Digital Readiness and Computer Education Quality in Private Secondary Schools: Evidence from Karachi

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Abstract

This study assesses perceived digital readiness and the quality of computer education in selected private secondary schools in Karachi District South. The source survey included 150 respondents: 120 students and 30 computer teachers. Separate 15-item questionnaires were piloted with 20 students and 10 teachers before administration. Because the surviving dataset contains only aggregate response classifications rather than item-level scores, the analysis is descriptive and does not test causal effects on academic performance. Among students, 16 responses (13.33%) were classified as favourable, 86 (71.67%) as unfavourable, and 18 (15.00%) as non-responses. Among teachers, 5 responses (16.67%) were favourable, 23 (76.67%) unfavourable, and 2 (6.67%) non-responses. Overall, 72.67% of the sample was classified as unfavourable, indicating widespread concern about the adequacy of computer-education provision. The source narrative identifies limited laboratory access, outdated equipment, weak connectivity, insufficient maintenance, excessive emphasis on theory, and inadequate professional development as recurring concerns; however, the absence of item-level data prevents independent estimation of their individual prevalence. The paper argues that digital readiness requires coordinated investment in infrastructure, teacher competence, curriculum, technical support, governance, and equitable student access rather than the purchase of devices alone.

Keywords: computer education; digital readiness; secondary schools; teacher digital competence; digital divide; Karachi; Pakistan

Introduction

Digital competence has become a foundational educational outcome. Students need more than familiarity with hardware or isolated software commands; they require the ability to locate and evaluate information, create digital content, communicate responsibly, solve problems, protect privacy, and adapt to emerging technologies. Schools therefore face a dual responsibility: to teach computing-related knowledge and to use digital tools appropriately across the curriculum.

Technology does not improve education simply by being present. The 2023 Global Education Monitoring Report emphasizes that decisions about educational technology should be appropriate, equitable, evidence based, and sustainable, with learner needs placed ahead of commercial or technological enthusiasm (Global Education Monitoring Report Team, 2023). Likewise, evidence from developing contexts suggests that learning gains depend on pedagogy, teacher engagement, implementation quality, and institutional support rather than equipment alone (Rodriguez-Segura, 2022; UNICEF Innocenti, 2024).

In Pakistan, unequal access to devices, connectivity, and digital support remains an important education challenge. Evidence from recent crises indicates that poor and rural households were less likely to access digital technologies, reinforcing pre-existing inequalities (World Bank, 2024). Private schools may have greater managerial flexibility than public institutions, but they also vary considerably in fees, resources, teacher capacity, and quality assurance. Local evidence is therefore necessary to understand whether access translates into meaningful computer education.

Problem statement

The original study sought to evaluate computer education in private secondary schools, but it combined questions about facilities, teaching, skills, interest, and academic performance without retaining the item-level evidence needed to test those relationships. Its hypotheses referred to mean achievement differences and teacher gender, although the reported analysis included only frequencies and percentages. The present rewrite addresses this mismatch by reframing the study as a descriptive assessment of perceived digital readiness.

1.2 Aim, objectives, and research questions

The study aims to assess student and teacher perceptions of computer-education readiness in selected private secondary schools in Karachi District South.

- Describe the distribution of favourable, unfavourable, and missing responses among students and teachers.
- Interpret the reported concerns through a multidimensional digital-readiness framework.
- Identify practical priorities for infrastructure, pedagogy, teacher development, technical support, and monitoring.
- RQ1. What pattern of responses is reported by students and computer teachers?

- RQ2. What institutional weaknesses may explain the predominantly unfavourable responses?
- RQ3. What improvements are needed for sustainable and equitable computer education?

1.3 Significance of the study

The study provides a historical local snapshot that can inform school leaders, teachers, education authorities, and researchers. Its value lies not in causal proof but in identifying a strong signal of dissatisfaction and converting earlier observations into a contemporary framework for school digital readiness.

Literature Review and Conceptual Framework

From computer access to digital readiness

Early school computer initiatives frequently measured progress through the number of devices or laboratories. Contemporary frameworks take a broader view. Digital readiness includes infrastructure and connectivity, relevant content, competent teachers, effective pedagogy, student access, technical support, leadership, data protection, and mechanisms for continuous improvement. A laboratory may exist yet remain educationally weak if devices are obsolete, internet access is unreliable, class sizes exceed capacity, or lessons remain entirely theoretical.

