

Challenges Hindering Effective ICT Integration in the Teaching and Learning of Pre-Technical Studies in Rural Public Junior Schools in Soy Sub-County, Uasin Gishu County, Kenya

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ABSTRACT

Despite Kenya's Competency-Based Education (CBE) mandate to mainstream digital literacy across all learning areas, Pre-Technical Studies instruction in rural public junior schools continues to face substantial barriers to effective ICT integration. This study examined the challenges hindering ICT integration in Pre-Technical Studies instruction in rural public junior schools in Soy Sub-County, Uasin Gishu County, Kenya. A mixed-methods descriptive survey design was employed, drawing data from 66 sampled schools, 66 teachers and 267 Grade 7 learners selected through stratified, purposive and simple random sampling, alongside a Quality Assurance Officer interviewed as a key informant. Data were collected using questionnaires, an interview guide and an observation checklist and analysed using descriptive statistics, and thematic analysis. Findings revealed that device scarcity was near-universal, with majority of learners and teachers reporting inadequate computers or tablets, while unreliable internet connectivity emerged as the most severe barrier for both groups. Inadequate funding and unreliable electricity supply were also rated dominant systemic barriers by teachers, alongside a distinct lack of Pre-Technical Studies-specific digital content. Observation data corroborated these self-reported challenges, while school administration attitudes were comparatively supportive, indicating that ineffective ICT integration stems primarily from resourcing and content-development gaps rather than implementation failure. The study concludes that generic ICT provision alone cannot resolve the subject-specific instructional gap in Pre-Technical Studies and recommends that the Kenya Institute of Curriculum Development develop offline-compatible, subject-specific digital content, and that the Teachers Service Commission institutionalize sustained, hands-on ICT professional development for rural teachers. These findings offer a grassroots perspective essential for aligning national digital education policy with classroom realities in resource-constrained rural settings.

Keywords: ICT integration, Pre-Technical Studies, rural schools, digital literacy, Competency-Based Education

INTRODUCTION

The integration of Information and Communication Technology (ICT) into Pre-Technical Studies instruction in rural public junior schools represents a critical yet largely unrealized opportunity to transform foundational learning by equipping learners with the integrated digital, entrepreneurial and technical skills essential for meaningful participation in Kenya's 21st-century economy. At its core, the problem lies in digital under-utilization, where mere acquisition of hardware does not translate into improved instructional outcomes (Tarus et al., 2015).

In the context of Pre-Technical Studies, this problem manifests as a failure to transition from traditional, theoretical teaching to dynamic, technology-mediated project-based learning that reflects the integrated, foundation skills required for everyday life and future vocational training, encompassing basic entrepreneurship, digital literacy and simple technical skills. Despite decades of investment, the central

challenge is that ICT is often treated as an add-on rather than a core catalyst for developing learners' digital literacy competency.

This problem is further complicated by a pedagogical-technological mismatch, where teachers' existing instructional methods are incompatible with the digital tools meant for classroom instruction. Public and academic discourse acknowledges that while technology is a vital asset, its ineffective application in the classroom directly hinders learners' ability to compete in a globalized economy. According to teachers, the current trajectory of ICT use is failing to bridge the gap between theoretical Pre-Technical Studies concepts and practical digital application (Boinett et al., 2025). This creates a scenario where learners may be digitally aware but remain digitally incompetent in applying technology to solve authentic Pre-Technical Studies problems, thus necessitating a re-evaluation of how ICT is integrated into instruction in rural settings.

In Kenya, the problem has gained fresh urgency with the implementation of the Competency-Based Education framework. The Ministry of Education (2023) emphasizes that digital literacy is a core competency that must be mainstreamed across all learning areas, including Pre-Technical Studies. However, there is a visible disconnect between this CBE mandate and actual classroom reality. While projects such as the digital literacy programme initiated under the previous administration sought to provide every learner with a device, the current CBE validation process reveals that many rural schools in Soy Sub-County lack the stable power and teacher capacity to fulfil these requirements (Ministry of Education, 2019). A negative perception among some educators, who view ICT as an additional burden rather than a teaching aid, further widens the gap between the government's digital aspirations and learners' daily experiences.

