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Digital Learning and Equity: Post-Pandemic Policy Implementation for the Education System in the Case of Konso Zone, South Ethiopia

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Abstract: *The integration of ICT into education is a key strategy for improving educational quality and equity. This study assessed the implementation of post-pandemic digital learning policies and their implications for educational equity in secondary schools of the Konso Zone, South Ethiopia. A convergent mixed-methods design was employed, involving 341 students, 114 teachers, focus group discussions, and key informant interviews. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were thematically analyzed. The findings revealed significant urban-rural disparities in digital learning access, with rural schools facing limited ICT infrastructure, internet connectivity, digital devices, and locally relevant learning resources. Although smartphones were widely available, access to computers, tablets, and educational software remained limited. Teachers and students demonstrated basic ICT skills but had gaps in advanced digital competencies. The study identified infrastructure limitations, insufficient training, weak policy implementation, and socio-cultural barriers as major challenges to digital inclusion. It concludes that achieving equitable digital learning in the Konso Zone requires targeted investment in ICT infrastructure, teacher capacity development, localized digital content, and effective implementation of digital education policies.*

Keywords: Digital learning; ICT integration; Educational equity; ICT competency; Rural-urban disparities; Konso Zone.

1. INTRODUCTION

The COVID-19 pandemic accelerated the adoption of digital technologies in education while exposing significant inequalities in access, digital skills, and the availability of inclusive learning resources (UNESCO, 2021; Hargittai, 2002; van Dijk, 2020). These disparities are particularly evident in rural and marginalized communities, where limited infrastructure and socio-economic constraints continue to restrict equitable participation in digital learning (World Bank, 2022).

In Ethiopia, national initiatives such as the Education Sector Development Plan VI (ESDP VI) and *Digital Ethiopia 2025* promote the integration of digital technologies into education (FDRE, 2020). However, implementation remains uneven because of inadequate infrastructure, limited funding, insufficient teacher support, and weak institutional capacity, creating a gap between national policy goals and local realities (Tadesse, 2020; Alemu, 2021).

The Konso Zone illustrates these challenges. Poor internet connectivity, limited electrification, low teacher digital competence, inadequate localized digital learning resources, and linguistic diversity hinder effective technology integration. As a result, digital education initiatives often fail to meet the needs of learners in this rural context, reinforcing rather than reducing educational inequalities (CSA, 2021; Helsper, 2012).

This study examines digital equity in the Konso Zone by assessing equitable access to digital resources, the inclusiveness of digital learning materials, and teachers' capacity to integrate technology into classroom practice. It also investigates the policy and implementation gaps that limit digital education, providing evidence to inform more inclusive and context-responsive digital education policies in Ethiopia (UNESCO, 2017).

1.1. Research Questions

1. To what extent are Konso zone schools equipped with the necessary ICT infrastructure (electricity, internet connectivity and digital devices) in relation to the Digital Ethiopia 2025 targets?
2. To what extent do ICT pedagogical competencies and digital literacy levels differ between teachers in urban and rural schools of Konso zone?
3. To what extent is the national provided digital learning content linguistically and culturally inclusive of Konso learners?
4. What gaps exist between national digital education policies and their implementation in Konso Zone schools?

1.2. Objectives of the Study

1.2.1. General Objective

The general objective of this study is to critically **assess** the implementation of post-pandemic digital learning policies in the Konso Zone and examine their impact on educational equity across infrastructural, pedagogical, and socio-cultural dimensions.

1.2.2. Specific Objectives

1) Assess the infrastructural readiness and physical access gaps (the first-level digital divide) in Konso Zone schools in relation to the targets of the Digital Ethiopia 2025 strategy.
2) Assess disparities in ICT pedagogical competencies and digital literacy levels (the second-level digital divide) among teachers across urban and rural schools in the Konso Zone.
3) Evaluate the socio-cultural and linguistic inclusivity of national digital learning content and its alignment with the indigenous language needs of Konso learners.
4) Analyze the gap between national digital learning policies and their implementation by examining resource allocation mechanisms and the "last-mile" implementation challenges within the socio-economic context of the Konso Zone.

