporary educational settings, diversity in classrooms is becoming an increasingly significant feature, especially in countries with rich cultural heritages like Indonesia. The country's unique composition, which includes over 300 ethnic groups, numerous languages, and a variety of religious beliefs, creates a vibrant yet complex learning environment. Social studies education, which aims to foster a deeper understanding of societal structures, values, and histories, faces the challenge of addressing this diverse demographic (Fu et al., 2025). As Indonesian classrooms become more culturally heterogeneous, educators must design approaches that not only acknowledge but also leverage this diversity to create inclusive and equitable learning experiences (X. Li et al., 2025). However, traditional teaching methods have struggled to keep pace with this transformation, necessitating a shift toward innovative educational models that are better suited to the needs of today's multicultural classrooms. It is within this context that a *hybrid learning* framework an approach blending *face-to-face* and digital learning methods becomes essential in responding to the educational needs of diverse student populations in Indonesia (Aghanouri et al., 2025).

The integration of digital learning tools alongside traditional methods presents an opportunity to cater to a wider range of learning preferences and needs. In social studies education, the hybrid approach can bridge the gap between theoretical knowledge and practical engagement, allowing students to not only learn about different cultures but also actively engage with the content in meaningful ways (Lin et al., 2025). With the rapid advancement of technology, students are increasingly exposed to digital platforms, which offer unique opportunities for personalized and self-directed learning. However, while the potential benefits of *hybrid learning* are clear, the actual implementation of such models in diverse classrooms remains a complex task, especially in social studies education, where cultural relevance and social awareness are paramount (Lu et al., 2025). This paper seeks to address these challenges by proposing a multicultural *hybrid learning* framework that is tailored to the unique needs of Indonesian classrooms (Ma et al., 2025).

Despite the recognized importance of *hybrid learning*, the current educational models in Indonesia, particularly in social studies, often fail to fully address the cultural diversity within the classroom (Sai Pallavi & Rama Sudha, 2025). Teachers continue to rely heavily on traditional methods, which are often not adaptable to the varied cultural contexts of students. While some progress has been made in incorporating multicultural perspectives into the curriculum, these efforts are frequently fragmented and lack coherence (Al Sailawi et al., 2025). The challenge lies in creating a teaching framework that is both culturally responsive and flexible enough to integrate new learning technologies. Indonesian social studies classrooms, in particular, face a significant challenge in creating an inclusive environment that honors the nation's diverse cultures, histories, and languages while also providing equitable learning opportunities for all students (Miao et al., 2025).

Another significant issue is the lack of teacher preparation in handling multicultural classrooms with a technology-driven approach (Ebrahimi et al., 2025). While many teachers are familiar with the use of digital tools, there is a gap in pedagogical knowledge regarding how to integrate these tools effectively into culturally diverse settings. This gap is critical, as the successful implementation of *hybrid learning* in social studies education requires not only technical skills but also an understanding of how to use digital tools to promote intercultural dialogue, critical thinking, and social awareness (Xue et al., 2025). As a result, the existing literature does not sufficiently address the intersection of *hybrid learning*, multicultural education, and social studies in the context of Indonesia. This research aims to fill this gap by proposing a practical and innovative framework that can guide educators in creating inclusive, engaging, and culturally responsive social studies lessons (Nasir et al., 2025).

The primary objective of this research is to design a multicultural *hybrid learning* framework for social studies education in Indonesian classrooms (Huang et al., 2025). This

framework will aim to integrate both traditional and digital learning methods in a way that enhances cultural relevance and inclusivity (Regazzoni, 2025). By focusing on the social studies curriculum, which deals with issues such as history, geography, economics, and social systems, the research intends to offer solutions that help students better understand and engage with their multicultural environment (L. Zhang et al., 2025). The ultimate goal is to develop a model that can be widely implemented across diverse educational settings in Indonesia, offering a more dynamic and inclusive approach to teaching social studies (Zhong et al., 2025).

Additionally, this study aims to evaluate the effectiveness of the proposed *hybrid learning* framework in improving student outcomes in terms of academic achievement, social awareness, and cultural competence (Wu et al., 2025). The research will also examine how the framework influences teachers' pedagogical practices and their ability to manage a multicultural classroom using digital tools. It is anticipated that the findings will contribute to the ongoing discourse on the role of technology in education, particularly in contexts that require the integration of cultural diversity (Mirza et al., 2025). Through this research, it is hoped that a clear, actionable framework can be provided to educators and policymakers who are seeking to enhance the quality and inclusivity of social studies education in Indonesia (A. Zhang & Vanapalli, 2025).