Despite these initiatives and policies, a significant research gap exists concerning the localized, subject-specific application of ICT in rural Pre-Technical Studies classrooms. While general studies have examined ICT in Kenyan secondary schools, there is limited documented evidence on how specific Pre-Technical Studies pedagogical tools, such as basic spreadsheets for project modelling or digital circuit simulations, are being integrated in resource-constrained environments like Soy Sub-County (Nyamboki et al., 2026). Most existing literature focuses on urban success stories or broad national statistics, leaving a void in understanding the rural, subject-specific instructional gap. The originality of the present study lies in this narrower focus: rather than re-establishing that infrastructural barriers to ICT exist in African and Kenyan schools generally, which prior literature has already documented, the study isolates the barriers that are specific to Pre-Technical Studies as a subject and locates them within the four administrative zones of a single rural sub-county, thereby generating a grassroots evidence base that is fine-grained enough to inform subject-specific policy and content-development decisions. This study sought to bridge that gap by investigating the practical hurdles and opportunities for enhancing Pre-Technical Studies instruction through ICT, providing a roadmap for aligning classroom reality with national digital policy.

METHODOLOGY

Research Design and Study Area

This study adopted a mixed-methods, descriptive survey design to assess the challenges hindering ICT integration in Pre-Technical Studies instruction in rural public junior schools in Soy Sub-County, Uasin Gishu County, Kenya, a predominantly agricultural area with uneven ICT infrastructure across its four zones: Kiplombe, Soy, Karuna and Ziwa (Creswell & Creswell, 2023). A descriptive design was selected because the study's objective was to document and describe the nature and severity of the barriers to ICT integration as reported and observed, rather than to test a causal or experimental hypothesis linking ICT integration to teaching quality, learner participation or academic achievement.

Target Population and Sample Size

The target population comprised 78 schools, 78 Pre-Technical Studies teachers, 800 Grade 7 learners and 1 Quality Assurance Officer. The sample size for schools and learners was determined using Yamane's (1967) formula. Applying the formula to the 78 target schools yielded a sample of 66 schools, and applying it to the 800 target learners yielded a sample of 267 learners. Because every sampled school retained its single

designated Pre-Technical Studies teacher, the teacher sample was correspondingly set at 66. Table 1 summarizes the target population and sample size for each respondent category.

Table 1. Target Population and Sample Size Sampling Procedure

Category	Target Population	Sample Size
Schools	78	66
Grade 7 Learners	800	267
Pre-Technical Studies Teachers	78	66
Quality Assurance Officer	1	1

The study adopted a multi-stage sampling design combining three techniques. Stratified random sampling was applied to select the 66 schools proportionately from the four zones of Soy Sub-County (Kiplombe, Soy, Karuna and Ziwa), ensuring that no single zone dominated the results; this was necessary because ICT facilities and resources vary from zone to zone, and omitting any zone would have introduced geographic bias into the findings (Creswell & Creswell, 2023). Purposive sampling was used to select the Pre-Technical Studies teacher in each sampled school and the Quality Assurance Officer, since these respondents needed direct knowledge and experience of ICT integration in Pre-Technical Studies teaching. Simple random sampling was then used to select 267 Grade 7 learners from within the sampled schools, giving every learner in the target grade an equal chance of selection. This combination of stratified, purposive and simple random sampling was intended to secure geographic representation, target knowledgeable respondents and minimize grade-level bias.

Data Collection Instruments

Data were collected using teacher and learner questionnaires, a semi-structured interview guide for the Quality Assurance Officer, and an observation checklist verifying ICT resource availability across sampled schools. The teacher and learner questionnaires combined closed-ended, Likert-scaled items with open-ended items to capture qualitative detail, while the observation checklist was used by the researcher to independently verify the presence and condition of ICT infrastructure, thereby triangulating self-reported survey data.

Validity of the Research Instruments

Content validity was addressed by developing all instrument items directly from the study's specific objectives, after which the draft questionnaires, interview guide and observation checklist were submitted to two university supervisors and two subject-matter specialists in the Department of Curriculum and Instruction for expert review of item coverage. Face validity, particularly for the learner questionnaire, was established by asking two Pre-Technical Studies teachers who were not part of the sample to assess the instruments for clarity and appropriateness of language; their feedback led to the simplification of technical wording and the re-ordering of items. Construct validity was achieved by linking each subscale to its corresponding research objective, and poorly correlated items identified during the pilot study were revised or dropped before the main data collection exercise.

Reliability of the Research Instruments

A pilot study was conducted in two rural public junior schools in the neighbouring Moiben Sub-County, which shares comparable demographic and infrastructural characteristics with Soy Sub-County but has no administrative, staffing or supervisory overlap with it, so that no cross-contamination occurred between pilot and main-study respondents. Internal consistency reliability for the questionnaire subscales was assessed using Cronbach's Alpha computed in SPSS, with a coefficient of 0.7 or above taken as the acceptable threshold; the test-retest method, administered two weeks apart, was used to check the consistency of the qualitative interview items. As shown in Table 2, the subscale for the objective addressed in this article, the challenges hindering ICT integration, returned a Cronbach's Alpha of 0.821, indicating good reliability.