2. RESEARCH METHODOLOGY

2.1. Research Design

The study employed a convergent mixed methods research design. In this design, quantitative and qualitative data were collected during the same phase of the study, analyzed separately, and then integrated during interpretation to provide a comprehensive understanding of the research problem (Creswell J. &., 2018). The quantitative component was use to assess ICT infrastructure readiness, ICT pedagogical competence, digital literacy, linguistic inclusiveness, and policy implementation challenges among teachers and students. The qualitative component explored stakeholders' experiences and perceptions regarding infrastructure limitations, implementation barriers, and contextual challenges affecting the realization of Digital Ethiopia 2025 in Konso zone schools.

2.2. Research Approach

This study employed a mixed-methods research approach, integrating quantitative and qualitative methods to provide a comprehensive assessment of post-pandemic digital learning policy implementation. Quantitative data were collected through structured questionnaires administered to teachers and students and analyzed using descriptive and inferential statistics, while qualitative data were gathered through focus group discussions with school administrators and education office officials to explore implementation experiences and challenges. The integration of both methods enhanced the depth, validity, and credibility of the study findings.

2.3. Types and Sources of Data

This study used both quantitative and qualitative data to assess the implementation of Digital Ethiopia 2025 in secondary and preparatory schools of Konso Zone. Quantitative data were collected from teachers and students through structured questionnaires and analyzed using descriptive and inferential statistics, focusing on ICT readiness, digital competencies, inclusiveness, and implementation challenges. Qualitative data were obtained through FGDs with school administrators and education officials to explore infrastructure barriers, training needs, language issues, and policy implementation gaps.

2.4. Sources of Data

Primary data were obtained directly from the study participants. Teachers and students provided quantitative data through questionnaires, while school principals, vice principals, ICT coordinators, and education office officials provided qualitative information through FGDs. These sources supplied first-hand information regarding the current status of ICT infrastructure, digital literacy, pedagogical competence, digital content inclusiveness, and implementation challenges. Secondary data were obtained from relevant documents and published materials. These included the Digital Ethiopia 2025 strategy document, Minster of Education reports, educational policies, schools' records, research articles, books, reports related to ICT integration, digital literacy, educational equity and digital transformation in Ethiopia. These secondary sources were used to support the analysis and interpretation of the study findings.

2.5. Population and Sampling Frame

The target population included secondary students (Grades 9–12), teachers, school leaders, and education officials. Secondary schools were selected due to their focus under Digital Ethiopia 2025 initiatives. Sampling frames were obtained from official student and teacher lists, while principals, ICT coordinators, and education officials were selected as key informants. The study covered four schools with a total population of 160 teachers and 3,073 students.

2.5.1. Sampling Unit

The sample units for this study were: individual teachers, individual students, school administrators (principals, vice principals and ICT coordinators) and education office officials.

2.5.2. Sample Size Determination

The quantitative sample size for students and teachers was calculated using Cochran's Formula (1977) for finite populations:

$$n=(Z^2.p.q/e^2)/(1+(Z^2.p.q/N))\text{----------(1)}$$

Where:

- n= sample size

- Z = Z-score corresponding to confidence level
- p = estimated proportion
- q=1−p
- e = margin of error
- N= total number of teachers

Using Cochran's finite population correction formula with a 95% confidence level and a 5% margin of error, the required sample size for the 160 teachers was calculated as 113 respondents.

The sample size was proportionally distributed to each school using:

*ni=Ni/N*n*----------(1)

Where: ni= sample size for each school, Ni = population size of each school, N=160 = total number of teachers, and n=113 = total sample size

Students sample size : Where: ni= sample size for each school , Ni = population size of each school, N=3073 = total number of students, and n=341 = total sample size

For the qualitative strand, purposive sampling was used to select 15–20 key informants (principals and experts) until thematic saturation were achieved.

2.6. Validity, Reliability, and Ethical Considerations

The validity of the research instruments was ensured through expert review and a pilot test conducted before the main study. Reliability was assessed using Cronbach's Alpha in SPSS, with a value of **0.70 or above** considered acceptable. For the qualitative data, trustworthiness was enhanced through member checking and an audit trail. Ethical principles were maintained by obtaining the necessary permissions, securing informed consent, ensuring voluntary participation, protecting participants' confidentiality and anonymity, and informing them of their right to withdraw from the study at any time.

2.7. Methods of Data Analysis

Quantitative data were coded, cleaned, and analyzed using SPSS version 25 through descriptive and inferential statistics, while qualitative data from interviews and FGDs were analyzed thematically by identifying and interpreting key themes related to ICT access, digital learning equity, language inclusiveness, policy implementation, and technology use barriers.

