ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

TECHNOLOGY READINESS IN EDUCATION: AN ANALYSIS OF ICT FACILITIES IN HIGH SCHOOLS OF LORALAI, BALOCHISTAN

Nargis Noor Jalalzai[1], Huma Akram[2, *], Muhabat Khan[3], Abdul khaliq kakar[4]
[1]Department of Education, BUITEMS, Quetta, Pakistan.
[2]School of International Education, North China University of Water Resources and Electric Power, Zhengzhou, China.
[3]Department of Education, University of Loralai, Loralai, Pakistan.
[4]Government College of Elementary Education Loralai, Balochistan, Pakistan.
Corresponding author E-mail: akramhuma@ncwu.edu.cn

Abstract
The incorporation of technology into instructional programs has become a critical component in preparing learners to thrive in the digital age. However, schools in underdeveloped regions often encounter considerable obstacles when it comes to providing sufficient technology infrastructure. This study investigated the status of computer laboratory facilities in public sector high schools of Loralai, a district in Balochistan, Pakistan. Using a descriptive survey design, data were collected from all 25 high schools through structured observation and measurement. Findings revealed that none of technological infrastructure indicator, such as computer labs, their area, seating capacity and number of functional computers fell under standards provided by national and international standards. Furthermore, none of the schools had supporting facilities such as printers or photocopiers. The study provides a baseline for local and provincial education by highlight a severe gap between the current state of technological infrastructure and international benchmarks, reflecting broader disparities in educational resources across underdeveloped provinces. Given that the study underscores the urgent need for policy interventions and targeted investments to bridge the digital divide in secondary education. Moreover, education authorities are suggested to prioritize resource allocation and align school facilities with global standards, ultimately supporting equitable digital learning opportunities for students in underserved regions.

Keywords: *Educational technology; technology integration; technological infrastructure; high/secondary schools; International standards*

Introduction

The information and communication technology (ICT) revolution has permeated every aspect of human existence and is an integral component of our modern era (Ma et al., 2024; Abdelrady et al., 2025). Likewise, technology is a key component of education in the twenty-first century and has transformed pedagogical methods to more interactive (Akram et al., 2021a, 2021b, 2022). Meeting the global demands, it brings diversity in the instructional practices making teaching innovative and more productive (Al-Adwan et al., 2022; Akram & Abdelrady, 2023, 2025). As a result, it enhances the quality of education by building a proactive learning environment, keeping students motivated, and prepare students for digital-era. In addition, technology-integrated learning improves students' cognitive abilities and enable to maintain lively connections with their teachers and peers (Abdelrady & Akram, 2022). These social interactions not only enhance students' interpersonal skills but also help them find solutions to academic problems, and remain engaged in the learning process (Noor et al., 2021; Li & Akram, 2023, 2024). Given that, Pakistan's national educational policies put a lot of emphasis on using ICT in teaching and learning to meet the needs of students around the world (Pakistan Ministry of Education, 2018). Nevertheless, there are numerous problems that impede the successful use of ICT in educational practices, such as lack of digital literacy (Congman et al., 2019), inadequate teacher

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

trainings (Bhutto et al., 2019), and scarce infrastructure (Ramzan et al., 2025, 2023). For a good use of technology, infrastructure plays a key role in schools (Moore & Fodrey, 2017). Talking about the underdeveloped regions where resources are limited, assessing the state of such infrastructure is not merely an academic exercise but it is a prerequisite for designing targeted interventions to advance educational equity.

Balochistan, Pakistan's largest but most underdeveloped province, faces unique challenges in educational technology adoption (Chachar et al., 2023). Chronic underfunding, geographic remoteness, and limited institutional capacity have left many of its schools without basic digital resources (Coşkun, 2023). Yet there exists no empirical data on how well these schools are equipped to integrate technology in learning practices. In particular, computer labs fall under main infrastructure, which is viewed as the most common entry point for technology use in secondary education globally (Pittman & Gaines, 2015). Without this data, policymakers and local education authorities lack a clear understanding of how to address existing deficits, and how to align with national and international standards for educational technology. Given this, the present study aims to fill this critical gap by assessing the state of technology infrastructure, focusing on computer labs in public sector high schools in Loralai.