Data Collection Procedures

Following ethical clearance from the University of Eldoret, the National Commission for Science, Technology and Innovation (NACOSTI), and county administrative and education offices, the researcher personally administered the instruments under informed consent, guardian consent for learners, and assurances of anonymity and confidentiality.

Data Analysis Procedure

Quantitative data from the questionnaires were coded and entered into SPSS version 30, where descriptive statistics, frequencies, percentages, means and standard deviations, were computed to summarize responses; Pearson correlation was additionally computed to test the relationship between ICT professional development training and teachers' confidence in using ICT. Qualitative data from open-ended questionnaire items and the Quality Assurance Officer interview were analysed thematically following Braun and Clarke's (2006) six-step framework: the researcher read and re-read the transcribed and compiled data to gain familiarity, manually generated initial codes capturing recurring words and ideas, grouped these into candidate themes, reviewed and refined the themes against the coded extracts, and then named and defined the final themes.

Manual coding was used in preference to software-based coding given the relatively small qualitative data set, which allowed the researcher to remain close to the context-specific meanings expressed by respondents. The quantitative and qualitative strands were integrated at the interpretation stage, with qualitative excerpts used to explain and enrich the quantitative patterns, strengthening the convergent validity of the study's conclusions.

Ethical Considerations

The study observed the ethical principles of informed consent, voluntary participation, confidentiality and anonymity throughout. Approval was obtained from the University of Eldoret, NACOSTI, and the relevant county administrative and education offices before data collection began, and guardian consent was secured for all learner participants.

RESULTS AND DISCUSSION

This section presents results on the challenges hindering effective ICT integration in Pre-Technical Studies instruction in rural public junior schools in Soy Sub-County. Responses from both learners and teachers were collected and analyzed.

Response Rate

Of the 267 Grade 7 learners targeted, 251 completed the questionnaires, a response rate of 94.0%. Of the 66 Pre-Technical Studies teachers targeted, 60 responded, a response rate of 90.9%, while the Quality Assurance Officer participated fully in the interview (100.0%). The combined response rate across all three respondent categories was 93.4%, which exceeds the 70% threshold that Mugenda and Mugenda (2003) consider adequate for descriptive survey research, and supports the reliability and representativeness of the data collected. Table 2 presents the distribution of the response rate.

Table 2. Response Rate Learners' Perspectives on Challenges to ICT Integration

Category	Target Respondents	Actual Respondents	Data Collection Tool	Response Rate (%)
Grade 7 Learners	267	251	Questionnaire	94.0
Pre-Technical Studies Teachers	66	60	Questionnaire	90.9

Quality Assurance Officer	1	1	Interview	100.0
Total	334	312	—	93.4

Table 3. Learners' Perspectives on Challenges Hindering ICT Integration (N = 251)

Statement	SD	D	N	A	SA	Mean	SD
There are enough computers or tablets for all learners in my class.	132 (52.6%)	77 (30.7%)	18 (7.2%)	16 (6.4%)	8 (3.2%)	1.77	1.03
I know how to operate a computer or tablet properly.	48 (19.1%)	65 (25.9%)	42 (16.7%)	70 (27.9%)	26 (10.4%)	2.85	1.27
The internet connection in my school is too slow or not available.	11 (4.4%)	14 (5.6%)	17 (6.8%)	87 (34.7%)	122 (48.6%)	4.18	1.05
The computers or projectors in my school are in good condition and working properly.	109 (43.4%)	82 (32.7%)	22 (8.8%)	24 (9.6%)	14 (5.6%)	2.01	1.13

Source: Field Data (2026)

Results in Table 3 reveal that only 9.6% of learners agreed there were enough computers or tablets for all learners in their class ($M=1.77$, $SD=1.03$), while 44.8% did not know how to operate a computer or tablet properly ($M=2.85$, $SD=1.27$). This suggests device scarcity limits practice opportunities, which in turn constrains learners' digital skill development.

Learners strongly identified internet connectivity as too slow or unavailable as the most significant challenge ($M=4.18$, $SD=1.05$), with 83.3% agreeing or strongly agreeing, while 76.1% disagreed that computers or projectors in their school were in good condition ($M=2.01$, $SD=1.13$). This implies that even where devices exist, poor connectivity and disrepair jointly block meaningful use. The overall pattern confirms that infrastructure deficits, rather than attitudes or motivation, constitute the primary barrier to ICT use among learners.

Teachers' Perspectives on Challenges Hindering ICT Integration

Table 4 presents teachers' perspectives on the challenges hindering ICT integration in Pre-Technical Studies.