3. RESULT AND DISCISSION

3.1. ICT Infrastructure Readiness and Physical Access Gap

This section presents and discusses findings related to the availability and accessibility of ICT infrastructure in the study schools. Specifically, it assesses the status of electric supply, internet connectivity, computer availability, computer laboratory facilities, and technical support services. The findings are further compared with aspirations and targets outlined in the Digital Ethiopia 2025 strategy to identify existing infrastructure gaps that my hinder effective digital learning implementation.

3.2. Socio-demographic Characteristics of Respondents

Table 1: Socio-demographic Characteristics of Teacher Respondents from Konso Zone Secondary School

Variable	Category	Frequency	Percent
Age (Years)	<35	58	50.9
	≥35	56	49.1
Gender	Female	11	9.6
	Male	103	90.4
Educational level	Diploma	5	4.4
	Bachelor's degree	108	94.7
	Master's degree	1	0.9
Teachers experience (Years)	<10	68	59.6
	10-20	40	35.1
	>20	6	5.3
School Location	Rural	22	19.3
	Town center	92	80.7

Table (3) presents sociodemographic characteristics of teacher respondents. A total of 114 teachers were participated in this study among them a majority of the teachers 103 (90.4%) were male that may indicate gender imbalance that may influence participation in digital learning activities. Most teachers 108 (94.7%) held bachelor's degree and had an average of 10.87 years of teaching experience, suggesting that respondents were actually qualified and experienced. The age of the teachers was ranged from 28 to 54 years with a mean of 35.70 and S.D 5.84 years. Most teachers (80.7%) were from town center schools, reflecting the greater concentration of education al services in urban areas. The distribution is important because school location may affect access to ICT infrastructure and digital learning opportunity. The socio demographic characteristics is important because they may

influence ICT competency, technology adoption and digital literacy levels among teachers (Tondeur. J., 2017).

Table 2: Availability of ICT Resources of Teachers in Konso Zone Secondary School

ICT Digital Resource Variables	Category		Frequency	Percent
Type of ICT devices used	Desktop/laptop	Yes	79	69.3
		No	35	30.7
	Projector	Yes	0	0
		No	114	100
	Tablet	Yes	12	10.5
		No	102	89.5
	Smartphone	Yes	107	93.9
		No	7	6.1
	Educational software/apps	Yes	40	35.1
		No	74	64.9
Internet Access	Yes		63	55.3
	No		51	44.7

The study found that smartphones were the most widely available ICT devices (93.9%), followed by computers (69.3%), while tablets were limited (10.5%) and projectors were unavailable. Although smartphone access indicates potential for mobile learning, limited educational applications and instructional technologies reduce their educational value. Qualitative findings revealed shortages of functional computers and inadequate ICT facilities in many schools, limiting effective technology integration. These findings align with previous studies showing that while digital device ownership is increasing, access to educational technologies and resources remains a major challenge in Ethiopian and sub-Saharan African schools.

3.3. Urban Rural Difference in ICT Infrastructure and ICT Resources

Table 3: Urban rural difference in ICT Infrastructure among Secondary and preparatory schools in Konso zone

Infrastructure and Resource Variables		Location		Total N (%)	X2	p-value
		Rural village N (%)	Town center N (%)			
Computer Laboratory availability	Yes	0 (0)	92 (100)	92 (100)	114	<0.001*
	No	22 (100)	0 (0)	22 (100)		
Internet access	Yes	0 (0)	63(100)	63(100)	33.67	<0.001*
	No	22(43)	29(56.9)	51(100)		
Reliability of electric supply	Not available	7 (100)	0(0)	7(100)	37.85	<0.001*
	Rare	3(4.8)	60(95.2)	63(100)		
	Sometimes	0(0)	32(100)	32(100)		
	Always	12(100)	0(0)	12(100)		
Number of functional computers	<20	0(0)	76 (100)	76 (100)	4.4	0.039*
	≥20	0(0)	16(100)	16(100)		

The findings revealed significant urban-rural disparities in ICT infrastructure. Computer laboratory availability (χ^2=144, p<0.001), internet access (χ^2=33.67, p<0.001), electricity reliability (χ^2=37.85, p<0.001), and functional computers (χ^2=4.4, p=0.039) were strongly associated with school location. Town center schools had better ICT facilities, while rural schools lacked computer laboratories, internet connectivity, stable electricity, and adequate computers. These disparities limit rural students' opportunities for digital learning and reflect the persistent digital divide identified in previous studies.

