Journal of Digital Psychology Review

Type Original Research
Published 02-04-2026
Doi

Digital Inclusion in Education: The Relationship between Internet Access, Digital Literacy, and Academic Performance at the Global Level

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Citation:

Received: 10-04-2026
Accepted: 01-04-2026
Published: 02-04-2026

Publisher's Note: Jodipi stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract: Digital inclusion in education is increasingly seen as a crucial prerequisite for improving the quality of learning and academic performance in the era of globalization and digital transformation. However, the relationship between internet access, digital literacy, and academic achievement remains complex, particularly in developing countries. This study aims to analyze the relationship between digital inclusion, as represented by internet access and digital literacy, and academic performance in the context of global education, with an emphasis on Indonesia and the ASEAN region. This study uses a qualitative approach with a content analysis design on global secondary data sourced from Our World in Data, the World Bank, UNDP, and the UNESCO Institute for Statistics. The analysis focuses on indicators of the quantity and quality of education, participation and completion of education across levels, and internet access in schools as a form of digital inclusion. Data are analyzed descriptively and comparatively to identify patterns, gaps, and implications for academic performance. The results show that increased access to education and digital infrastructure has not automatically been followed by improved quality of learning outcomes. Indonesia and several ASEAN countries have made significant progress in expanding access to education and internet access in schools, but still face a gap between the quantity of education and the quality of learning. These findings confirm that the effectiveness of technology utilization, digital literacy, and pedagogical quality are key factors in determining the impact of digital inclusion on academic performance. This research contributes to the digital education literature by highlighting the importance of a multidimensional approach to understanding digital inclusion. A limitation of this study lies in the use of aggregate data and proxy indicators of digital literacy. Future research is recommended to utilize microscale data and mixed-method approaches to deepen our understanding of the mechanisms underlying the relationship between digital inclusion and academic achievement.

Keywords: Digital inclusion, Internet acces, Digital literacy, Academic performance, Global education, ASEAN

Introduction

Digital transformation has fundamentally changed the global education landscape, especially through the use of information and communication technology in the learning process (Timotheou et al., 2023). Increasingly widespread internet access opens up new opportunities for learners to obtain learning resources without space and time limits, while encouraging the emergence of various digital-based pedagogical innovations (Bond et al., 2020). However, global realities show that the benefits of digital transformation have not been enjoyed equally by all students. Inequality in internet access, device availability, and digital literacy skills are still major challenges known as *digital inclusion*. Digital inclusion in education includes not only the availability of technology infrastructure, but also the ability of individuals to use technology effectively, critically, and productively in supporting the learning process and academic achievement (Burns & Gottschalk, 2020; Reynolds, 2021) Therefore, understanding the relationship between internet access, digital literacy, and academic performance is a strategic issue in an effort to realize inclusive and equitable education at the global level.

A number of previous studies have examined the relationship between digital technology access and academic achievement. Empirical studies show that students who have stable and quality internet access tend to show better academic performance than those who have limited access (Bulman and Fairlie, 2016; Falck, Mang and Woessmann, 2018). In addition, digital literacy has been shown to play an important role as a mediating factor that allows learners to make optimal use of technology for learning activities, information retrieval, and high-level cognitive skill development (Davis et al., 2018; Siddiq et al., 2016). Cross-border research also shows that the integration of digital technology in education can improve learning outcomes when supported by the digital competence of students and teachers, as well as conducive education policies (Fraillon et al., 2020; OECD, 2023). However, these positive impacts are not universal and are greatly influenced by the social, economic, and cultural context of each country.

Although the existing literature has made important contributions, there are still some research gaps that need further attention. First, most studies still focus on specific national or regional contexts, so they do not provide a comprehensive picture of the relationship between internet access, digital literacy, and academic performance on a global scale (van Deursen and van Dijk, 2019). Second, many studies have examined internet access and digital literacy separately, without integrating the two into a single complete analytical model to explain variations in academic performance. Third, research that systematically includes socio-economic factors and structural inequality as moderation variables in these relationships is still relatively limited, especially in cross-country analyses with diverse characteristics of digital development.

Based on these gaps, this research offers novelty by developing an integrative approach in examining digital inclusion in education. The main novelty of this research lies in the preparation of a conceptual model that links internet access and digital literacy simultaneously as determinants of academic performance at the global level. In addition, this study adopts a cross-country comparative perspective to identify differences in the patterns of relationships between variables in countries with different levels of digital and economic development. This research also expands the theoretical contribution by placing socio-economic factors as moderation variables that can strengthen or weaken the influence of digital inclusion on academic achievement, thereby providing a more contextual and layered understanding.