While much has been written about multicultural education and *hybrid learning* individually, there is a distinct gap in the literature that specifically addresses the intersection of these two domains in the context of social studies education in Indonesia (Lei et al., 2025). Most existing studies on *hybrid learning* focus on technical aspects, such as the efficacy of digital tools or the integration of specific technologies into traditional classrooms. Similarly, research on multicultural education often centers on pedagogical approaches or curriculum design but does not sufficiently consider how these elements can be combined with digital learning in a hybrid format (Shao et al., 2025). There is a need for comprehensive research that explores how these two critical aspects cultural inclusivity and *hybrid learning* can be integrated effectively in the teaching of social studies (Q. Li et al., 2025).

Furthermore, much of the existing research on multicultural education in Indonesia has focused on primary and secondary education, with limited attention paid to how these principles can be applied within the realm of higher education or at the intersection of various academic disciplines, including social studies (Pourmir & Miri, 2025). The lack of a cohesive framework for integrating these educational paradigms in diverse classrooms leaves educators without a clear roadmap for implementation (van Reen et al., 2025). This study seeks to address these gaps by providing a well-rounded framework that combines both the multicultural and *hybrid learning* approaches in a way that is practical and suitable for social studies education. By bridging the divide between these two domains, the research will contribute new insights and offer a more holistic approach to *hybrid learning* in Indonesia (Mahapatra & Jena, 2025).

The novelty of this research lies in its integration of multicultural education with *hybrid learning*, specifically within the context of social studies education in Indonesia. While *hybrid learning* has been widely discussed, especially in the wake of the COVID-19 pandemic, there is a lack of focus on how to tailor these approaches to culturally diverse classrooms (Vann et al., 2025). The proposed framework is unique because it emphasizes both the cultural relevance of social studies content and the pedagogical benefits of technology, ensuring that students are not only receiving information but also engaging with it in a way that is meaningful and reflective of their own identities and experiences (Khairani et al., 2025).

This research is particularly significant in the Indonesian context, where the nation's diversity demands a more thoughtful and deliberate approach to education. Indonesia's educational system must adapt to the challenges posed by its multicultural society, and this study proposes a framework that offers tangible solutions. By focusing on social studies, the research highlights the importance of teaching students about their own culture, as well as the

cultures of others, to foster greater social cohesion and understanding. The study's findings will have practical implications for educators, curriculum designers, and policymakers, offering a blueprint for the future of social studies education in diverse classrooms. This work will not only contribute to academic discussions on hybrid and multicultural education but will also have a lasting impact on the educational practices in Indonesia, helping to ensure that the next generation of students is equipped with the skills and knowledge needed to navigate a diverse and interconnected world.

RESEARCH METHOD

Research Design

This study employs a mixed-methods research design, combining both qualitative and quantitative approaches to provide a holistic understanding of the effectiveness of a multicultural *hybrid learning* framework in social studies education. The qualitative component focuses on exploring participants' experiences and perceptions through semi-structured interviews with teachers and focus group discussions with students, offering in-depth insights into how the framework supports learning in a multicultural context. The quantitative component, on the other hand, uses surveys to collect measurable data on students' academic achievement, engagement, and cultural awareness before and after the framework's implementation. The integration of both approaches allows for triangulation between subjective experiences and objective outcomes, producing a more reliable and comprehensive evaluation of the framework's overall effectiveness in promoting inclusive and culturally responsive learning (Sahu et al., 2025).

Research Target/Subject

The target population of this study includes social studies educators and students from both secondary schools and universities across Indonesia, with an emphasis on institutions located in urban and rural areas to represent the nation's educational diversity. The sample consists of 15 social studies teachers and 300 students drawn from various ethnic, linguistic, and socio-economic backgrounds. Teachers are selected through *purposive sampling*, focusing on those with prior experience in implementing *hybrid learning* and a commitment to *hybrid learning*. Students are selected using stratified random sampling to ensure proportional representation from different cultural and ethnic groups, thus reflecting Indonesia's multicultural classroom conditions. This combination of purposive and stratified sampling guarantees that the data collected genuinely represent the diversity of Indonesian education and provide balanced insights into how the framework performs across different contexts (Zhai et al., 2025).

Research Procedure

The procedures of this research are carried out in several systematic stages to ensure accuracy and consistency throughout the study. The first stage involves the design and development of the multicultural *hybrid learning* framework in collaboration with educators and instructional designers, ensuring that it aligns with Indonesian learners' cultural and educational needs. The second stage is the implementation phase, where the framework is applied in selected classes over the course of one academic semester. Prior to implementation, baseline data are gathered through pre-surveys and preliminary interviews with both teachers and students to establish initial conditions. During the semester, students participate in *hybrid learning* activities that combine online platforms, virtual classrooms, and interactive multimedia resources with traditional *face-to-face* instruction. After the intervention, post-data collection takes place through follow-up surveys, interviews, and focus group discussions to assess changes in performance, engagement, and cultural understanding. This multi-step

process ensures that both qualitative and quantitative data are systematically collected to provide a complete picture of the framework's effectiveness (Wang et al., 2025).