Teacher digital competence

Teachers mediate the relationship between technology and learning. UNESCO's ICT Competency Framework for Teachers identifies competencies across policy understanding, curriculum and assessment, pedagogy, application of digital skills, organization and administration, and professional learning (UNESCO, 2018). This reinforces a crucial distinction: basic operational competence is necessary, but teachers also need pedagogical judgment to select tools, design activities, assess learning, manage online safety, and support diverse learners.

Professional development is most effective when it is continuous, practice based, subject relevant, and supported by leadership. One-off workshops may increase awareness but rarely change classroom routines without coaching, time to practise, access to functioning tools, and follow-up. UNICEF Innocenti (2024) similarly highlights teacher engagement as a condition for successful digital learning.

Curriculum, pedagogy, and student engagement

Computer education should balance conceptual understanding with purposeful practice. Students need structured opportunities to create documents, analyze data, communicate, code, solve problems, evaluate online information, and apply ethical and safety principles. A theory-heavy curriculum may reduce engagement, while unstructured device use can produce activity without learning. Curriculum alignment, progressive skill standards, authentic tasks, and formative assessment are therefore essential.

Equity, sustainability, and learner protection

Digital education can expand opportunity but may deepen inequality when access depends on household income, personal devices, or private connectivity. Sustainable planning must consider total cost of ownership, including maintenance, replacement, software, cybersecurity, electricity, connectivity, accessibility, and technical staff. UNESCO (2025) also emphasizes privacy, learner wellbeing, and the risk of widening digital divides as education systems become more digital.

Table 1
Digital-readiness framework used to interpret the study

Dimension	Illustrative indicators	Risk when weak
Infrastructure	Adequate devices, safe laboratory space, power, network	Limited or unequal hands-on access
Teacher capability	Operational, pedagogical, ethical, and assessment competence	Technology used superficially or avoided
Curriculum and pedagogy	Progressive skills, practical tasks, integration, feedback	Theory-heavy instruction and low engagement
Technical support	Maintenance, updates, inventory, troubleshooting	Equipment becomes unusable
Student access and inclusion	Reasonable device ratios, accessibility, gender and income equity	Digital divide within and beyond school
Leadership and governance	Budget, policy, safety, monitoring, improvement plans	Fragmented and unsustainable implementation

Research Methodology

Research design and participants

The study used a cross-sectional descriptive survey. The reported sample comprised 150 respondents from selected private secondary schools in Karachi District South: 120 students (80.0% of the sample) and 30 computer teachers (20.0%). The source document does not specify the number or names of schools, sampling frame, selection technique, participant demographics, fieldwork dates, or response rate. The findings therefore apply only to the participating sample.

Instrument development and pilot testing

Separate questionnaires containing 15 questions were prepared for students and teachers. The source reports that the questions drew on literature, expert opinion, and investigator judgment. A pilot test involved 20 students and 10 teachers from a population considered similar to the main sample, after which unclear wording was revised. However, the final item wording, response scale, expert-review procedure, and reliability estimates are unavailable. The claim of content validity should consequently be treated as preliminary rather than established.

Data analysis

The retained analysis classifies responses as favourable ('yes'), unfavourable ('no'), or non-response and reports frequencies and percentages. Percentages were recalculated from the published counts. No item-level dataset, composite scores, achievement measures, or gender-disaggregated teacher outcomes were available. Inferential hypotheses concerning student performance or differences between male and female teachers cannot therefore be tested.

Ethical considerations

The source manuscript does not report informed consent or assent procedures, parental permission for minors, confidentiality safeguards, institutional approval, or data-retention arrangements. These requirements should be documented in any replication or journal submission.

Data Analysis

Respondent composition

Table 2.
Respondents included in the survey

Group	n	Percentage of sample
Students	120	80.00%
Computer teachers	30	20.00%
Total	150	100.00%

Aggregate response pattern

Table 3
Published response classifications by respondent group

Group	Favourable n (%)	Unfavourable n (%)	Non-response n (%)	Total
Students	16 (13.33%)	86 (71.67%)	18 (15.00%)	120
Teachers	5 (16.67%)	23 (76.67%)	2 (6.67%)	30
Combined	21 (14.00%)	109 (72.67%)	20 (13.33%)	150

The response distribution is predominantly unfavourable in both groups. Teachers reported a slightly higher favourable share than students (16.67% versus 13.33%), but the difference is descriptive and should not be interpreted as statistically significant. Student non-response was higher than teacher non-response (15.00% versus 6.67%), suggesting that some questions may have been unclear, inapplicable, or left unanswered.

Interpretation of the source observations

The narrative accompanying the original survey identifies several recurring concerns: insufficient laboratory space, limited access to computers, outdated equipment, lack of internet, weak maintenance arrangements, shortage of trained personnel, limited practical work, and absence of regular in-house professional development. These themes are consistent with the predominantly unfavourable aggregate pattern and with the digital-readiness framework in Table 1.