Review of Literature

Computers are a tool for enhancing teaching and learning processes under the new paradigm of adopting and integrating technology into education (Pittman & Gaines, 2015). IT managers and educators must create a technology plan that maximizes the potential of the computers at their disposal (Jin et al., 2018). The majority of computing activity at the school takes place in the computer labs, whether students are utilizing laptops, desktops, PCs, or Macs (Ayasrah et al., 2024). Nearly all computer labs give student's access to the Internet and applications so they may do their schoolwork and conduct research (Coşkun, 2023). According to Suwarto et al. (2022) the new paradigm of integrating technology into the curriculum places computers on demand throughout the school day. The successful integration of computers in educational settings depends on the availability of well-equipped and effective computer lab facilities in schools (Hasin & Nasir, 2021). A computer specialist usually instructs in-service teachers on other subjects in the computer lab, which serves as a central venue for teaching computer usage to full classrooms. Nkadimeng and Ankiewicz (2022) concur and emphasize that computer technology should be an essential part of all educational settings because it can be used by both students and teachers to accomplish a variety of academic goals. Students are drawn to computer labs with the right software (Cui & Ng, 2021); this influences students' drive to learn and raises their interest in the teaching-learning process (Sohail & Akram, 2025). Computers also assist students in learning new material, conducting topical research, and increasing their productivity (Efendi et al., 2023). According to Cui and Ng's (2021) observation, actual teaching and learning processes in labs assist students internalize scientific method and comprehend presented mathematical science courses.

International standards provide a critical benchmark for this assessment and advises 1000 square feet for computer labs in secondary schools for optimal learning. Moreover, seating capacity should be at least for 40 students to align with typical class sizes, and at least 40 functional computers to avoid overcrowding and ensure individual access (International Society for Technology in Education, 2007). These standards are not arbitrary—they are designed to ensure that technology use is inclusive (i.e., no student is excluded due to limited space or devices) and effective (i.e., students can engage in hands-on, independent learning tasks). By comparing

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

Loralai's schools to these benchmarks, the study highlights both strengths and critical deficits in current infrastructure.

Methodology

This study employed a quantitative descriptive survey design to examine the availability and adequacy of technological infrastructure in public sector high schools of Loralai, Balochistan. A descriptive design was deemed appropriate as it enables the systematic collection and analysis of factual data regarding the current state of facilities without manipulating any variables (Lans & Van der Voordt, 2002).

Population and Sample

The population of the study comprised all public sector high schools for boys and girls in the district of Loralai. A total of 25 schools were identified through official records obtained from the District Education Department. Because of the manageable size, a census approach was adopted (Drechsler & Reiter, 2010), and 25 schools were included in the study.

Data Collection Instrument

A structured observation checklist was developed by the researchers to record the presence, condition, and adequacy of computer laboratories and related technological facilities. The checklist covered indicators such as:

1. Availability and functionality of computer laboratories.
2. Area of computer laboratories (in square feet).
3. Seating capacity of the laboratories (number of students).
4. Number of computers available in each laboratory.
5. Availability of supporting equipment (e.g., printers and photocopiers).

The checklist was designed based on international standards for ICT facilities in secondary schools (Anderson, 2010), as recommended by UNESCO (2021). This provided a benchmark for comparing the observed data.

Data Collection Procedure

Data were collected through direct visits to each of the 25 schools during the academic year 2024. The researchers measured the physical dimensions of the laboratories using a measuring tape, recorded seating arrangements, and counted the number of computers. School records and consultation with laboratory in-charges (where available) were used to confirm the functionality of labs and availability of supporting equipment.

Results

Data was analyzed via descriptive statistics, including frequencies, percentages, ranges, and means, to summarize the findings. The analysis of technological infrastructure in public high schools of Loralai indicated substantial gaps when compared with international standards (see Table 1). Out of 25 schools, only 3 (12%) had computer laboratories, and among these, only one was functional. Regarding lab functionality, it was observed that out of a total of 25 schools, only 3 had computer lab facilities. Among these 3 schools, only one had a functional computer lab.

Table 1. Technological Infrastructure of Public Sector High Schools in Loralai

Indicator	N	Observed Range	M
Computer Labs	25	3 of 25	-
Functional Labs	25	1 of 3	-
Lab Area	25	330 – 720	541.66
Seating Capacity	25	20 – 30	25

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

Number of Computers	25	7 – 30	19
Printer/Photocopier Availability	25	0 of 25	-

Regarding laboratory area, the observed size ranged between 330 and 720 square feet, with a mean of 541.66 square feet, which falls considerably below the international standard of 1,000 square feet. Similarly, seating capacity was limited, ranging from 20 to 30 students (M = 25), whereas the benchmark is 40. The number of computers available per lab was also insufficient, ranging from 7 to 30 (M = 19), again below the international recommendation of 40 units. The boxplot comparisons showed significant variation among these indicators (see Figure 1). The median values for lab area, seating capacity, and number of computers were below international standards, indicating that none of the schools met the recommended criteria.

