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Information and Communication Technology (ICT) and education

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Abstract: In today's fast changing world, we must adopt 21st-century skills and knowledge to keep pace with the evolving needs of society and the economy. One of these is the use of ICT, or Information and Communication Technology, in education. This study addresses the identified gaps and effectiveness of ICT training and integration in education. To analyze the concept, the researcher conducted data mining across various countries that have studied common interests. Through analysis and synthesis, we can conclude that ICT is crucial and timely to use and adopt in this technological era for both teachers and students. The study reveals that socioeconomic level (SES) is one of the factors hindering students from accessing the internet and Information and Communication Technology (ICT), particularly those from low-income and rural communities. At the same time, providing consistent ICT training and programs to teachers enhances competency, overall instructional management, and positively affects students' learning outcomes. Students' academic performance has improved as a result of the use and integration of ICT, which also helps them become more engaged and motivated to study in the classroom. The study concluded that while ICT use in schools is essential for improving the teaching and learning process, specific initiatives from the government and other stakeholders are required to close the digital divide and ensure that all students can utilize its potential, such as continuous professional development for teachers, and guaranteed technology access for marginalized students. Such dual-focused interventions, combining infrastructure investment with human capacity building, can transform educational ecosystems into equitable, future-ready learning environments.

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INTRODUCTION

In the rapidly changing context of the digital age, the integration of Information and Communication Technology (ICT) in education has emerged as a prime driver of teaching and learning innovation. Not only does ICT promote student engagement and increase access to information, but it also empowers learners with critical digital skills needed to survive in the 21st century. The significance of ICT has gained further prominence in the background of worldwide initiatives towards blended and online learning models. It significantly contributes to improving the quality of education, promoting equity, and preparing teachers and students for a technologically enabled world (Tamim et al., 2011; Selwyn, 2020). Understanding the factors that influence access to, and use of ICT is crucial, as most classrooms now utilize digital technologies. It will help ensure that every child receives a decent education.

This study examines the impact of socio-economic status (SES) on the availability of ICT resources, ICT teacher training for effective classroom implementation, and the combined effect of these factors on students' academic performance. Previous research has shown that children from low-income families are less likely to have secure digital devices and stable internet connections, which hampers their learning process (Hargittai, 2019; Van Dijk, 2020). On the other hand, the majority of teachers lack e-pedagogy training, which limits their ability to apply ICT tools to their maximum potential (Ertmer & Ottenbreit-Leftwich, 2019). Despite the growing body of literature on ICT in education, a critical gap remains in our understanding of how socio-economic differences and inadequate teacher training collectively impact student performance. Most studies isolate these variables, instead of investigating them within an integrated framework. Additionally, although international reports highlight access issues, localized data examining the compounded impact of socio-economic status and teacher preparedness on academic performance remain limited, especially in under-resourced school settings (Nguyen et al., 2021; Makrakis & Kostoulas-Makrakis, 2016). This paper aims to overcome these gaps and generate a more inclusive and data-informed approach to educational planning through a more detailed analysis of the relationships between socioeconomic status, access to Information and Communication Technology (ICT), teacher training, and student performance.

Statement of the problem

The integration of information and communication technology (ICT) in schools has been widely acknowledged as a means of enhancing students' academic performance and teaching strategies to deliver learning instructions.

This study addresses the following objectives:

1) To investigate how socioeconomic status (SES) influences students' access to digital learning resources and participation in online education.

2) To examine the impact of Information and Communication Technology (ICT) integration on students' academic performance.

3) To assess the impact of Information and Communication Technology (ICT) training on teachers' competency and its effect on student learning outcomes.

METHODOLOGY

Research design

The gathered data employed qualitative research, including descriptive, correlational, and quasi-experimental research designs, to analyze the goals of each study about the use of information and communication technology in education.

Locale of the study

The participants and respondents in this study came from various countries, representing diverse age groups, genders, races, educational levels, cultures, and beliefs, as well as teachers handling different subject areas. The purpose of including global respondents is to analyze the diverse perspectives and experiences of individuals towards the study's goal, thereby avoiding a limitation to a single type of respondent.