Table 4: Urban rural difference in Teachers' ICT Resources among Secondary and preparatory schools in Konso zone

ICT	Category	Location	Total	X^2	P-value

resource variables			**Rural village N (%)**	**Town center N (%)**	**N (%)**		
Internet Access	Yes		0(0)	63(100)	63(100)	33.67	<0.001*
	No		22 (43.1)	29(56.9)	51(100)		
ICT devices	Desktop/Laptop	Yes	0(0)	79(100)	79(100)	61.53	<0.001*
		No	22(62.9)	13(37.1)	35(100)		
	Tablet	Yes	0(0)	12(100)	12(100)	3.2	0.119
		No	22 (21.6)	80(78.4)	102(100)		
	Smartphone	Yes	22(20.6)	85(79.4)	107(100)	1.78	0.343
		No	0(0)	7(100)	7(100)		
	Educational Software/application	Yes	1(2.5)	39(97.5)	40(100)	11.16	0.001*
		No	21(28.4)	53(71.6)	74(100)		

The chi-square analysis revealed significant disparities in ICT infrastructure between urban and rural schools in the Konso Zone. Desktop/laptop availability ($\chi^2 = 61.53$, $p < 0.001$) and educational software ($\chi^2 = 11.16$, $p = 0.001$) were significantly higher in urban schools, while tablet and smartphone availability showed no significant differences. The widespread availability of smartphones suggests their potential for supporting digital learning. Overall, the findings indicate a substantial first-level digital divide, with rural schools facing limited access to ICT infrastructure and digital resources, highlighting the need for targeted investments to achieve the Digital Ethiopia 2025 goals.

Table 5:Table of Students Access to ICT Digital Resources in Konso Zone Schools

ICT Digital Resource Variables	**Category**		**Frequency**	**Percent**
Type of ICT devices used	Desktop/laptop	Yes	23	6.7
		No	318	93.3
	Tablet	Yes	0	0
		No	341	100.0
	Smartphone	Yes	244	71.6
		No	97	28.4
	Educational software/apps	Yes	182	53.4
		No	159	46.6
Internet Access	Yes		159	46.6
	No		182	53.4

The findings indicate that students' access to ICT resources remains inadequate for effective digital learning. Only 6.7% of students had access to desktops/laptops, and none had access to tablets, reflecting limited availability of devices for academic purposes. Although 71.6% reported access to smartphones, qualitative findings showed that these were mainly used for communication and social media rather than learning. Internet access was available to only 46.6% of students, while 53.4% had access to educational applications. These findings are consistent with UNESCO (2021), the World Bank, and ITU (2022), which report persistent ICT infrastructure and connectivity challenges in developing countries, highlighting a substantial first-level digital divide in Konso Zone schools.

Table 6:Urban Rural disparity in students access to ICT Digital Resources in Konso Zone Schools

ICT resource variables	**Category**		**Location**		**Total N (%)**	**X^2**	**P-value**
			Rural village N (%)	**Town center N (%)**			
Internet Access	Yes		27(17)	132(83)	159(100)	44.55	<0.001*
	No		94(51.6)	88(48.4)	182(100)		
ICT devices	Desktop/Laptop	Yes	0(0)	23(100)	23(100)	13.56	<0.001*
		No	121(38.1)	197(61.9)	318(100)		
	Smartphone	Yes	79(32.4)	165(67.6)	244(100)	3.617	0.057

		No	42(43.3)	55(56.7)	97(100)		
	Educational Software/application	Yes	76(41.8)	106(58.2)	182(100)	6.712	0.010*
		No	45(28.3)	114(71.7)	159(100)		

The findings reveal significant urban-rural disparities in students' access to ICT resources. Students in town center schools had significantly higher access to internet services (χ^2=44.5, p<0.001), desktop/laptop computers (χ^2=13.5, p<0.001), and educational software/applications (χ^2=6.712, p=0.01). However, smartphone access showed no significant difference, indicating wider availability of mobile devices across locations. These results suggest that urban students benefit from greater digital learning opportunities, while rural students face continued barriers due to limited infrastructure and connectivity. The findings align with UNESCO (2023) and the Ethiopian Ministry of Education (2023), which highlight persistent urban-rural inequalities in digital resource access.