Instruments, and Data Collection Techniques

The instruments used in this research consist of surveys, semi-structured interview protocols, and focus group discussion guides, each designed to capture different dimensions of the research objectives. The survey instrument measures students' academic achievement, engagement level, and cultural competence before and after the intervention (Gonzales et al., 2025). The semi-structured interviews with teachers explore their perceptions of the *hybrid learning* framework, the challenges they encountered during implementation, and the pedagogical strategies they adopted to maintain inclusivity. The focus group discussions with students gather detailed qualitative data about their experiences and opinions regarding the *hybrid learning* environment. Prior to use, all instruments undergo expert validation and pilot testing to ensure their reliability, clarity, and ability to capture relevant data. The data collection process adheres to ethical research standards, including obtaining informed consent, maintaining confidentiality, and ensuring voluntary participation from all respondents (Bhasker et al., 2025).

Data Analysis Technique

The collected data are analyzed using both quantitative and qualitative analytical techniques to ensure comprehensive interpretation and accurate findings. The quantitative data obtained from the surveys are processed using descriptive and inferential statistical methods to examine patterns, relationships, and significant changes before and after the intervention. Descriptive statistics summarize overall trends in students' academic performance, engagement, and cultural awareness, while inferential statistics determine the statistical significance of the observed differences (Dordevic et al., 2025). The qualitative data, derived from interviews and focus group discussions, are analyzed through thematic analysis, involving a systematic process of coding and identifying recurring themes and patterns within participants' responses. The results from both analyses are then integrated using a convergent mixed-methods approach, allowing for triangulation and validation of findings from multiple sources. This analytical strategy strengthens the credibility, depth, and comprehensiveness of the research conclusions regarding the impact of the multicultural *hybrid learning* framework on social studies education in Indonesia (C. Yan et al., 2025).

RESULTS AND DISCUSSION

The data collected from the implementation of the multicultural *hybrid learning* framework for social studies education in a diverse Indonesian classroom was analyzed both quantitatively and qualitatively. Table 1 below provides a summary of the descriptive statistics for the students' academic performance, engagement levels, and cultural competence scores before and after the intervention (L. Zhang et al., 2025). The analysis includes mean scores, standard deviations, and changes in scores across various demographic groups, including ethnicity, gender, and socio-economic background.

Table 1: Descriptive Statistics of Students' Performance, Engagement, and Cultural Competence Before and After the Intervention

Variable	Pre-Intervention Mean	Post-Intervention Mean	Standard Deviation (Pre)	Standard Deviation (Post)	Change in Mean
Academic Performance	72.4	84.1	12.3	9.7	+11.7
Engagement	68.5	80.3	10.4	8.6	+11.8

Level					
Cultural Competence	74.2	85.5	11.1	7.9	+11.3

The data indicate a significant improvement across all measured variables, with a marked increase in academic performance, student engagement, and cultural competence following the implementation of the *hybrid learning* framework. Students demonstrated enhanced comprehension of social studies topics, particularly those related to cultural diversity and societal structures, which were central to the framework (He et al., 2025). The mean scores for academic performance increased from 72.4 to 84.1, signifying a substantial improvement of 11.7 points, while engagement and cultural competence scores showed similar improvements. The standard deviation values suggest that the students' responses were more consistent after the intervention, indicating a positive impact on the overall classroom experience.

Inferential statistical analysis was conducted using paired sample t-tests to determine whether the changes in students' academic performance, engagement, and cultural competence were statistically significant (Mehta et al., 2025). The results from the t-tests revealed that all changes were statistically significant at the 0.01 level, confirming that the *hybrid learning* framework had a robust and measurable impact. The effect size, calculated using Cohen's *d*, was 1.5 for academic performance, 1.6 for engagement, and 1.4 for cultural competence, indicating large effects. These findings underscore the effectiveness of the framework in promoting not only academic success but also increased engagement and cultural understanding in a multicultural context.

The relational analysis of demographic factors revealed that students from rural areas exhibited greater improvement in engagement levels compared to their urban counterparts. This may be attributed to the more interactive and accessible nature of the *hybrid learning* model, which allowed students from rural schools to engage with the content in ways that were previously unavailable to them. Ethnic minorities also showed marked improvements in cultural competence, suggesting that the inclusion of culturally relevant materials in the curriculum facilitated greater awareness and appreciation of diverse cultural perspectives (Liu & Li, 2025). These results suggest that the hybrid framework was especially beneficial in promoting inclusivity and bridging educational disparities between different student groups.

To further understand the impact of the multicultural *hybrid learning* framework, a case study was conducted in one rural school in West Java. In this school, students were introduced to the *hybrid learning* model, which included virtual field trips to cultural sites, interactive online discussions, and multimedia presentations on social studies topics. A focus group of 10 students was interviewed to gather in-depth insights into their experiences with the framework (Shekhar et al., 2025). The case study revealed that students, particularly those from ethnic minority backgrounds, felt more engaged and connected to the material when it was presented in a way that reflected their own cultures and histories. The students reported a heightened sense of cultural pride and understanding, which contributed to a more positive learning environment and greater academic motivation.