Research instruments and data analyses procedure

The instruments and tools used in this study include ANOVA, survey forms, interviews, observations, sampling, and checklists that are administered to respondents to collect data for analysis.

DISCUSSION OF FINDINGS

Socioeconomic status on ICT access

According to the IEEE Connecticut Section (2023), a digital divide is evident between different economic levels. Those with lower incomes cannot afford digital devices or a monthly internet subscription. Users in remote, secluded areas or less developed countries may lack the broadband infrastructure necessary for internet access. As more people get online, the disparity between those with and without internet access will only widen. Those with internet access can also seize advantageous social, educational, and economic chances. Those without internet access miss out on these chances, which helps to explain the continuation of economic inequalities, the widening social gaps, and the support of segregation. In societies where the poorest individuals lack access to digital technology, but the richest ones can afford it, this disparity can lead to class strife. In places where inequality exists, this is especially true.

In Nepal, students from low-income families face significant obstacles to digital learning, including a lack of access to gadgets, internet, and digital literacy. The epidemic exacerbated these difficulties and exposed structural disparities (Karmacharya, 2023). In India, study findings show significant rural-urban differences in all five states. Socioeconomic factors worsen the digital divide, as low-income and rural households are disproportionately disadvantaged, while high-income households have greater access to online schooling (Mandal, 2025). Additionally, compared to less than 10% in metropolitan areas, a survey conducted in China revealed that 60% of rural students lacked access to a computer at home. Students with internet access performed 20% better on tests; however, without teacher support and digital curricula, government device subsidies alone proved inadequate (Zhang & Mao, 2022). In South Africa, access to Information and Communication Technology (ICT) in Port Elizabeth's educational system is shaped by socioeconomic factors, including income, parental education, infrastructure, and community perceptions. While underprivileged schools face several challenges that limit students' access to digital resources, affluent schools tend to utilize technology more effectively in their classrooms (Sammu & Olaoba, 2024). In Nigeria, digital technologies were more readily available to students in private schools than in public schools (Azubuike et al., 2020). In the United Kingdom (UK), 45% of families lacked the digital skills or access to participate in online learning (Skopeliti, 2024). Lastly, in the United States of America (USA), research shows that many low-income households continue to lack dependable internet connectivity, limiting their children's educational participation (Lifewire, 2023).

Similarities

Students from low-income and rural areas across Nepal, India, China, South Africa, Nigeria, the United Kingdom, and the United States face significant challenges in accessing digital learning. Typical problems include inadequate digital literacy, poor internet connection, and restricted device access. Particularly impacted are rural areas in China and India, public schools in Nigeria, and impoverished groups in South Africa. Many low-income households lack the necessary

technical skills and infrastructure for successful online learning, even in developed nations such as the United States and the United Kingdom.

Advantages

Understanding these shared challenges across countries helps international projects aiming at digital equity in education to be more coordinated. It helps to create better policies, distribute resources more evenly, and provide targeted support to underprivileged groups. These revelations inspire global cooperation and challenge educational systems to fund digital infrastructure, teacher development, and community-oriented projects.

Students' academic performance

Information and communication technology (ICT) enhances academic achievement by enabling interactive learning, providing real-time feedback, and offering access to a wide range of global resources. According to Cheung and Slavin (2019), pupils who use instructional technology do better by 12%. It is because kids are more involved in their education and receive more personalized training. Furthermore, the use of digital technologies helps develop 21st-century skills, such as problem-solving (OECD, 2015).