Several percentages reported elsewhere in the source manuscript—including the proportions of schools with laboratories, equipment generations, trained staff, student software skills, and preference for practical learning—cannot be reproduced from the three surviving tables. They are therefore not presented as verified results in this rewrite. The original questionnaires and item-level data are required before those estimates can be restored.

Status of the original hypotheses

Table 4
Alignment of the original hypotheses with available evidence

Original proposition	Required evidence	Available evidence	Decision
Computer resources affect student outcomes	Resource exposure and valid achievement scores	Aggregate yes/no/non-response counts only	Not testable
Teaching effectiveness differs by teacher gender among digitally skilled teachers	Gender, digital-skill measures, and effectiveness scores	No gender-disaggregated scores	Not testable

Discussion and Concusion

Discussion

The main result is a consistent pattern of unfavourable perceptions among both students and teachers. This convergence suggests that computer education was not meeting respondent expectations. Yet the evidence does not show that computer resources had no effect on achievement; such a conclusion would require a suitable comparison, valid outcome measures, and control of competing explanations. The study instead indicates limited readiness to deliver high-quality computer education.

The findings support a systems perspective. Purchasing computers without maintenance, teacher learning, appropriate curriculum, internet access, and monitoring can produce visible infrastructure with little educational value. Global evidence likewise warns that technology must serve defined learning problems and be implemented under conditions that support equity and sustainability (Global Education Monitoring Report Team, 2023; Rodriguez-Segura, 2022).

The reported preference for practical learning, although not independently reproducible from the retained tables, is educationally plausible. Practical work should not replace conceptual knowledge; it should enable students to apply concepts through progressive tasks. Schools need sufficient device time, manageable groups, accessible software, and performance-based assessment to make such learning meaningful.

Implications for school leadership

- Conduct a baseline audit of devices, connectivity, laboratory capacity, software, power, safety, and accessibility.
- Define minimum student competencies for each grade and align lessons and assessments with them.
- Provide sustained teacher professional development linked to classroom practice and mentoring.
- Establish accountable technical-support, maintenance, inventory, update, and replacement procedures.
- Monitor student access and participation so that income, gender, disability, or home connectivity do not create hidden exclusion.

Limitations

The study is limited by an unspecified school sample, lack of demographic and contextual information, absence of item-level data, unknown measurement reliability, and reliance on aggregate response categories. The coding of a whole respondent as favourable or unfavourable is not explained. Non-response was substantial among students. No achievement outcomes were collected, and the design cannot support causal conclusions. Some narrative percentages in the original manuscript could not be reconciled with the available tables.

Conclusion and Recommendations

The survey provides evidence of widespread dissatisfaction with computer-education provision among the participating students and teachers. Of 150 respondents, 109 (72.67%) were classified as unfavourable, 21 (14.00%) as favourable, and 20 (13.33%) did not respond. These results identify a readiness problem but do not demonstrate that computers fail to improve achievement or that teacher effectiveness differs by gender.

Improvement requires a coordinated model in which infrastructure, teaching competence, curriculum, technical support, student inclusion, and governance reinforce one another. Schools should move from counting devices toward monitoring meaningful access and demonstrated digital competence.

Priority action plan

Table 5

Recommended actions for strengthening computer education

Priority	**Action**	**Suggested indicator**
1. Baseline audit	Inventory equipment, connectivity, capacity, software, safety, and accessibility	Verified school digital-readiness profile
2.Minimum provision	Set device-access, connectivity, maintenance, and replacement standards	Student-to-functioning-device ratio; uptime
3.Teacher development	Use needs-based training, coaching, peer demonstration, and follow-up	Competency evidence and classroom application
4.Curriculum redesign	Balance concepts, practical tasks, digital citizenship, safety, and emerging technologies	Grade-level performance standards
5.Technical support	Assign responsibility and budget for repair, updates, security, and backups	Resolution time and maintenance records
6. Evaluation	Collect item-level baseline and follow-up data plus student performance tasks	Annual readiness and competence report

Future research

A replication should use a documented sampling frame across multiple schools, publish the questionnaire, establish validity and reliability, and retain item-level responses. It should measure distinct constructs such as infrastructure, teacher competence, practical exposure, student digital competence, and leadership support. Mixed methods could combine surveys with laboratory audits, classroom observations, interviews, and authentic student performance tasks. Longitudinal or quasi-experimental designs would be required to evaluate effects on learning outcomes.

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