The main focus of this study is to analyze the relationship between internet access, digital literacy, and students' academic performance in a global context. The objectives of this study are (1) to examine the influence of internet access on academic performance, (2) to analyze the role of digital literacy in supporting academic achievement, and (3) to evaluate the role of socio-economic factors as a moderation variable in the relationship. The research questions asked include: *How is the relationship between internet access and digital literacy on academic performance at the global level?* and *How do socio-economic factors moderate the relationship?* The research method used is a quantitative approach with international secondary data analysis, which is analyzed using multivariate regression and a cross-country comparative approach to obtain a comprehensive and robust empirical picture.

Literature Review

Digital inclusion in education refers to systematic efforts to ensure that all students have equal access to digital technology, internet connectivity, and the competencies needed to effectively utilize these technologies in the learning process. This concept developed from the study of *the digital divide* which initially focused on the gap in physical access to technology, then expanded to include the dimensions of skills, use, and outcomes of the use of digital technology (Scheerder, van Deursen and van Dijk, 2017). In the context of education, digital inclusion is not only related to the availability of internet devices and networks, but also to the digital literacy of students and teachers, the relevance of digital learning content, and adequate institutional support and educational policies (Niemann, Seitzer and Martens, 2025). Dastyari and Jose (2024) emphasized that digital inclusion is an important prerequisite for the realization of inclusive, equitable, and sustainable education, especially in the era of technology-based learning and distance learning.

A number of international studies show that internet access has a significant relationship with students' academic performance. Stable internet access allows students to acquire additional learning resources, participate in online learning, and participate in digital-based academic activities that support the development of knowledge and skills (Vargas-Montoya, Gimenez and Fernández-Gutiérrez, 2023). A cross-country study by Wu (2024) found that the use of

digital technology in the learning environment can have a positive impact on academic achievement if supported by adequate internet infrastructure. However, without equal access, technology has the potential to widen the educational gap, especially between students from high and low socio-economic groups. These findings suggest that internet access is an important prerequisite, but it is not enough to guarantee an equitable improvement in academic performance.

In addition to access, digital literacy is recognized as a key factor that determines the extent to which digital technology can be used effectively in learning. Digital literacy includes technical, cognitive, and critical abilities in using digital technology to search, evaluate, and process information (Martínez-Bravo, Chalezquer and Serrano-Puche, 2022). Various studies show that students with higher levels of digital literacy tend to have better academic performance because they are able to use technology as a tool for independent learning, problem-solving, and academic collaboration (Hatlevik, Guomundsdóttir and Loi, 2015). Meta-analysis conducted by Scherer et al. (2019) also shows a consistent positive relationship between digital competence and academic achievement in various educational contexts, although the strength of these relationships is influenced by contextual factors such as the educational system and the social background of students.

In the ASEAN region, the issue of digital inclusion in education is becoming increasingly relevant as digital transformation accelerates. Although the internet penetration rate in ASEAN countries continues to increase, the gap in access between urban and rural areas as well as between member countries is still quite significant (ASEAN Secretariat, 2022). Research shows that limited digital infrastructure and uneven internet access have a direct impact on the quality and continuity of learning, especially during the implementation of online learning after the COVID-19 pandemic (Ndibalema, 2022). This condition causes differences in learning opportunities which lead to disparities in student academic performance in various countries and regions in ASEAN.

In addition to access challenges, digital literacy among students and teachers in ASEAN countries still shows considerable variation. Regional studies show that many education systems in ASEAN have not fully integrated the development of digital literacy systematically in the national curriculum. As a result, even though students have access to devices and the internet, they are not necessarily able to make optimal use of these technologies to support learning and improve academic achievement. Research in several ASEAN countries shows that low digital literacy correlates with limited independent learning ability and low student involvement in technology-based learning. This emphasizes the importance of strengthening digital competence as an integral part of the strategy to improve the quality of education in the region.

Although the global and regional literature has examined the relationship between internet access, digital literacy, and academic performance, there are still a number of significant research gaps. First, most studies tend to analyze internet access and digital literacy separately, without integrating them in a single, comprehensive analytics model. Second, cross-country studies that compare the relationships between these variables in global and regional contexts, especially ASEAN, are still relatively limited. Third, the role of socio-economic factors and education policy as moderation variables in the relationship between digital inclusion and academic performance has not been explored empirically, especially using large-scale comparative data.

Based on these gaps, this research offers novelty by developing an integrative model that connects internet access and digital literacy simultaneously to academic performance in a global context. Another novelty lies in the cross-country comparative approach that allows the analysis of differences in the patterns of relationships between variables in countries with different levels of digital development, including ASEAN countries. In addition, this study included socio-economic factors as a moderation variable to understand more deeply how structural context affects the effectiveness of digital inclusion in improving academic achievement. This approach is expected to enrich the literature and provide stronger theoretical and empirical contributions.