In Asian countries, studies have shown that students' academic improvement can be achieved through the use and integration of Information and Communication Technology (ICT). In Pakistan, research has shown that ICT enhances students' academic achievement and retention in chemistry. The medium was deemed more interesting, practical, fulfilling, and advantageous in secondary chemistry instruction (Hussain et al., 2017). In India, higher-level graduates who utilize ICT in their learning environments to acquire the necessary technical capabilities demonstrate this. With numerous e-learning resources available, it sparks people's passion for furthering their education and learning (Pathak et al., 2019). The use of ICT provides students in China with engaging lessons, fast feedback, and additional learning resources (Zhao, X., & Yang, L., 2022). In Europe, particularly in Germany, a study found that students who utilized digital simulations in scientific lectures learned abstract concepts more effectively and performed better on subsequent examinations (Kuhlen & Müller, 2021). The academic achievement of high school students in Ontario, Canada, who participated in a study in North America, indicated that online resources and interactive learning platforms helped them perform better. These methods helped students improve their performance on standardized tests, particularly in math and language arts, by 10-15%. Personalised digital learning tools helped pupils grow at their own pace, leading to improved grades (Beattie, T., & Cole, J., 2021). Moreover, a study conducted in a São Paulo school in Brazil found that integrating Information and Communication Technology (ICT) into the curriculum improved students' academic performance, particularly in areas related to critical thinking and creativity. Student final exam performance improves when using video lessons and instructional games (Lima, C. P., & Oliveira, M. R., 2021).

Similarities

In many countries throughout Asia, Europe, and the Americas, including Pakistan, India, China, Germany, Canada, and Brazil, the incorporation of information and communication technology (ICT) into educational environments has consistently shown to improve students' academic

performance. Many studies emphasize the importance of knowledge and communication technologies (ICT) in facilitating more engaging, accessible, and practical education. Whether it's through digital simulations in Germany, interactive platforms in Canada, or video lectures in Brazil, information and communication technology (ICT) typically enhances student learning in many academic environments.

Advantages

Different ICT technologies in the classroom offer numerous benefits, including improved retention, enhanced academic achievement, and tailored learning opportunities. Digital tools help Pakistani and Brazilian students stay engaged and develop their critical thinking skills. ICT access excites people about their own countries, such as India and China, and allows them to be more self-directed in their studies. Examining students from Germany and Canada, those who apply interesting and graphic strategies score better. It proves that ICT not only offers current courses but also enables students to learn more efficiently and retain knowledge for a longer period.

ICT trainings for teachers

All teachers should be taught in information and communication technology (ICT). It would equip them with the skills to utilize technology in the classroom in a way that facilitates student learning. Ghavifekr and Rosdy (2015) claim that competent users of information and communication technologies are better adapted to create engaging and student-centered learning environments. They emphasize the importance of knowledge and communication technology (ICT) training for teachers, which will help them utilize technology to support a diverse range of students in today's digital age.

In Vietnam, educators demonstrated increased confidence in incorporating ICT into their pedagogical methods, resulting in more engaging and dynamic classroom experiences (Pham, N. T. T., 2025). In Pakistan, ICT tools have made teachers' lessons more efficient, helped them plan lessons more effectively, and provided students with improved access to online resources for ongoing learning (Abbasi et al., 2022). In Malaysia, consistent ICT training significantly improved teachers' competency in using ICT for administrative tasks, thereby enhancing school management. The development programs improved student learning (Ghavifekr and Rosdy, 2015). In Tanzania, consistent ICT training has significantly improved teachers' competency in using ICT for administrative tasks, thereby enhancing school management (Chaula & Mwamlangala, 2025). Moreover, in Greece, teachers' plans and motivation to use ICT skills in their teaching were significantly influenced by their perception of the usefulness and satisfaction with ICT training classes (Tzafilkou et al., 2023). In Mexico, teachers who participated in ICT training courses could more effectively include digital technology into their teaching, therefore improving student academic performance and digital literacy (Rios & Araujo, 2021).

Similarities

Teachers in countries such as Vietnam, Pakistan, Malaysia, Tanzania, Greece, and Mexico have found that ICT training helps them raise their competence and inclination to incorporate technology into their classroom environments. Across several countries, regular ICT training for

teachers has been shown to increase lesson preparation, teaching confidence, and the use of digital technologies in administrative activities and classroom instruction.