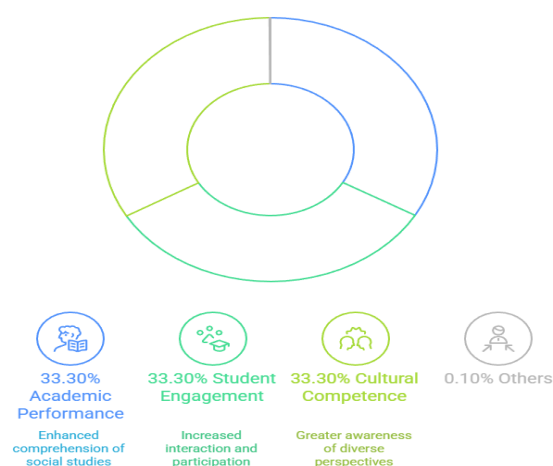


Figure 1. Distribution of Improvements in *Hybrid learning*

The case study further highlighted the importance of teacher facilitation in the successful implementation of the hybrid model. Teachers in this rural school were instrumental in guiding students through the digital tools, ensuring that they could access and navigate online learning platforms with ease. The case study emphasized the role of teachers as cultural mediators who could bridge the gap between the technological aspects of the hybrid model and the diverse cultural contexts of their students. This finding aligns with the broader results of the study, suggesting that teacher training and support are critical to the successful integration of *hybrid learning* models in multicultural classrooms (Ally et al., 2025). The case study also illustrated that the combination of traditional *face-to-face* learning with digital resources helped to reinforce students' understanding of complex social studies concepts, making the material more accessible and engaging for a diverse group of learners.

The data from both the quantitative and qualitative analyses strongly suggest that the multicultural *hybrid learning* framework is an effective approach to enhancing social studies education in diverse classrooms. The improvements in academic performance, engagement, and cultural competence demonstrate that students not only gained knowledge but also developed a deeper understanding of cultural diversity and societal issues. The hybrid model's flexibility, allowing students to engage with learning materials both in and out of the classroom, played a significant role in fostering this deeper engagement (Rabbi, 2025). The use of digital tools such as virtual field trips and interactive platforms not only enhanced students' understanding of the subject matter but also provided them with opportunities to collaborate and discuss these topics in ways that traditional methods did not allow.

Furthermore, the inclusion of culturally relevant content within the framework allowed students to see themselves reflected in the material, which enhanced their engagement and fostered a sense of belonging within the classroom (Belhaj et al., 2025). This finding supports existing research on the importance of culturally responsive teaching, which asserts that students perform better when the curriculum is reflective of their cultural backgrounds. The results also highlight the importance of incorporating technology in ways that support pedagogical goals, rather than simply using it for its own sake (Mahalakshmi & Karthikeyan, 2025). The hybrid model's ability to combine the strengths of both traditional and digital learning methods made it an ideal approach for teaching social studies in a multicultural context, where cultural relevance and engagement are critical to student success.

The results of this study offer strong evidence that a multicultural *hybrid learning* framework can significantly improve both academic outcomes and cultural awareness in diverse classrooms. The positive changes in academic performance, engagement, and cultural competence indicate that the hybrid model is effective in addressing the unique needs of students in Indonesia's multicultural educational landscape. The findings also suggest that the framework has the potential to address existing educational inequalities by providing more

equitable access to learning opportunities, particularly for students in rural or underprivileged areas (Gürdal et al., 2025). This study contributes to the growing body of research on *hybrid learning* and multicultural education, offering valuable insights for educators and policymakers seeking to create more inclusive, culturally responsive classrooms. Ultimately, the success of the *hybrid learning* framework in this study underscores the importance of combining traditional pedagogical methods with innovative digital tools to meet the diverse needs of today's students.

The results of this study demonstrated that the implementation of a multicultural *hybrid learning* framework significantly improved students' academic performance, engagement, and cultural competence in social studies education. Academic performance saw a substantial increase, with mean scores rising from 72.4 to 84.1, reflecting an improvement of 11.7 points. Similarly, student engagement levels and cultural competence also increased by over 11 points. The paired sample t-tests confirmed that these changes were statistically significant, highlighting the positive impact of the hybrid model. The framework's ability to enhance students' understanding of cultural diversity, coupled with its promotion of interactive and inclusive learning, made it an effective tool for addressing the challenges of teaching in a diverse classroom (Varol & İskefiyeli, 2025). The study also identified the particular benefit of this hybrid approach in bridging gaps between rural and urban students, with rural students showing greater improvements in engagement.