Table 4. Teachers' Perspectives on Challenges Hindering ICT Integration (N = 60)

Statement	SD	D	N	A	SA	Mean	SD
There are enough computers or tablets for all learners in my class.	44 (73.3%)	12 (20.0%)	2 (3.3%)	1 (1.7%)	1 (1.7%)	1.38	0.76
The internet connection in school is too slow or not available.	3 (5.0%)	2 (3.3%)	3 (5.0%)	18 (30.0%)	34 (56.7%)	4.30	1.07
Unreliable or no electricity supply during lessons hinders my use of ICT.	4 (6.7%)	5 (8.3%)	4 (6.7%)	22 (36.7%)	25 (41.7%)	3.98	1.17

Lack of relevant digital content or software for Pre-Technical Studies hinders my instruction.	3 (5.0%)	5 (8.3%)	6 (10.0%)	26 (43.3%)	20 (33.3%)	3.92	1.08
Negative attitude from school administration or lack of support hinders ICT use.	10 (16.7%)	15 (25.0%)	14 (23.3%)	13 (21.7%)	8 (13.3%)	2.90	1.25
Inadequate funding or budget for ICT resources hinders integration.	2 (3.3%)	3 (5.0%)	2 (3.3%)	23 (38.3%)	30 (50.0%)	4.27	1.00

Source: Field Data (2026)

Table 4 reveals that device scarcity was almost universal, with 93.3% of teachers disagreeing that there were enough computers or tablets for learners ($M=1.38$, $SD=0.76$), while internet connectivity was rated the greatest challenge of all ($M=4.30$, $SD=1.07$), with 86.7% agreement. This points to connectivity gaps compounding an already severe hardware deficit.

Unreliable or absent electricity supply during lessons was also rated a major barrier ($M=3.98$, $SD=1.17$), with 78.4% agreement, as was the lack of relevant digital content for Pre-Technical Studies ($M=3.92$, $SD=1.08$), with 76.6% agreement. This implies that even where power and devices exist, subject-specific content remains a separate, unmet need.

Negative school administration attitude received a more moderate mean ($M=2.90$, $SD=1.25$), whereas inadequate funding or budget for ICT resources was rated a dominant barrier ($M=4.27$, $SD=1.00$), with 88.3% agreement. This indicates that leadership attitude is less problematic than the financial constraints schools actually face. Together, these findings confirm that financial under-resourcing, power instability and connectivity gaps are the dominant systemic barriers to ICT integration in rural Pre-Technical Studies classrooms.

Open-ended responses from teachers reinforced the quantitative findings. One teacher described the situation bluntly, explaining that the school lacked computers, a projector and internet access, and that the unreliable electricity supply made ICT integration impossible under those conditions. Another teacher noted that even the use of mobile phones as a substitute ICT tool was constrained because the school administration had banned mobile phones for both teachers and learners during school hours due to misuse concerns, despite their potential as an improvised ICT tool.

Majority teachers pointed to the absence of Pre-Technical Studies-specific digital content as a distinct challenge. Unlike general subjects where online resources abound, one respondent observed that very little digital material was aligned with the Kenya Junior School Pre-Technical Studies curriculum, making it difficult to find appropriate videos, simulations or software for topics such as bookkeeping or entrepreneurship. The Quality Assurance Officer corroborated these findings, noting that the digital content gap for vocational and technical subjects at junior school level is a national issue rather than one unique to Soy Sub-County, and that it requires deliberate intervention from KICD and the Ministry of Education.

Direct evidence of the challenges was revealed through the observation checklist. A lack of internet connectivity, a lack of digital learning resources, a lack of ICT infrastructure and inadequate learner participation in ICT usage were among the observations made in all the selected schools during the study period, affirming the views held by both teachers and learners on the challenges facing ICT integration.

The challenges documented in this study aligns with the wider literature on ICT integration in Sub-Saharan African schools, which has already established that infrastructural and resourcing constraints are common barriers. Wamusi and Taban (2024) similarly found that the presence of ICT hardware in Ugandan schools

does not, on its own, guarantee sustained use once logistical and maintenance demands are considered; this is reflected in the present study, where inadequate funding ($M=4.27$) and unreliable electricity ($M=3.98$) ranked among the top barriers identified by teachers, indicating that the cost of maintaining ICT equipment and the reliability of power supply, rather than the absence of hardware alone, undermine sustained ICT use in resource-constrained schools such as those in the Karuna and Ziwa zones of Soy Sub-County, where power instability was reported as a persistent challenge.