Advantages

The use of information and communication technology (ICT) not only enhances the classroom atmosphere but also facilitates easier access to resources, supports students in achieving higher academic levels, streamlines administrative processes, and encourages students to develop their digital literacy. Enhancements in instructional outcomes are also significantly linked to improvements in the effectiveness of educational delivery. It enhances the morale and motivation of educators by implementing programs such as information and communication technology (ICT) training.

CONCLUSION

Effective ICT integration in education necessitates fair access to technology, targeted teacher training, and systemic support to bridge socioeconomic gaps. The study reveals that socioeconomic level (SES) is one of the factors influencing access to the internet and Information and Communication Technology (ICT), particularly among students from low-income and rural communities. Providing consistent ICT training and programs to teachers enhances competency, overall instructional management, and positively affects students' learning outcomes. Students' academic performance has improved as a result of the use and integration of ICT, which also helps them become more engaged and motivated to study in the classroom. The study concluded that while ICT use in schools is essential for improving the teaching and learning process, specific initiatives from the government and other stakeholders are required to close the digital divide and ensure that all students can utilize its potential, such as continuous professional development for teachers, and guaranteed technology access for marginalized students. Such dual-focused interventions, combining infrastructure investment with human capacity building, can transform educational ecosystems into equitable, future-ready learning environments.

REFERENCES

Abbasi, S., Abbasi, P., Alvi, H., Junejo, S., & Shaharbano. (2025). The Impact of ICT on Teacher Professional Development: A Quantitative Study. Indus Journal of Social Sciences, 3(1), 668–682. https://doi.org/10.59075/ijss.v3i1.770

Azubuike, O. B., Adegboye, O., & Quadri, H. (2020). Who gets to learn in a pandemic? Exploring the digital divide in remote learning during the COVID-19 pandemic in Nigeria. International Journal of Educational Research Open, 2, 100022. https://doi.org/10.1016/j.ijedro.2020.100022

Beattie, T., & Cole, J. (2021). The effects of ICT on academic performance in Canadian secondary schools. Journal of Educational Psychology, 23(2), 45–56. https://doi.org/10.1037/edu0000412

Chaula, A., & Mwamlangala, M. C. (2025). Influence of teacher training on ICT usage in school management information systems: A case of Rorya District, Tanzania. International Journal of Research and Scientific Innovation, 11(12). https://doi.org/10.51244/IJRSI.2024.11120034

Cheung, A. C. K., & Slavin, R. E. (2019). The effectiveness of educational technology applications for enhancing mathematics achievement in K-12 classrooms. Educational Research Review, 27, 88-113

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2019). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. Journal of Research on Technology in Education, 42(3), 255–284. https://doi.org/10.1080/15391523.2019.1592739

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. International Journal of Research in Education and Science, 1(2), 175–191. https://files.eric.ed.gov/fulltext/EJ1105224.pdf

Hargittai, E. (2019). Potential and Real-Life Limitations of Digital Learning. Education and Information Technologies, 24(2), 1113–1126. https://doi.org/10.1007/s10639-018-09840-4

Hussain, I., Suleman, Q., Din,M.N.,&Shafique, F.(2017).Effects of Information and Communication Technology (ICT) on Students' Academic Achievement and Retention in Chemistry at Secondary Level.,(1),1–40

IEEE Connecticut Section. (2023, February 27). Impact of the digital divide: Economic, social, and educational consequences. IEEE Connecticut. https://ctu.ieee.org/blog/2023/02/27/impact-of-the-digital-divide-economic-social-and-educational-consequences/

Karmacharya, S. (2023). Children's rights to education in the digital era: Barriers of the digital divide for children of low-income families in Nepal. Global Campus of Human Rights. https://repository.gchumanrights.org/handle/20.500.11825/2788

Kuhlen, C., & Müller, L. (2021). The role of ICT in enhancing academic performance in German secondary education. International Journal of Educational Development, 50, 120–131. https://doi.org/10.1016/j.ijedudev.2021.04.008