3.4. ICT Pedagogical Competency and Digital Literacy Disparities

3.4.1. Teachers' ICT pedagogical competency level

Table 7: ICT Pedagogical Competency of Teachers in Konso Zone Schools

Variable	Category		Frequency	Percent
Purpose of using ICT in teaching	Lesson preparation	Yes	86	75.4
		No	28	24.6
	Delivering lessons	Yes	101	88.6
		No	13	11.4
	Student assignments	Yes	45	39.5
		No	69	60.5
	Assessments/quizzes	Yes	35	30.7
		No	79	69.3
	Communication with students/parents	Yes	38	33.3
		No	76	66.7

Teachers primarily use ICT for lesson delivery (88.6%) and lesson preparation (75.4%), suggesting that ICT has become an important tool for supporting classroom instructions. However, the use of ICT for student assignments (39.5%), communication (33.3%), and assessment and quizzes (30.7%) were relatively low. This implies that while teachers are integrating ICT into teaching activities, its interactive learning, assessment and communication remains limited. These findings are consistent with previous studies. UNESCO (2023), reported that teachers in many developing countries use ICT mainly for lesson planning and content delivery, while advanced applications such as digital assessment and collaborative learning remains less common. In Ethiopia a study by Tadesse and Muluye (2020) also reported that limited infrastructure, training, and technical support hinder the pedagogical use of ICT beyond basic instructional purposes.

Table 8: Teachers ICT Competency by Competency area in Konso Zone Schools

ICT Skills	Level of ICT usage				
	Poor N (%)	Fair N (%)	Good N (%)	Excellent N (%)	Mean ± SD
Operate a computer	9 (7.9)	16 (14)	53 (46.5)	36 (31.6)	2.02 ± 0.882
Use MS Word	9 (7.9)	4 (3.5)	39 (34.2)	62 (54.4)	2.35 ± 0.882
Use MS Excel	48 (42.1)	25 (21.9)	35 (30.7)	6 (5.3)	0.99 ± 0.973
Use MS PowerPoint	13 (11.4)	33 (28.9)	56 (49.1)	12 (10.5)	1.59 ± 0.829
Search for educational resources online	32 (28.1)	14 (12.3)	29 (25.4)	39 (34.2)	1.66 ± 1.218
Use educational software/apps	9 (7.9)	27 (23.7)	41 (36.0)	37 (32.5)	1.93 ± 0.938

The findings show that teachers have relatively strong basic ICT skills, particularly in MS Word (Mean=2.35, SD=0.88) and computer operation (Mean=2.02, SD=0.88). More than half of the teachers reported excellent MS Word skills, and most rated their computer operation skills as good or excellent, indicating confidence in using ICT for routine tasks. However, skills in MS Excel (Mean=0.99, SD=0.97), MS PowerPoint (Mean=1.59, SD=0.83), online educational resources (Mean=1.66, SD=1.22), and educational applications

(Mean=1.93, SD=0.94) were relatively limited. These findings suggest that teachers have basic digital competencies but require further training in advanced and pedagogically focused ICT applications. The results are consistent with previous studies showing stronger teacher skills in basic computer applications than in instructional technologies, largely due to differences in ICT infrastructure, professional development, and institutional support.

Table 9: Teachers Attitude Toward the Use of ICT in Education in Konso Zone Schools

Table 14 shows that teachers generally have a positive attitude toward ICT use in education. Teachers strongly agreed that ICT makes lessons more interactive (Mean=3.96, SD=0.64), indicating its perceived value in enhancing student engagement. This finding supports previous studies that link positive teacher attitudes with effective ICT integration. However, lower agreement regarding ICT's role in improving students' critical thinking skills (Mean=2.91, SD=1.58) suggests the need for greater emphasis on pedagogical approaches to maximize the educational benefits of technology.