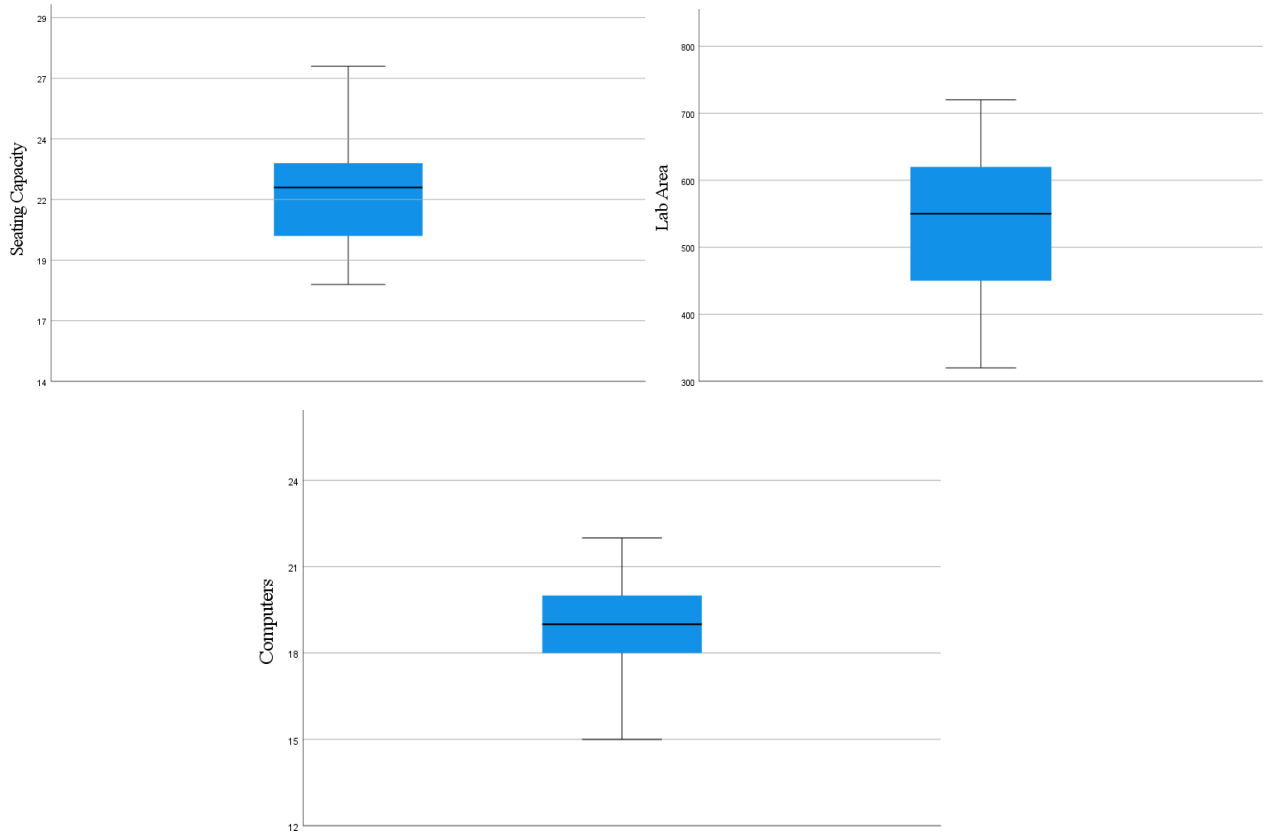

Figure 1. Boxplot Comparisons

In addition to these limitations, none of the school had access to printers or photocopiers in their computer laboratories. The complete absence of such supporting facilities further restricts the effective use of technology for educational purposes.