Based on the synthesis of the literature, this research framework places internet access and digital literacy as the main independent variables that affect students' academic performance. Digital literacy is positioned not only as an independent factor, but also as a key mechanism that allows students to make productive use of internet access in the learning process. This relationship is moderated by socio-economic factors and the context of national education policies that can strengthen or weaken the influence of digital inclusion on academic achievement. This conceptual framework reflects the view that digital inclusion in education is a multidimensional phenomenon that requires a holistic approach to understand its impact on academic performance at the global and regional levels.

Method

This study uses *a qualitative content analysis* approach as the main research strategy to explore in depth the phenomenon of *digital inclusion* in education as well as the relationship between internet access, digital literacy, and academic performance at the global level. The selection of this approach is based on the complexity of the phenomenon being studied, which is not only related to statistical data but also related to the contextual understanding of how access and use of digital technology is integrated in educational practices in various countries and diverse cultural regions (Rodiah Nasution & M Sholih Salimul Uqba, 2024). Qualitative content analysis allows researchers to explore the "meanings" behind digital data to understand the narratives, patterns, and themes that emerge from large-scale data sources, as well as formulate richer and more comprehensive interpretations of diverse educational experiences, perceptions, and policies (Hsieh & Shannon, 2005). This approach is particularly relevant in cross-border comparative research and requires a holistic understanding of the dynamics of social contexts, policies, and digital education practices. Thus, qualitative

content analysis is the right methodological choice to answer this research question in depth and systematically.

The main challenge in this study is to manage and analyze large-scale and multi-dimensional data from various global sources, so an integrated qualitative *big data* approach is needed . The qualitative big data approach combines traditional content analysis techniques with *large-scale data processing capabilities* and heterogeneous data sources (Chandrasekar et al., 2024). Qualitative big data analysis focuses not only on the frequency of occurrence of words or themes, but also on deeper thematic patterns, relationships between themes, and the social and policy contexts surrounding the analyzed digital data (Bakhtawar, 2020; Bazeley, 2013). In the context of this study, a qualitative big data approach was used to analyze global data sets that reflect indicators of internet access and digital literacy in various countries and can be linked to academic performance through narrative narratives, trend reports, and relevant metadata. This method allows researchers to explore not only "what" happens in the data, but also the "why" the pattern arises and how the phenomenon varies based on the social, economic, and educational policy contexts in the countries analyzed. Analytical techniques such as thematic *coding*, *pattern recognition*, and data triangulation help produce qualitatively meaningful and conclusive findings (Guest, MacQueen and Namey, 2014).

The main source of data in this study is the *Our World in Data* (OWID) platform, a global research database maintained by the Oxford Martin School at the University of Oxford that provides comprehensive data on social, technological, economic, and educational developments in various countries. The https://ourworldindata.org/ site offers downloadable datasets, including indicators of internet access (e.g. percentage of the population with broadband access), use of digital technologies, and a variety of other social statistics relevant to the study of digital inclusion (*Our World in Data, n.d.*). The data available on OWID is longitudinal, cross-country, and standardized, allowing for cross-region comparisons and long-term trend mapping. In the qualitative content analysis method, data from OWID are used as a basis to form a thematic narrative that reflects how internet access and digital literacy develop in various national contexts and how they are associated with different educational outcomes. The process of data collection and analysis includes stages: (1) selection of relevant indicators from OWID related to internet access, digital literacy, and education; (2) *data cleaning* to produce valid and reliable datasets; (3) the application of thematic *coding* techniques to metadata, trend reports, and indicator descriptions to identify patterns, themes, and contextual differences between countries; and (4) triangulation with other scientific literature to strengthen the validity of findings. The OWID data was chosen for its openness, high standard quality, and relevance in cross-border research on technology and education, which has been widely used in international social and public policy research (Efgivia, 2020).

Results

This section presents research results obtained through qualitative content analysis of secondary data sourced from Our World in Data, the World Bank, UNDP, and the UNESCO Institute for Statistics. The analysis focused on three main aspects relevant to the research objectives, namely: (1) the quality and quantity of education, (2) participation and completion of cross-level education in Indonesia, and (3) internet access in elementary schools as an indicator of digital inclusion in education. These three aspects are analyzed in an integrated manner to understand Indonesia's position in the ASEAN regional and global context.

Quality versus Quantity of Education in the ASEAN Region

The results of the analysis on the *Quality vs. Quantity of Schooling graph (2020)* show that there is a significant variation between the expected number of years *of schooling* and the quality of learning outcomes measured through *harmonized learning outcomes*. ASEAN countries occupy diverse positions in the spectrum of quality and quantity of education.