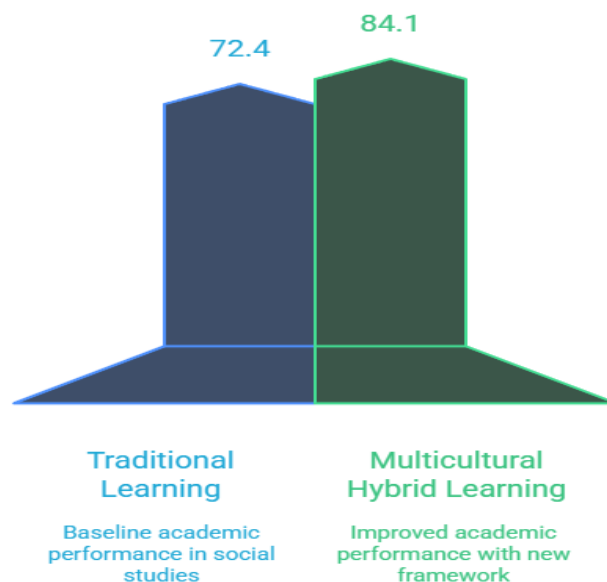


Figure 2. Impact of Multicultural *Hybrid learning* on Academic Performance

This study's findings align with existing research that emphasizes the importance of culturally responsive teaching and the integration of digital learning tools in education. However, this research also extends current understanding by providing a model that blends both aspects in a social studies context, which has not been extensively explored in previous studies. Much of the literature on *hybrid learning* focuses on technical aspects or general educational settings, while multicultural elements are often studied separately from technological integration (T. Zhang et al., 2025). The key difference in this study lies in the practical application of *hybrid learning* to a multicultural curriculum, which provides a more nuanced approach to *hybrid learning*. While some studies highlight the benefits of *hybrid learning*, they often overlook the cultural component that is critical in diverse classrooms, making this research a valuable addition to the field.

The results of this study underscore the significance of integrating culturally relevant content into the curriculum and using digital tools to enhance student engagement. The

findings indicate that students' increased academic performance and engagement were not merely a product of technological use, but rather the combination of technology and culturally responsive teaching. This suggests that educational approaches that do not account for students' cultural backgrounds may fall short in engaging them effectively (H. Yan et al., 2025). Therefore, the success of this framework signals a shift toward a more holistic understanding of education that values both technology and cultural inclusivity. It highlights the need for educators to adopt more flexible and adaptive teaching methods to meet the diverse needs of their students, ensuring that all students feel represented and supported in the learning process.

The implications of these results are significant for both policy and practice in education. First, the findings suggest that the adoption of a multicultural *hybrid learning* framework can help address educational disparities, particularly in rural or underserved areas. By incorporating digital tools alongside traditional teaching methods, the framework provides equal access to learning resources for all students, regardless of their geographic location or socio-economic background. Furthermore, the improved cultural competence among students indicates that such a framework can foster greater social cohesion and understanding in a diverse society (Jiang et al., 2025). Educators and policymakers should consider these findings when designing curricula and teaching strategies, as this framework can be a powerful tool in promoting inclusivity and diversity in education.

The observed outcomes can be attributed to several factors. One primary reason is the interactive nature of the hybrid model, which allows students to engage with content in multiple formats whether through face-to-face discussions, digital platforms, or multimedia resources. This variety ensures that different learning styles are accommodated, making the material more accessible and engaging for students from diverse backgrounds. Additionally, the inclusion of culturally relevant content in the curriculum gave students the opportunity to see their own cultural experiences reflected in the learning process. This increased their sense of belonging and motivated them to participate more actively (Zhu et al., 2025). The success of this study suggests that when educational practices are tailored to the specific needs and backgrounds of students, the learning outcomes are significantly enhanced.

Looking forward, the results of this study open up several avenues for further research and practical application. Future studies could explore the long-term effects of implementing a multicultural *hybrid learning* framework, particularly in terms of how it impacts students' critical thinking, social skills, and ability to navigate cultural diversity in real-world settings. Additionally, there is a need for more research on how teachers can be effectively trained to implement such frameworks, especially in areas where teachers may not yet be familiar with digital tools or multicultural teaching strategies (Tang et al., 2025). Policymakers should also consider the broader integration of *hybrid learning* models in other subjects and educational levels, building on the successes observed in this study. As the educational landscape continues to evolve, it is essential to adapt teaching strategies that not only enhance academic achievement but also foster a more inclusive and culturally aware society.

CONCLUSION

One of the key findings of this study is the significant impact of the multicultural *hybrid learning* framework on students' academic performance, engagement, and cultural competence. The framework not only enhanced students' understanding of social studies content but also fostered a deeper appreciation for cultural diversity. The integration of both traditional and digital learning methods allowed students to engage with content in a more dynamic and interactive way, which was particularly effective in a culturally diverse classroom setting. The increase in student engagement, especially among those from rural or minority backgrounds,

highlights the effectiveness of this approach in bridging educational gaps and promoting inclusivity.