Lifewire. (2023). How low-income families face a digital divide and what can be done to help. https://www.lifewire.com/how-low-income-families-face-a-digital-divide-and-what-can-be-done-to-help-7229014

Lima, C. P., & Oliveira, M. R. (2021). Digital learning tools and academic performance in Brazilian secondary schools. Latin American Journal of Education Technology, 11(1), 80–92. https://doi.org/10.1177/2042717032127895

Makrakis, V., & Kostoulas-Makrakis, N. (2016). Bridging the digital divide in education: E-learning and digital literacy. International Journal of Digital Literacy and Digital Competence, 7(1), 1–14. https://doi.org/10.4018/IJDLDC.2016010101

Mandal, B. (2025, January). Digital divide in online education: A state-wise survey of internet accessibility and usage patterns in India (Chapter 12). In Digital crossroads: Integrating humanities, science and technology (1st ed.). https://doi.org/10.9734/bpi/mono/978-93-48859-10-5/CH12

Nguyen, T., Netto, C. L. M., Wilkins, J. F., Bröker, P., & Moore, J. A. (2021). Evaluating the impact of digital learning on student outcomes: A meta-analysis. Educational Technology Research and Development, 69(4), 187–204. https://doi.org/10.1007/s11423-021-10097-1

OECD. (2015). Students, computers, and learning: Making the connection. PISA, OECD Publishing. https://doi.org/10.1787/9789264239555-en

Pathak, S., Raja, R., Sharma, V., & Ambala, S. (2019). ICT Utilisation and Improving Student Performance in Higher Education. International Journal of Recent Technology and Engineering, 8(2), 5120-5124.

Pham, N. T. T. (2025, April). The impact of IDDIRR model-based ICT training workshop on in-service teachers in Vietnam. https://www.researchgate.net/publication/390527830_The_Impact_of_IDDIRR_Model-based_in_ICT_Training_Workshop_on_In-serviced_Teachers_in_Vietnam

Ratheeswari, K. (2018, May). Information communication technology in education. Journal of Applied and Advanced Research, 3(S1), 45. https://doi.org/10.21839/jaar.2018.v3iS1.169

Rios, L. E., & Araujo, F. M. (2021). Teacher training in ICT: Benefits and challenges in Brazilian education. Journal of Educational Technology & Society, 24(4), 1–12. https://www.jstor.org/stble/26395162

Sammu, J., & Olaoba, A. (2024, December). Socioeconomic factors influencing ICT access in Port Elizabeth's education system. https://www.researchgate.net/publication/386370707_Socioeconomic_Factors_Influencing_ICT_Access_in_Port_Elizabeth s_Education_System

Selwyn, N. (2020). Digital education: The importance of policy and practice. Journal of Educational Change, 21(2), 255–272. https://doi.org/10.1007/s10833-020-09383-6

Skopeliti, C. (2024, March 17). Half of UK families excluded from modern digital society – study. The Guardian. https://www.theguardian.com/technology/2024/mar/17/half-uk-families-excluded-modern-digital-society-study

Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning: A second-order meta-analysis. Review of Educational Research, 81(1), 4–28. https://doi.org/10.3102/0034654310393361

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education. Educational Technology Research and Development, 65(3), 555–575. https://doi.org/10.1007/s11423-016-9492-3

Tzafilkou, K., Perifanou, M., & Economides, A. A. (2023). Factors affecting teachers' transfer of ICT training: Considering usefulness and satisfaction in a PLS-SEM transfer training model. Journal of Educational Computing Research. https://doi.org/10.1177/14779714221096500

Van Dijk, J. (2020). The digital divide in education: A multi-level analysis. New Media & Society, 22(7), 1246–1265. https://doi.org/10.1177/1461444820917352

Zhang, W., & Mao, C. (2022). Digital divide and education inequality in rural China: A longitudinal study.

Zhao, X., & Yang, L. (2022). Improving academic performance through ICT in Chinese high schools. Journal of Educational Technology Research and Development, 28(3), 219–230. https://doi.org/10.1007/s11423-022-09768-0