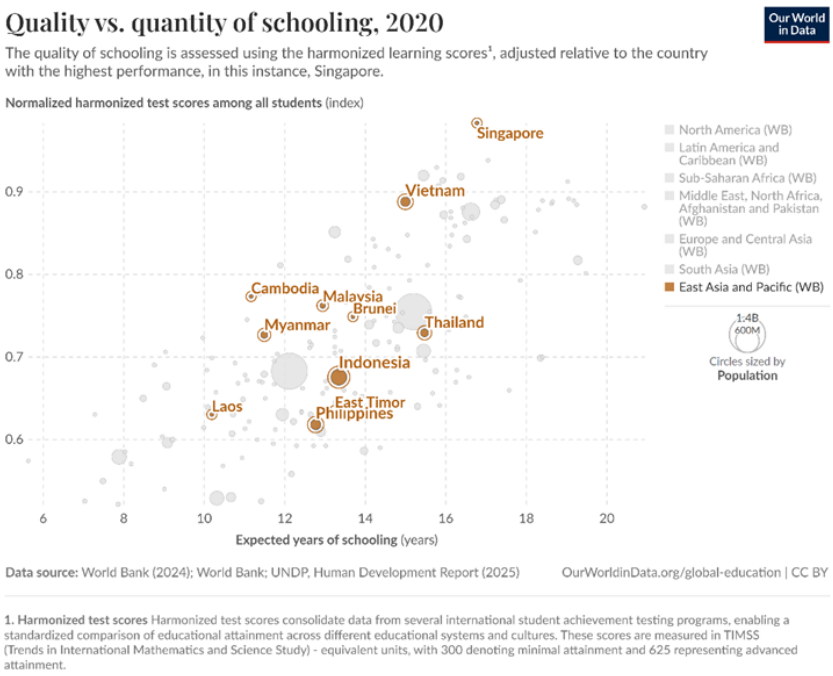

Figure 1. Data quality vs quantity of schooling 2020 in ASEAN country

Singapore occupies the most prominent position, with a relatively high number of school years (around 16–17 years) accompanied by the highest learning scores in the region and the world. These findings show that the high quantity of education in Singapore is accompanied by a very strong quality of learning. Vietnam also showed outstanding performance, with high learning scores despite a slightly lower number of school years than Singapore. This indicates that the effectiveness of the education system is not solely determined by the duration of schooling, but also by the quality of the learning process.

Other ASEAN countries, such as Malaysia, Brunei Darussalam, and Thailand, are in the middle category with a combination of relatively high education quantity but the quality of learning that is not equal to Singapore and Vietnam. Meanwhile, Indonesia, the Philippines, Laos, Myanmar, Cambodia, and Timor Leste were in the group with lower learning quality even though the number of school years did not differ significantly significantly.

Indonesia, in particular, has *expected years of schooling* of around 13–14 years, but the standardized learning score is in the middle to lower range compared to other ASEAN countries. These findings indicate that there is a gap between access or quantity of education and the quality of learning outcomes, which is a crucial issue in the development of national education.

Participation and Completion of Education in Indonesia

Analysis of the *Primary, Secondary and Tertiary Education Enrollment and Completion Rates in Indonesia* graph shows the dynamics of the development of cross-level education participation and completion during the 2010–2023 period. At the primary education level, the *gross enrollment rate* showed a relatively high and stable trend, even exceeding 100 percent at the beginning of the observation period. This condition reflects the high access to basic education in Indonesia, including students who enter early or repeat classes.