Discussion

The findings of this study reveal that the technological infrastructure of public high schools in Loralai is significantly underdeveloped and far below international standards. With only three schools having computer laboratories and only one of them functional, both students and teachers face limited opportunities to acquire essential digital literacy skills. These results resonate with

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

Akram et al. (2021), who highlighted the lack of adequate ICT infrastructure in educational institutions. Rahim et al. (2020) also reported that rural schools in Pakistan struggle with insufficient access to computer labs and outdated equipment, which hinders the integration of technology into classroom practices. Similarly, studies conducted in other developing countries such as Malaysia (Hasin & Nasir, 2021) and Bangladesh (Hossain et al., 2019) have found that infrastructure deficits, including the absence of functioning laboratories and supporting equipment, remain a critical barrier to technology-enhanced education.

The inadequate laboratory space further reflects the broader issue of resource allocation to education in underdeveloped provinces like Balochistan. This shortage of space not only limits the number of students who can benefit simultaneously but also constrains the overall learning environment. Scherer et al.'s (2020) metanalysis also shown that physical space and seating arrangements directly influence the effectiveness of computer-based learning activities. Similarly, the average seating capacity of 25 students per lab, compared with the standard of 40, further reduces the inclusiveness of technology-based education in these schools. The limited number of computers in labs was also significantly lower than the international standard. This shortage is consistent with findings from Zamir and Wang (2023), who noted that the "one-computer-for-many-students" situation is a widespread challenge in rural Pakistani schools, often resulting in limited hands-on practice and reduced student motivation. International studies echo this concern, emphasizing that insufficient access to hardware undermines students' ability to develop basic computer skills and restricts teachers' ability to integrate ICT into instruction effectively (Nwana et al., 2017).

Additionally, the most striking finding of this study is the absence of printers and photocopiers in the surveyed schools. Supporting equipment plays a vital role in enhancing the functionality of computer labs by enabling students and teachers to produce, reproduce, and share digital content. The lack of such facilities has also been highlighted in earlier research as a critical limitation in the adoption of ICT in developing regions (Munje & Jita, 2020). Without these supporting tools, the effectiveness of computer labs remains highly compromised. Taken together, these findings illustrate that the digital divide in education persists strongly in underdeveloped regions such as Loralai. While international standards set a clear framework for what constitutes adequate ICT infrastructure, the situation in Loralai highlights the gap between policy aspirations and ground realities. Consistent with the observations of Moore and Fodrey (2017), the issue is not merely about access to computers but also about ensuring equitable, functional, and supportive environments for meaningful use.

In light of these results, there is a pressing need for targeted policy interventions and investments in school infrastructure. Strengthening ICT facilities in underdeveloped provinces like Balochistan is essential for bridging the digital divide. For this, education department should allocate funds for building computer labs or expand physical space where possible in the underdeveloped areas. They should prioritize schools with the largest number of student enrollment to maximize impact on learning. They should further seek additional support from local NGOs to attain more funding and resources to overcome this challenge. In addition, they should upgrade the existing labs by installing necessary infrastructure and ensure the stable internet connectivity. They should also train lab attendants or existing school staff to optimize the efficient use of ICT resources. They should further ensure promoting equitable access for all students to technology, and preparing students for participation in the digital economy. Future research could explore the perspectives of teachers and students to better understand how infrastructure deficits

affect teaching practices and learning outcomes, as well as investigate the role of government policies in shaping resource allocation.

Conclusions

This study set out to examine the availability and adequacy of technological infrastructure in public high schools of Loralai, Balochistan. The results demonstrated that the majority of schools lack computer laboratories altogether, and even among those that have them, functionality and adequacy remain far below international standards. In terms of laboratory area, seating capacity, and number of computers, the existing facilities failed to meet global benchmarks. Moreover, the complete absence of supporting equipment such as printers and photocopiers further limits the potential of technology integration in these schools. For practice, the study offers actionable guidance for local and provincial education authorities: prioritize funding for computer lab construction in the schools without labs; upgrade the existing labs to meet international standards (e.g., increasing computer numbers, expanding physical space); and provide advanced tools like printers to enhance lab functionality. For policy, the baseline data can advocate for increased provincial and national investment in Balochistan's educational technology infrastructure, aligning local efforts with global goals of equitable digital education (UNESCO, 2021). Limitations of the study include its focus on infrastructure (rather than actual technology use or student/teacher perceptions) and its geographic scope (only Loralai). Future research could expand to other districts in Balochistan, explore barriers to infrastructure maintenance (e.g., funding, technical support), and assess how improved labs impact student learning outcomes.

References

Abdelrady, A. H., & Akram, H. (2022). An empirical study of ClassPoint tool application in enhancing EFL students' online learning satisfaction. *Systems*, *10*(5), 154.