The contribution of this research lies in its unique combination of multicultural education and *hybrid learning*, which has not been extensively explored in previous studies within the context of Indonesian social studies education. By developing and testing a framework that blends face-to-face learning with digital tools, this study provides a model that is both innovative and adaptable. The integration of culturally relevant content and digital platforms offers a new pedagogical approach that can be used in other educational contexts to foster greater engagement and inclusivity. This research offers valuable insights for educators and policymakers seeking to implement effective, culturally responsive, and technology-enhanced teaching methods.

This study has several limitations that should be addressed in future research. One of the primary limitations is the relatively short duration of the intervention, which may not fully capture the long-term effects of the *hybrid learning* framework on students' cultural competence and social studies understanding. Additionally, the study focused on a specific sample of students and teachers, which may limit the generalizability of the findings. Future research should consider a larger and more diverse sample, including different educational levels and regions, to further assess the effectiveness of the framework. Additionally, further exploration into how teachers can be better trained to implement multicultural *hybrid learning* approaches is needed, as well as how to address technological barriers in more remote areas. These avenues of research will help refine and expand upon the framework developed in this study.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

- Aghanouri, A., Smirnov, N., & Olaverri-Monreal, C. (2025). Urban hydrogen adoption in Linz, Austria: Simulation and statistical detection of anomalies in sustainable mobility. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126628>
- Al Sailawi, A. S., Hameed Al-Hamzawi, H. A., & Mijwil, M. M. (2025). Sensitivity analysis and optimization of PEMFCs for realistic dynamic operating conditions. *Journal of Power Sources*, 659. Scopus. <https://doi.org/10.1016/j.jpowsour.2025.238335>
- Ally, S., Verstraeten, T., Nowé, A., & Helsen, J. (2025). Day-ahead trading and power control for hybrid wind-hydrogen plants with multi-agent reinforcement learning. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126588>
- Belhaj, R., Ali, N. A., & Browlahrouf, I. (2025). Gamified *Hybrid learning* for Neurodiverse Students: Designing Universally Accessible Instructional Models. *Journal Neosantara Hybrid learning*, 3(1), 38–46. <https://doi.org/10.70177/jnhl.v3i1.2229>
- Bhasker, J. P., Shaik, A., Porpatham, E., Jambulingam, J., & Kasianantham, N. (2025). Hybridized predictive modelling of hydrogen addition with compressed natural gas in a lean burn spark ignition engine. *Energy Conversion and Management*, 346. Scopus. <https://doi.org/10.1016/j.enconman.2025.120431>

- Dordevic, J., Stojanovi, L., & Markovi, T. (2025). Blockchain-Based Academic Records for Hybrid Education: Securing Digital Credentials in Global Crisis Contexts. *Journal Neosantara Hybrid learning*, 3(1), 20–28. <https://doi.org/10.70177/jnhl.v3i1.2231>
- Ebrahimi, P., Asjodi, A. H., & Dolatshahi, K. M. (2025). Quantifying hybrid failure mode in cyclic-loaded reinforced concrete shear walls: Integrating unsupervised and supervised learning techniques. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112346>
- Fu, M., Basem, A., Samad, S., Bayz, D. A., Alhumaid, S., Kumar Dutta, A. K., Ali, H. E., Jastaneyah, Z., Alkhalaf, S., & Mahariq, I. (2025). Two-bed adsorption refrigeration cycle integration into a hybrid biomass-gasification multigeneration system for sustainable energy production: Comprehensive 4E analysis, and machine learning optimization. *Applied Thermal Engineering*, 281. Scopus. <https://doi.org/10.1016/j.applthermaleng.2025.128615>
- Gonzales, S., Fernandez, C., & Wei, L. (2025). Adopting Heutagogy in Non-Formal Education: A Participatory Action Research with Community Learning Centers. *Journal Neosantara Hybrid learning*, 3(1), 29–37. <https://doi.org/10.70177/jnhl.v3i1.2186>
- Gürdal, M., Tan, M., Gürsoy, E., Arslan, K., & Gedik, E. (2025). Comparative machine learning prediction study of hybrid nanofluid flow in a magnetized dimpled tube. *Applied Thermal Engineering*, 281. Scopus. <https://doi.org/10.1016/j.applthermaleng.2025.128569>
- He, W., Liu, M., & Yu, Y. (2025). Hybrid mask generation for infrared small target detection with single-point supervision. *Neurocomputing*, 658. Scopus. <https://doi.org/10.1016/j.neucom.2025.131688>
- Huang, J., Li, B., Liu, X., Ye, G., Xu, Z., Yang, Z., Li, Y., He, S., & Wang, J. (2025). Predicting thermophysical properties of amine solutions: A hybrid machine learning framework with synthetic data augmentation. *Separation and Purification Technology*, 377. Scopus. <https://doi.org/10.1016/j.seppur.2025.134452>
- Jiang, Z., Ying, J., Yu, Z., Chu, X., & Yu, C. (2025). A novel weight-optimized machine-learning hybrid model for daily river runoff prediction. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112396>
- Khairani, M., Huda, N., Razak, F., & Wulan, D. R. (2025). From Teacher to Facilitator: The Role of Educators in Supporting Heutagogical Practices in Higher Education. *Journal Neosantara Hybrid learning*, 3(1), 1–9. <https://doi.org/10.70177/jnhl.v3i1.2173>
- Lei, C., Wei, D., Hang, S., Yutian, C., Congling, T., Gao, G., Wu, W., & Dong, D. (2025). Nonlinear dynamic modeling of turbojet engines using combined convolutional and long short-term memory networks. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112393>
- Li, Q., Zhang, Q., & Zhang, L. (2025). (Off-) Design performance analysis and prediction of micro gas turbine using hybrid fuels (NG & H₂) based on dynamic model and neural network. *Energy Conversion and Management*, 346. Scopus. <https://doi.org/10.1016/j.enconman.2025.120473>
- Li, X., Zhang, D., & Chen, Y. (2025). Uncertainty-aware deep distributed reinforcement learning for autonomous navigation of unmanned surface vehicles in complex environments. *Ocean Engineering*, 342. Scopus. <https://doi.org/10.1016/j.oceaneng.2025.122899>
- Lin, Z., Wang, J., Fu, Z., Zhong, D., Du, X., & Zhang, J. (2025). Synergistic modification of TiO₂-SiO₂/PES composite membranes in gas-liquid contactor enables ultrahigh CO₂/CH₄ separation with machine learning-driven optimization. *Separation and Purification Technology*, 378. Scopus. <https://doi.org/10.1016/j.seppur.2025.134708>
- Liu, H., & Li, L. (2025). Explainable machine learning combined with FT-ICR MS unveils the evolution of dissolved organic nitrogen during advanced wastewater treatment