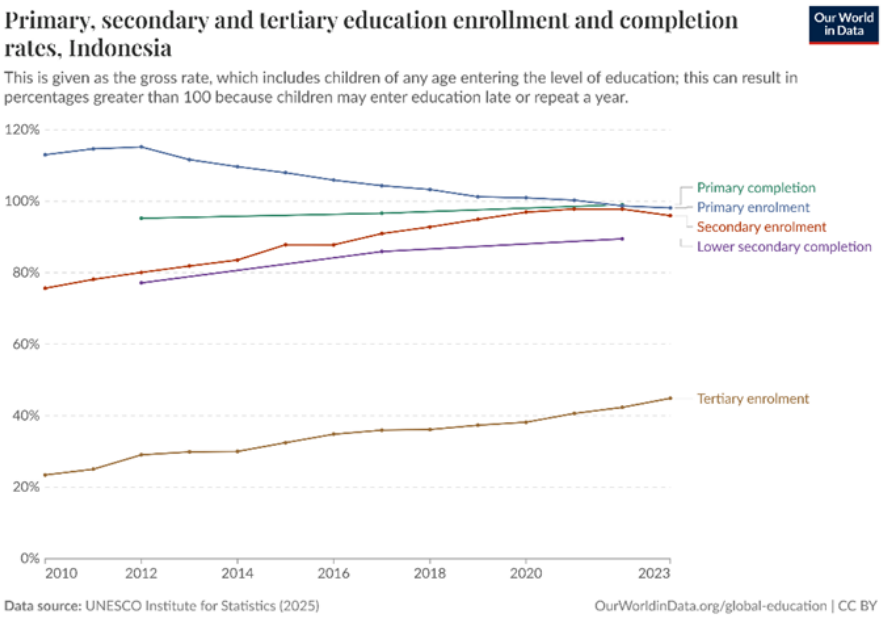

Figure 2. Data primary, secondary, and teritiary education enrollment and completion rates Indonesia 2010-2023

Nevertheless, although the participation rate of primary education is high, the completion rate of primary education shows a more gradual increase. This indicates that the challenge of education does not only lie in access to school, but also in the sustainability and success of students in completing their education. At the secondary education level, both the participation rate and the completion rate show a consistent trend of increasing from year to year. This increase reflects the success of the policy of expanding access to secondary education, although the gap between participation and completion is still visible. In other words, not all registered students manage to complete secondary education on time.

Meanwhile, at the higher education level, the participation rate shows a significant upward trend, from around 23 percent in 2010 to more than 45 percent in 2023. Although this increase reflects progress in access to higher education, the participation rate is still relatively low compared to countries with more advanced education systems. This shows that higher education in Indonesia is still selective and not fully inclusive.

Internet Access in Schools as an Indicator of Digital Inclusion

The results of the analysis on the *Share of Primary Schools with Access to the Internet for Teaching (2023)* chart show that Indonesia has a relatively high level of internet access in elementary schools compared to the global average. As many as 86.8 percent of elementary schools in Indonesia are recorded as having internet access for learning purposes. This figure is higher than the world average which is in the range of 48.6 percent, and higher than the average in the East and Southeast Asian regions.

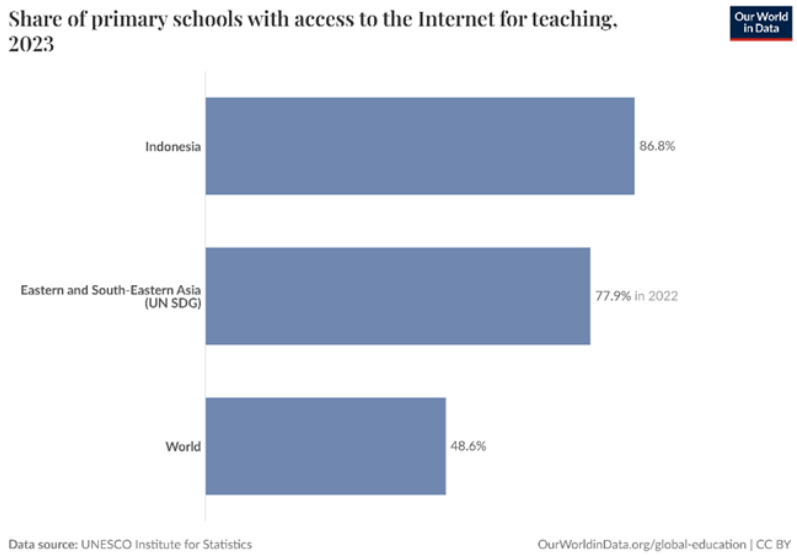

Figure 3. Share of primary schools with access to the internet for teaching

These findings show that in terms of basic infrastructure, Indonesia has made significant progress in expanding access to digital technology in the basic education sector. Internet access in schools is an important prerequisite for the implementation of digital learning, digital literacy, and technology integration in the teaching and learning process. However, the high internet access in elementary schools is not automatically proportional to the improvement in the quality of learning. If it is related to the results of the education quality indicator, it can be seen that although digital infrastructure is relatively available, the quality of learning outcomes of Indonesian students is still lagging behind some other ASEAN countries. This indicates that digital inclusion does not only depend on the availability of access to technology, but also on the capacity to use it pedagogically.

The Relationship between Digital Inclusion and Education Quality

Based on the integration of the three main findings, the results of this study show that there is a complex relationship between digital inclusion, the quantity of education, and the quality of learning outcomes. Indonesia has made significant progress in terms of access to education and the provision of digital infrastructure in schools, especially at the basic education level. However, these achievements have not been fully followed by an optimal improvement in the quality of learning. Comparisons with other ASEAN countries, such as Vietnam and Singapore, show that high quality of learning is determined not only by the length of school time or the availability of technology, but also by the effectiveness of the education system as a whole. Factors such as teachers' digital literacy, curriculum quality, learning methods, and education policy support play an important role in converting access and technology into meaningful learning outcomes.