Abdelrady,s A. H., Ibrahim, D. O. O., & Akram, H. (2025). Unveiling the Role of Copilot in Enhancing EFL Learners' Writing Skills: A Content Analysis. *World Journal of English Language, 15*(8), 174-185.

Akram, H., & Abdelrady, A. H. (2023). Application of ClassPoint tool in reducing EFL learners' test anxiety: an empirical evidence from Saudi Arabia. *Journal of Computers in Education*, 1-19.

Akram, H., & Abdelrady, A. H. (2025). Examining the role of ClassPoint tool in shaping EFL studensts' perceived E-learning experiences: A social cognitive theory perspective. *Acta Psychologica, 254,104775*.

Akram, H., Abdelrady, A. H., Al-Adwan, A. S., & Ramzan, M. (2022). Teachers' perceptions of technology integration in teaching-learning practices: A systematic review. *Frontiers in psychology*, *13*, 920317.

Akram, H., Aslam, S., Saleem, A., & Parveen, K. (2021). The challenges of online teaching in COVID-19 pandemic: a case study of public universities in Karachi, Pakistan. *Journal of Information Technology Education Research*, *20*, 263.

Akram, H., Yingxiu, Y., Al-Adwan, A. S., & Alkhalifah, A. (2021). Technology Integration in Higher Education During COVID-19: An Assessment of Online Teaching Competencies Through Technological Pedagogical Content Knowledge Model. *Frontiers in Psychology*, 12, 736522-736522.

Al-Adwan, A. S., Nofal, M., Akram, H., Albelbisi, N. A., & Al-Okaily, M. (2022). Towards a sustainable adoption of e-learning systems: The role of self-directed learning. *Journal of Information Technology Education: Re-search, 21,* 245-267.

Anderson, J. (2010). *ICT transforming education: A regional guide*.

Ayasrah, F. T. M., Alarabi, K., Al Mansouri, M., Fattah, H. A. A., & Al-Said, K. (2024). Enhancing secondary school students' attitudes toward physics by using computer simulations. *International journal of data and network science*, *8*(1), 369-380.

Bhutto, M., Bhayo, N. H., Dong, J., Umar, M., & Akram, H. (2019). Understanding Students' Psychological Stress: A Case of Sukkur Iba University. *British Journal of Education*, *7*(6), 38-52.

Chachar, Z. A., Ullah, N., & Ujjan, S. B. (2023). Enhancing access and quality of secondary education in Balochistan: Identifying challenges and implementing effective solutions. *Journal of Development and Social Sciences*, *4*(3), 270-279.

Congman, R., Umar, M., Bhayo, N. H., Ijaz, M. S., Sharifi, A. F., & Akram, H. (2019). Smartphone addiction and subjective well-being: A case of international students at Northeast Normal University, China. *American Journal of Creative Education*, *2*(2), 70-80.

Coşkun, H. C. (2023). Reflection of the iceberg: Key issues and challenges of education in Balochistan. *Culture, Education, and Future*, *1*(1), 47-65.

Cui, Z., & Ng, O. L. (2021). The interplay between mathematical and computational thinking in primary school students' mathematical problem-solving within a programming environment. *Journal of Educational Computing Research*, *59*(5), 988-1012.

Drechsler, J., & Reiter, J. P. (2010). Sampling with synthesis: A new approach for releasing public use census microdata. *Journal of the American Statistical Association*, *105*(492), 1347-1357.

Efendi, R., Ali, G., Purnomo, W. A., Iskandar, I., & Wulandari, R. A. (2023). Augmented Reality Based Competency Based Learning on Computer Network Learning in Vocational Education Vocational School. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *7*(2), 242-253.

Hasin, I., & Nasir, M. K. M. (2021). The Effectiveness of the Use of Information and Communication Technology (ICT) in Rural Secondary Schools in Malaysia. *Journal of Education and e-Learning Research*, *8*(1), 59-64.

Hasin, I., & Nasir, M. K. M. (2021). The Effectiveness of the Use of Information and Communication Technology (ICT) in Rural Secondary Schools in Malaysia. *Journal of Education and e-Learning Research*, *8*(1), 59-64.

Hossain, Z., Hashmi, Y., & Mezbah-ul-Islan, M. (2019). ICT facilities and literacy in rural non-government secondary school libraries of Bangladesh. *School Libraries Worldwide*, *25*(2), 66-80.