The study literature also highlights that, in Sub-Saharan Africa, despite increasing mobile technology penetration, schools had not yet acquired fundamental ICT facilities such as computers, projectors and reliable internet connection (Hessels & Naudé, 2019). Adarkwah (2021) further documented that teacher digital literacy levels remained low across the region, with most teaching remaining teacher-centred and making little use of technology, which mirrors the chalk-and-talk reality found in Soy Sub-County. Additionally, Adarkwah (2021) and Oyelere et al. (2016) observed that ICT adoption across Africa remained uneven, with most countries lagging behind due to a lack of funding, unstable electricity and insufficient teacher training, a combination of challenges confirmed by this study's findings.

Rather than treating this convergence with prior literature as the study's central contribution, it is more accurately read as confirmation that Soy Sub-County's experience is not exceptional. The distinctive contribution of the present study lies instead in the finding that the absence of Pre-Technical Studies-specific digital content identified by teachers aligns with, and sharpens, Ndungwa and Nzuki (2020), who noted that while ICT tools such as spreadsheets and online simulations could play an essential role in teaching financial literacy and design processes in Pre-Technical Studies, such resources were rarely available in rural Kenyan schools. By isolating this subject-specific content gap from the general infrastructural barriers already well documented elsewhere, and by showing that it persists even where school administration attitudes are comparatively supportive, this study demonstrates that closing the general digital divide would not, by itself, resolve the instructional gap that is unique to Pre-Technical Studies.

Viewed through a Constructivist lens, the challenges identified take on added significance because the theory requires an enabling environment for learners to construct knowledge actively through exploration and hands-on engagement. Persistent infrastructural and financial challenges directly undermine this requirement: without reliable internet, electricity and devices, exploratory, hands-on learning becomes impossible, confirming the theory-practice divide that rural schools in Soy Sub-County face. Beyond this confirmatory application, the findings suggest a refinement to how constructivist theory is applied to subject-specific, vocationally-oriented learning areas such as Pre-Technical Studies: an enabling environment for constructivist learning in this subject requires not only generic infrastructure (devices, power and connectivity) but also subject-specific digital scaffolding, such as offline simulations and discipline-relevant content, without which learners cannot construct the applied, practical knowledge that Pre-Technical Studies is meant to develop even when generic ICT provision is adequate. This distinction between infrastructural readiness and content readiness is the study's principal theoretical contribution, and it suggests that future applications of constructivist theory to technical and vocational subjects should treat subject-specific content availability as a distinct enabling condition rather than subsuming it within general ICT access.

CONCLUSION

Summary of Findings

The study found several challenges that impeded the integration of ICT into teaching and learning in Pre-Technical Studies. These included inadequate ICT infrastructure, unreliable electricity supply, poor internet connectivity, inadequate funding, insufficient technical support, inadequate teachers' professional development, and a distinct lack of Pre-Technical Studies-specific digital content. These factors affected the integration of ICT in teaching and learning processes.

Conclusion

The study concludes that ineffective ICT integration in Pre-Technical Studies is primarily a resourcing and content-development failure rather than a failure of implementation fidelity at the school level, since

administrative attitudes were comparatively supportive. The distinct absence of subject-specific digital content further demonstrates that generic ICT provision alone cannot resolve the instructional gap unique to Pre-Technical Studies.

RECOMMENDATIONS

1. Kenya Institute of Curriculum Development should develop and disseminate Pre-Technical Studies-specific digital content, including offline-compatible entrepreneurship and accounting simulations, to close the subject-specific content gap that generic ICT infrastructure alone cannot address; uptake could be evaluated through pre- and post-distribution audits of content usage and teacher-reported confidence in comparable sampled schools.
2. County and national education stakeholders should prioritize funding for device provision, electricity stabilization (including solar back-up where grid power is unreliable) and internet connectivity in rural schools, with progress tracked through periodic infrastructure audits against the observation checklist used in this study.
3. Teachers Service Commission should institutionalize continuous, hands-on ICT professional development for Pre-Technical Studies teachers in rural sub-counties, moving beyond one-time workshops toward sustained coaching and structured mentoring; the effectiveness of this training could be evaluated through pre- and post-training assessments of teacher confidence and observed ICT use in lessons.

Suggestions for Further Research

1. Undertake a comparative study of ICT integration in Pre-Technical Studies between urban and rural junior schools across Uasin Gishu County, to test the generalisability of the present findings beyond Soy Sub-County.
2. Conduct a longitudinal or correlational study tracking the effect of targeted ICT infrastructure investment and subject-specific digital content on teaching quality, learner participation and academic achievement, to address the causal questions that the present descriptive design could not answer.

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