Discussion

The results of this study confirm that digital inclusion in education is a multidimensional phenomenon that cannot be reduced only to the availability of internet access or the expansion of educational participation. Findings that show that there is a gap between the quantity of education and the quality of learning outcomes in Indonesia and a number of ASEAN countries reinforce the argument that access to education and digital technology is not necessarily directly proportional to the improvement of academic performance. These findings are in line with the international literature that emphasizes that an increase in the number of school years or the penetration of digital technology does not automatically result in better learning outcomes without adequate quality support from the education system (Suyudi, Sudadio and Muhyidin, 2026).

In the context of global comparisons, the position of Singapore and Vietnam that show high quality of learning despite variations in the number of school years corroborates the findings of previous research highlighting the importance of learning effectiveness and educational governance. A cross-border study by Huda et.al (2021) showed that the quality of learning outcomes, measured through standardized cognitive scores, has a stronger correlation with economic growth and human development than length of school time. Thus, the findings of this study support the perspective that the quality of education is a key determinant of academic performance and long-term development.

On the contrary, the finding that Indonesia has a relatively high number of school years but the learning outcomes that are still lagging behind show that there are structural challenges in the education system. This condition is consistent with the findings of Thomas (2014) who put forward the concept *of schooling without learning*, which is a situation when the education system succeeds in expanding access to schools but fails to ensure that students actually

acquire the basic competencies needed. In this context, digital inclusion characterized by increased internet access in schools has not been fully effectively integrated into the meaningful learning process.

Findings related to education participation and completion in Indonesia show that the success of education policies over the past two decades is more prominent in the aspect of expanding access, especially in primary and secondary education. The increase in higher education participation rates also reflects significant progress in educational inclusivity. However, the literature shows that the expansion of higher education without being accompanied by an improvement in the quality of learning and curriculum relevance has the potential to produce graduates with skills that are not aligned with the needs of the digital economy. Thus, the increase in higher education participation in Indonesia needs to be read critically in relation to the quality of learning and mastery of students' digital literacy.

In terms of digital inclusion, the findings that most primary schools in Indonesia already have internet access for learning purposes show significant progress compared to the global average. Accelerating the provision of educational digital infrastructure in developing countries, especially after the COVID-19 pandemic. Internet access in schools is seen as an essential prerequisite for supporting digital learning, access to global learning resources, and 21st-century skills development.

However, this study also found that the availability of internet access has not consistently correlated with an improvement in the quality of learning outcomes. These findings elaborate on the results of previous studies that showed that the impact of digital technology on academic performance is highly dependent on the pedagogical context and teacher capacity. A study by the OECD (2023) shows that the use of technology in education can produce positive, neutral, or even negative impacts depending on how the technology is integrated into the learning process. In other words, digital technology is not an automatic solution, but rather a tool whose effectiveness is determined by the learning design and competence of the educator.

Some studies even show contrasting results, where increased access to digital technology is not always followed by increased academic achievement. For example, a study by Falck, Mang, and Woessmann (2018) found that excessive use of computers in schools can actually reduce learning outcomes if not accompanied by the right pedagogical strategy. These findings are relevant to the results of this study, which shows that although internet access in Indonesian primary schools is relatively high, the overall quality of learning still faces challenges.

From the perspective of digital literacy, the results of this study strengthen the argument that digital literacy cannot be narrowed to the technical ability to use devices or access the internet. Digital literacy includes the ability to think critically, evaluate information, solve problems, and use technology productively for learning. Therefore, although internet access indicators show progress, students do not necessarily have adequate digital competence to make optimal use of this technology in learning.

These findings are also in line with the *second-level digital divide* approach, which emphasizes that the digital divide occurs not only at the level of access, but also at the level of use and outcomes. In the Indonesian context, these gaps can arise due to differences in school quality, teacher competence, socio-economic backgrounds of students, and policy support at the local level. Thus, digital inclusion in education needs to be understood as a layered process that includes access, literacy, and impact on learning outcomes.

Overall, the discussion of the results of this study shows that the relationship between internet access, digital literacy, and academic performance is complex and contextual. The findings of this study support the literature that emphasizes the importance of a systemic approach in the development of digital education, where infrastructure investment needs to be accompanied by pedagogical reforms, teacher capacity building, and curriculum adjustments. At the same time, the results of this study also make a critical contribution by showing that the success of digital inclusion cannot be measured only through quantitative indicators of access and participation, but must be evaluated through the quality of learning outcomes and the equitable distribution of the benefits of digital education.