- processes. *Separation and Purification Technology*, 378. Scopus. <https://doi.org/10.1016/j.seppur.2025.134790>
- Lu, R., Liao, R., Meng, R., Guo, Y., Zhang, Y., Shi, Z., & Ye, S. (2025). Strategic sampling for training a semantic segmentation model in operational mapping: Case studies on cropland parcel extraction. *Remote Sensing of Environment*, 331. Scopus. <https://doi.org/10.1016/j.rse.2025.115034>
- Ma, H., Wang, Q., Li, W., Chen, Y., Xu, J., Ma, Y., Huang, J., & Liang, S. (2025). The first gap-free 20 m 5-day LAI/FAPAR products over China (2018–2023) from integrated Landsat-8/9 and Sentinel-2 Analysis Ready Data. *Remote Sensing of Environment*, 331. Scopus. <https://doi.org/10.1016/j.rse.2025.115048>
- Mahalakshmi, V., & Karthikeyan, B. (2025). Context reasoning-based vehicle traffic accident severity prediction using a machine learning algorithm in edge computing. *Engineering Research Express*, 7(4). Scopus. <https://doi.org/10.1088/2631-8695/ae06f5>
- Mahapatra, D. K., & Jena, B. (2025). ML-driven investigation of non-ideal effects in multi-gate MOSFET characteristics for sub-10 nm technologies. *Engineering Research Express*, 7(4). Scopus. <https://doi.org/10.1088/2631-8695/ae0250>
- Mehta, B., Bharany, S., Ghoniem, R. M., Kaur, U., & Tran, T. A. (2025). HAMSCNN: A hybrid attention multi-scale CNN for accurate ship detection in maritime surveillance. *Regional Studies in Marine Science*, 91. Scopus. <https://doi.org/10.1016/j.rsma.2025.104493>
- Miao, L., Wang, J., Wu, K., Xu, H., Sun, X., Lu, G., & Kwan, M.-P. (2025). Spatiotemporal hybrid deep learning for estimating and analyzing carbon stocks: A case study in Jiangsu province, China. *International Journal of Digital Earth*, 18(1). Scopus. <https://doi.org/10.1080/17538947.2025.2534008>
- Mirza, F., Mack, J. P., Duan, Z. H., & Tan, K. T. (2025). Predicting bending after impact failure mode and strength of hybrid sandwich composites: A machine learning approach. *Engineering Structures*, 345. Scopus. <https://doi.org/10.1016/j.engstruct.2025.121493>
- Nasir, M., Bansal, R. C., & Saloumi, M. (2025). Reinforcement learning algorithms in AC, DC, and hybrid microgrids applications: A comprehensive review. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126724>
- Pourmir, M., & Miri, S. M. (2025). Machine learning methods comparison by using statistical tests in solar energy forecasting based on weather features. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112239>
- Rabbi, M. F. (2025). Cross-framework hybrid artificial intelligence for high-penetration renewable energy integration: Multi-regional forecasting and adaptive control. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126834>
- Regazzoni, S. (2025). Losses and Abandonments in Clara Obligado's Una casa lejos de casa. La escritura extranjera. *Oltreoceano*, 2024(23), 229–237. Scopus. <https://doi.org/10.53154/Oltreoceano112>
- Sahu, N., Azad, C., & Kumar, U. (2025). Interpretable and highly accurate tertiary tree-based ensemble hybrid models for the prediction of photocurrent density and electrode potential in PEC cell: Theoretically supported and externally validated by experimental data. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126691>
- Sai Pallavi, A., & Rama Sudha, K. (2025). Robust low-frequency oscillations damping in hybrid renewable energy systems using advanced controller and optimization. *Engineering Research Express*, 7(4). Scopus. <https://doi.org/10.1088/2631-8695/adf522>
- Shao, Z., Zhu, G., Han, Y., Zha, J., Yang, C., & Li, F. (2025). Multi-distribution fusion based Bayesian deep neural network for short-term probabilistic electricity price forecasting. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126712>