International Society for Technology in Education. (2007). *National educational technology standards for students*. ISTE (Interntl Soc Tech Educ.

Jin, G., Tu, M., Kim, T. H., Heffron, J., & White, J. (2018). Evaluation of game-based learning in cybersecurity education for high school students. *Journal of Education and Learning (EduLearn)*, *12*(1), 150-158.

Lans, W., & Van der Voordt, D. J. M. (2002). Descriptive research. In *Ways to study and research urban, architectural and technical design* (pp. 53-60). DUP Science.

Li, S., & Akram, H. (2023). Do emotional regulation behaviors matter in EFL teachers' professional development?: A process model approach. *Porta Linguarum: revista internacional de didáctica de las lenguas extranjeras*, (9), 273-291.

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR

Li, S., & Akram, H. (2024). Navigating Pronoun-Antecedent Challenges: A Study of ESL Academic Writing Errors. *SAGE Open*, *14*(4), 21582440241296607.

Ma, D., Akram, H., & Chen, I. H. (2024). Artificial Intelligence in Higher Education: A Cross-Cultural Examination of Students' Behavioral Intentions and Attitudes. *The International Review of Research in Open and Distributed Learning*, *25*(3), 134-157.

Moore, R. L., & Fodrey, B. P. (2017). Distance education and technology infrastructure: Strategies and opportunities. In *Leading and managing e-learning: What the e-learning leader needs to know* (pp. 87-100). Cham: Springer International Publishing.

Munje, P. N., & Jita, T. (2020). The impact of the lack of ICT resources on teaching and learning in selected South African primary schools. *International Journal of Learning, Teaching and Educational Research*, *19*(7), 263-279.

Nkadimeng, M., & Ankiewicz, P. (2022). The affordances of minecraft education as a game-based learning tool for atomic structure in junior high school science education. *Journal of Science Education and Technology*, *31*(5), 605-620.

Noor, N., Akram, H., & Kamran, M. (2021). Preferred reasons in selecting teaching profession as a life career: a case study of pre-service teachers. *Pakistan Journal of Educational Research*, *4*(1).

Nwana, S. E., Ofoegbu, T. O., & Egbe, C. I. (2017). Availability and utilization of ICT resources in teaching computer education in secondary schools in Anambra State, Nigeria.

Pakistan Ministry of Education (MoE). (2018). *National education policy 2018*. Islamabad: Government of Pakistan.

Pittman, T., & Gaines, T. (2015). Technology integration in third, fourth and fifth grade classrooms in a Florida school district. *Educational Technology Research and Development*, *63*(4), 539-554.

Rahim, S., Bibi, T., Bahadur Qutoshi, S., Gul, S., Gul, Y., Khani, N. A. K. K., & Malik, M. S. (2020). The challenges and opportunities to formulate and integrate an effective ict policy at mountainous rural schools of gilgit-baltistan. *Information*, *11*(11), 522.

Ramzan, M., Akram, H., & kynat Javaid, Z. (2025). Challenges and Psychological Influences in Teaching English as a Medium of Instruction in Pakistani Institutions. *Social Science Review Archives*, *3*(1), 370-379.

Ramzan, M., Bibi, R., & Khunsa, N. (2023). Unraveling the Link between Social Media Usage and Academic Achievement among ESL Learners: A Quantitative Analysis. *Global. Educational Studies Review, 8*, 407-421.

Scherer, R., Siddiq, F., & Viveros, B. S. (2020). A meta-analysis of teaching and learning computer programming: Effective instructional approaches and conditions. *Computers in Human Behavior*, *109*, 106349.

Sohail, A., & Akram, H. (2025). The role of self-awareness and reflection in academic achievement: A psychological and Bayesian analysis. *Pedagogical Research*, *10*(1).

Suwarto, D. H., Setiawan, B., & Machmiyah, S. (2022). Developing digital literacy practices in Yogyakarta elementary schools. *Electronic Journal of E-Learning*, *20*(2), pp101-111.

UNESCO. (2021). ICT in education policy review report: Mongolia. UNESCO. https://unesdoc.unesco.org/ark:/ 48223/pf0000379606

Zamir, S., & Wang, Z. (2023). Uncovering Covid-19, distance learning, and educational inequality in rural areas of Pakistan and China: a situational analysis method. *Humanities and Social Sciences Communications*, *10*(1), 1-13.