Conclusion

This study concludes that digital inclusion in education has a complex relationship with academic performance and cannot be understood solely as a matter of the availability of internet access or the expansion of educational participation. The findings show that although Indonesia and a number of ASEAN countries have made significant progress in terms of the quantity of education, increased internet access in schools, and expanded education participation across levels, the achievement of learning quality still shows a significant gap. Global and regional data show that countries with high quality learning outcomes do not always have the longest number of school years, but are able to manage the education system effectively, including in the use of digital technology for learning. Thus, this study answers the research question by emphasizing that internet access and digital inclusion are important prerequisites, but not the sole determining factor in improving academic performance; Pedagogical quality, digital literacy, and educational governance have equally crucial roles.

The main contribution of this research lies in the presentation of integrative analysis that links internet access, digital literacy, and academic performance in global and regional contexts with a qualitative content analysis approach based on big data. This research expands the conceptual understanding of digital inclusion by showing that the availability of digital infrastructure in schools has not automatically resulted in improved learning quality. These findings make an empirical and theoretical contribution to the digital education literature by affirming the importance of a multidimensional approach that includes access, utilization

capacity, and learning impact. In addition, this research provides relevant policy implications for developing countries, especially Indonesia, in designing digital education strategies that are not only oriented towards technological expansion, but also on strengthening the quality of learning and competence of educators.

However, this study has a number of limitations. First, the analysis was conducted based on cross-country aggregate data sourced from Our World in Data, so that it did not capture microdynamics at the school or individual level. Second, the digital literacy indicators used are still proxy-based and do not fully represent the complexity of the digital competencies of students and educators. Therefore, further research is recommended to combine quantitative and qualitative approaches with primary data, such as digital literacy surveys, observation of learning practices, and case studies at the school level. In addition, further research can explore the mediated role of teachers, curriculum, and digital education policies in strengthening the relationship between digital inclusion and academic performance, resulting in more contextual and sustainable policy recommendations.

Reference

ASEAN Secretariat. (2022). *Declaration on the digital transformation of education systems in ASEAN*.

Bakhtawar, B. (2020). *An Introduction to Qualitative Research (Flick, U. (2014). An introduction to qualitative research. Sage.) Book Review for Academic Consultation*. https://doi.org/10.13140/RG.2.2.11809.22887

Bazeley, P. (2013). *Qualitative Data Analysis : Practical Strategies*.

Bond, M., Bedenlier, S., Buntins, K., Kerres, M., & Zawacki-Richter, O. (2020). Facilitating Student Engagement in Higher Education Through Educational Technology: A Narrative Systematic Review in the Field of Education. *Contemporary Issues in Technology and Teacher Education*, *20*, 315–368. https://api.semanticscholar.org/CorpusID:225822177

Bulman, G., & Fairlie, R. W. (2016). Technology and Education: Computers, Software, and the Internet. *Handbook of the Economics of Education*, *5*, 239–280. https://doi.org/10.1016/B978-0-444-63459-7.00005-1

Burns, T., & Gottschalk, F. (2020). *Education in the Digital Age: Healthy and Happy Children, Educational Research and Innovation*. OECD Publishing. https://doi.org/https://doi.org/10.1787/1209166a-en

Chandrasekar, A., Clark, S. E., Martin, S., Vanderslott, S., Flores, E. C., Aceituno, D., Barnett, P., Vindrola-Padros, C., & Vera San Juan, N. (2024). Making the most of big qualitative datasets: a living systematic review of analysis methods. *Frontiers in Big Data*, *7*. https://doi.org/10.3389/fdata.2024.1455399

Dastyari, A., & Jose, C. (2024). Achieving inclusive and equitable quality education for all: The importance of digital inclusion. *Alternative Law Journal*, *49*(4), 282–287. https://doi.org/10.1177/1037969X241295798

Davis, D., Chen, G., Hauff, C., & Houben, G. J. (2018). Activating learning at scale: A review of innovations in online learning strategies. *Computers and Education*, *125*, 327–344. https://doi.org/10.1016/j.compedu.2018.05.019

Efgivia, M. G. (2020). *Pemanfaatan Big Data Dalam Penelitian Teknologi Pendidikan*. https://api.semanticscholar.org/CorpusID:225482192

Falck, O., Mang, C., & Woessmann, L. (2018). Virtually No Effect? Different Uses of Classroom Computers and their Effect on Student Achievement. *Oxford Bulletin of Economics and Statistics*, *80*(1), 1–38. https://doi.org/10.1111/obes.12192