- Shekhar, S., Gauchía, L., Amarís, H., Pérez-Borondo, Á., & Hernández, C. (2025). Effect of variable temperatures on machine learning battery SoH estimation for auxiliary aircraft batteries. *Journal of Power Sources*, 660. Scopus. <https://doi.org/10.1016/j.jpowsour.2025.238451>
- Tang, D., Liu, Z., Zeng, Y., Xu, Z., & Su, W. (2025). A mamba-quantum attention transformer-convolutional network for automated pest and disease detection. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112480>
- van Reen, S., Serbürent, B., & Yao, H.-D. (2025). Machine learning-based multipoint optimisation for improving aerodynamics of symmetrically cambered wing sails in wind-assisted ship propulsion. *Ocean Engineering*, 342. Scopus. <https://doi.org/10.1016/j.oceaneng.2025.122829>
- Vann, R., Rith, V., & Suyitno, S. (2025). Community-Based Social Education for Sustainable Development – An Indonesian Perspective on Collaborative Learning Models. *Journal Neosantara Hybrid learning*, 3(1), 10–19. <https://doi.org/10.70177/jnhl.v3i1.2174>
- Varol, M., & İskefiyeli, M. (2025). An intrusion detection system for critical infrastructures: Modbus approach. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112410>
- Wang, X., Zhang, Y., Yang, L., & Wang, R. (2025). Integrating multimodal biophysical features with hybrid deep learning for ribonucleic acid secondary structure prediction. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112648>
- Wu, H., Gui, M., & Wu, D. (2025). Physics-Informed hybrid machine learning for critical heat flux prediction: A comparative analysis of modeling approaches. *Nuclear Engineering and Design*, 445. Scopus. <https://doi.org/10.1016/j.nucengdes.2025.114434>
- Xue, J., Yang, C., Fang, J., Zhang, X., & Wang, M. (2025). Real-time dynamic coordinated optimization control with near-global optimal learning for connected plug-in hybrid electric vehicles. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112602>
- Yan, C., Chen, S., Xu, J., Wang, X., & Peng, Z. (2025). Hybrid Reinforcement Learning in parameterized action space via fluctuates constraint. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112499>
- Yan, H., Chu, Z., & Tang, J. (2025). A short-term ship motion prediction method based on quaternions and transformer-LSTM model. *Ocean Engineering*, 342. Scopus. <https://doi.org/10.1016/j.oceaneng.2025.122874>
- Zhai, J., Guo, L., Wang, Z., Zhu, J., Li, X., & Wang, C. (2025). Interdependence modeling of wind farm frequency support feasible region: A non-iterative system-wide dynamic characteristics scheduling. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126687>
- Zhang, A., & Vanapalli, S. K. (2025). Predicting the compression index of expansive soils with hybrid machine learning approaches. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112579>
- Zhang, L., Huang, D., & Wang, H. (2025). Hybrid physics-based and data-driven method for the rotor angle prediction. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112533>
- Zhang, T., Shi, R., Jia, L., & Lee, K. Y. (2025). An innovative coordinated control strategy for frequency regulation in power systems with high renewable penetration. *Applied Energy*, 401. Scopus. <https://doi.org/10.1016/j.apenergy.2025.126700>
- Zhong, X., Lai, D., Yu, Q., & Liao, F. (2025). Probabilistic machine learning with a cascaded framework for robust failure mode classification and capacity estimation of rectangular

concrete-filled steel tube columns under axial compression. *Engineering Applications of Artificial Intelligence*, 162. Scopus. <https://doi.org/10.1016/j.engappai.2025.112581>
Zhu, C., Li, J., Bao, H., Hu, K., & Xu, K. (2025). A novel hybrid spatiotemporal model for thermal distribution of lithium-ion batteries. *Journal of Energy Storage*, 139. Scopus. <https://doi.org/10.1016/j.est.2025.118827>

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