Teachers Attitude Toward ICT	Attitude Scale					Mean ± SD
	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)	
ICT improve teaching?	14 (12.3)	19 (16.7)	11 (9.6)	53 (46.5)	17 (14.9)	3.35 ± 1.269
ICT enhance student engagement?	14 (12.3)	21(18.4)	10 (8.8)	48 (42.1)	21 (18.4)	3.36 ± 1.311
ICT enhance student engagement?	14 (12.3)	21(18.4)	10 (8.8)	48 (42.1)	21 (18.4)	3.26 ± 1.415
ICT saves time in lesson preparation?	24 (21.1)	14 (12.3)	0 (0))	60 (52.6)	16 (14.0)	3.39 ± 1.393
ICT makes lesson more inactivity	12 (10.5)	28 (24.6)	9 (7.9)	33 (28.9)	32 (28.1)	3.96 ± 0.643
ICT help student to develop critical thinking?	32 (28.1)	15 (13.2)	16 (14.0)	33 (28.9)	18(15.8)	2.91 ± 1.479

Table 10: Supports Needed by Teachers in Kons Zone Schools

Support needed	Category	Frequency	Percent
More functional computers	Yes	85	74.6
	No	29	25.4
Reliable electricity supply	Yes	110	96.5
	No	4	3.5
Internet access in school	Yes	96	84.2
	No	18	15.8
Continuous ICT training for teachers	Yes	103	90.4
	No	11	9.6
Technical support staff in school	Yes	93	81.6
	No	21	18.4
Smaller class sizes for ICT lessons	Yes	62	54.4
	No	52	45.6
Locally relevant digital content	Yes	65	57.0
	No	49	43.0
Flexible lab schedules for all students	Yes	61	53.5
	No	53	46.5

Table (16) shows the most frequently needed support was electric supply (96.5%), continuous ICT training for teachers (90.4%), internet access in the school (84.2%), technical support staff in in the school (81.6%) followed by more functional computers (74.6%). This indicates that teachers recognize ICT infrastructure, ICT resources and professional development as essential for successful ICT implementation. The finding is consistent with studies showing that teachers training and technical support is critical for ICT integration into education (Pelgrum, 2001). Qualitative data further supported these results, as participants frequently mentioned the need for stable electricity, improved connectivity, additional functional computers, regular ICT training and technical support.

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3.4.2. Students ICT competency

Table 11: ICT Pedagogical Competency of Students in Konso Zone Schools

Variable	Category	Frequency	Percent
Assignment /homework	Yes	247	72.4
	No	94	27.6
Watching educational videos	Yes	69	20.2
	No	272	79.8
Communication	Yes	115	33.7
	No	226	66.3
Online classes	Yes	174	51.0
	No	167	49.0

Table (17) indicates that students mainly used ICT for assignments or homework activities (72.4%), followed by online classes (51%). However, ICT use for communication (33.7%) and watching educational videos (20.2%) was relatively low. This shows students use ICT for school works than for interactive learning and communications. These findings are in line with studies showing ICT enhances students access to learning resources and supports independent learning (Hailegebriel, 2022) (Wasif, 2012). Conversely the low utilization of educational videos and communication tools suggests limited digital learning opportunities. This finding aligns with studies that indicates ICT integration in developing countries schools is often constrained by limited infrastructure and ICT resources (Gizaw, 2020).

Table 12: Students' ICT Competency by Competency area in Konso Zone Schools

Students self-reported ICT usage skills were measured using a four-point Likert scale coded as 0 (poor), 1 (fair), 2 (good) and 3 (excellent). The mean scores, standard deviation and percentage distribution for each competence are presented in table 15. This study showed that students performed relatively well in basic computer operation (Mean=3.094, SD=1.0560) and word processing (Mean=3.053, SD=1.131). However, nearly half of the students (49.9%) demonstrated poor email skill, and competency in educational software was limited (Mean=1.728, SD=0.728). This finding is consistent with studies conducted in developing countries context, which reported that students tend to learn basic digital skill such as operating computer and word processing. Hennessy et al. (2010) observed that students in resource constrained educational settings often develop foundational computer literacy while exhibiting limited proficiency in educational software and online communication tools. Similarly, Tadesse (2020) found that secondary school students demonstrated relatively higher competency in basic ICT application but lower competency in email use, online communication, and educational software utilization.