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Duckworth, D. (2020). Preparing for life in a digital world: IEA international computer and information literacy study 2018 international report. In *Preparing for Life in a Digital World: IEA International Computer and Information Literacy Study 2018 International Report*. https://doi.org/10.1007/978-3-030-38781-5

Guest, G., MacQueen, K., & Namey, E. (2014). Applied Thematic Analysis. *Applied Thematic Analysis*. https://doi.org/10.4135/9781483384436

Hatlevik, O. E., Guomundsdóttir, G. B., & Loi, M. (2015). Digital diversity among upper secondary students: A multilevel analysis of the relationship between cultural capital, self-efficacy, strategic use of information and digital competence. *Computers and Education*, *81*, 345–353. https://doi.org/10.1016/j.compedu.2014.10.019

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687

Martínez-Bravo, M. C., Chalezquer, C. S., & Serrano-Puche, J. (2022). Dimensions of Digital Literacy in the 21st Century Competency Frameworks. *Sustainability (Switzerland)*, *14*(3). https://doi.org/10.3390/su14031867

Ndibalema, P. (2022). Constraints of transition to online distance learning in Higher Education Institutions during COVID-19 in developing countries: A systematic review. *E-Learning and Digital Media*, *19*(6), 595–618. https://doi.org/10.1177/20427530221107510

Niemann, D., Seitzer, H., & Martens, K. (2025). Tackling the Digital Divide? A Comparative Policy Analysis of International Organizations' Varying Approaches to the Digitalization of Education. *Journal of Comparative Policy Analysis: Research and Practice*, *27*(1), 105–125.

https://doi.org/10.1080/13876988.2024.2385361

Nurul Huda, & Kurniyati Indahsari. (2021). Pengaruh Rata-Rata Lama Sekolah, Angka Harapan Hidup DanPengeluaran Perkapita Terhadap Pertumbuhan EkonomiProvinsi Jawa Timur Tahun 2014-2018. *Buletin Ekonomika Pembangunan*, *Vol. 2 No.1*(1), 55–66.

OECD. (2023). *OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem*. OECD Publishing. https://doi.org/https://doi.org/10.1787/c74f03de-en

Reynolds, R. (2021). JanvanDijk. (2020). The digital divide. Cambridge, UK: Polity, 208 pp. £17.99 (paperback) (ISBN 9781509534456). *Journal of the Association for Information Science and Technology*, *72*(1), 136–138. https://doi.org/10.1002/asi.24355

Rodiah Nasution, & M Sholih Salimul Uqba. (2024). Preparing For Tomorrow's Challenge: Tren Teknologi & Media Dalam Pendidikan Masa Depan. *KIRANA : Social Science Journal*, *1*(2), 76–86. https://doi.org/10.61579/kirana.v1i2.167

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, *34*(8), 1607–1624. https://doi.org/https://doi.org/10.1016/j.tele.2017.07.007

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers and Education*, *128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Siddiq, F., Hatlevik, O. E., Olsen, R. V., Throndsen, I., & Scherer, R. (2016). Taking a future perspective by learning from the past - A systematic review of assessment instruments that aim to measure primary and secondary school students' ICT literacy. *Educational Research Review*, *19*, 58–84. https://doi.org/10.1016/j.edurev.2016.05.002

Suyudi, I., Sudadio, S., & Muhyidin, A. (2026). Implementation of the Governor's Policy on Free Education in Improving the Quality of State Vocational High School Education in Banten Province, Indonesia. *Jurnal Pendidikan Indonesia Gemilang*, *6*, 81–90. https://doi.org/10.53889/jpig.v6i1.841

Thomas, S. (2014). The Rebirth of Education: Schooling Ain't Learning by LantPritchettCenter for Global Development, Washington DC, 2013 Pp. 274. ISBN 978-1-933286-77-8. *Asian-Pacific Economic Literature*, *28*(2), 107–110. https://doi.org/10.1111/apel.12076

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Monés, A. M., & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies*, *28*(6), 6695–6726. https://doi.org/10.1007/s10639-022-11431-8

van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New Media and Society*, *21*(2), 354–375. https://doi.org/10.1177/1461444818797082

Vargas-Montoya, L., Gimenez, G., & Fernández-Gutiérrez, M. (2023). ICT use for learning and students' outcomes: Does the country's development level matter? *Socio-Economic Planning Sciences*, *87*, 101550. https://doi.org/https://doi.org/10.1016/j.seps.2023.101550

Wu, X. Y. (2024). Exploring the effects of digital technology on deep learning: a meta-analysis. *Education and Information Technologies*, *29*(1), 425–458. https://doi.org/10.1007/s10639-023-12307-1