Table 13: Students Attitude Towards ICT Use for Learning in Konso Zone Schools

ICT Skills	Level of ICT usage				
	Poor N (%)	Fair N (%)	Good N (%)	Excellent N (%)	Mean ± SD
Operate a computer	60(17.6)	29(8.5)	85(24.9)	167(49.0)	3.094 ± 1.056
Use MS Word	47(13.8)	34(10.0)	100(29.3)	160(46.9)	3.053 ± 1.131
Send or receive Email	170(49.9)	87(25.5)	84(24.6)	0(0)	2.178 ± 0.901
Search for educational resources online	106(31.1)	75(22.0)	153(44.9)	7(2.1)	2.106 ± 0.911
Use educational software/apps	125(36.7)	55(16.1)	161(47.2)	0(0)	1.748 ± 0.827

Students Attitude Toward ICT	Attitude Scale					Mean ± SD
	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)	
ICT help me to learn more effectively?	0(0)	2(0.6)	35(10.3)	147(43.1)	157(46.0)	4.35±0.684
I enjoy using ICT tools for education purpose?	85(24.9)	68(19.9)	180(52.8)	8(2.3)	0(0)	2.33±0.876
I feel confident when using ICT for learning Purpose	32(9.4)	210(61.6)	99(29.0)	0(0)	0(0)	2.2±0.589
ICT increases my interest and motivation to learn	0(0)	2(0.6)	94(27.6)	180(52.8)	65(19.1)	3.90±0.694
I prefer lessons that incorporate ICT tool	0(0)	149(43.7)	60(17.6)	45(13.2)	87(25.5)	3.21±1.246
I am willing to use ICT more frequently for my studies in the future	190(55.7)	76(22.3)	75(22.0)	0(0)	0(0)	1.66±0.816

The findings from assessment of the students' attitude toward ICT use for learning showed mixed patterns. Most students agreed that ICT help the more effectively (89.1%, Mean=4.35, Sd=0.68) and increase their motivation to learn (71.9%, Mean=3.90, SD=0.69). these findings suggest that students recognize the educational value of ICT in enhancing and motivation. Similar study by Howard et al. (2022) reported that students generally perceive ICT as beneficial for learning and academic performance. However, students expressed less favorable attitude toward regarding ICT usage enjoyment (Mean=2.33, SD=0.88), confidence in using ICT for learning (Mean=2.43, SD=0.59), and willing to use ICT more frequently in the future (Mean=1.66, SD=0.82). The findings may reflect limited access to ICT infrastructure, ICT resource or insufficient opportunity for technology use. Similar challenges were identified by Scherer (2021), who found students attitude toward ICT are strongly influenced by their competence and access to ICT resources.

3.4.3. Urban rural disparities in ICT competence

3.4.3.1. Urban rural disparities in teachers ICT competence

Table 14: Urban rural disparities in teachers ICT competence in Konso Zone Schools

Group Statistics						
Variable	**Location**	**N**	**Mean Rank**	**U**	**Z**	**P-value**
ICT integration level	Rural village	22	28.89	382.50	-4.683	<0.001
	Town center	92	64.34			
ICT competency level	Rural village	22	20.68	202.00	-5.861	<0.001
	Town center	92	66.30			

The distribution of ICT integration level and ICT usage level of the teachers was tested by Kolmogorov-Smirnov and Shapiro-Wilk and the variables are not normally distributed (P<0.05); hence a Man-Whitney U was conducted to compare ICT integration level and ICT usage level between urban and rural teachers. The finding

indicated statistically significant ICT integration level (U=382.50, Z= -4.683, P<0.001) and ICT usage level (U=202, Z=-5.861, P<0.001). This suggests that teachers in urban schools integrate and use ICT more frequently than the rural school teachers. This finding agrees with studies that indicate urban-rural inequalities in ICT access and utilization due to infrastructural, technological and ICT resource challenges that are faced by rural schools (UNESCO, 2023) (Scherer, 2019) (Tondeur. J., 2017).

Table 15: Barriers to ICT Integration in Learning Faced by Students in Kons Zone Schools

Barriers to ICT	Category	Frequency	Percent
Too few computers for all students	Yes	280	82.1
	No	61	17.9
Computers not working / poorly maintained	Yes	264	77.4
	No	77	22.6
No internet connection	Yes	290	85.0
	No	45	13.2
Unreliable electricity at school	Yes	300	88.0
	No	41	12.0
Unreliable electricity at home	Yes	317	93.0
	No	24	7.0
Lack of ICT skills	Yes	212	62.2
	No	129	37.8
Teachers do not use ICT in lessons	Yes	211	61.9
	No	130	38.1
Cultural/family restrictions	Yes	235	68.9
	No	106	31.1
Fear of damaging equipment	Yes	203	59.5
	No	138	40.5
Lack of time due to household chores	Yes	255	74.8
	No	86	25.2

The finding showed students face several barriers toward ICT integration. The most frequent barrier was unreliable electricity at home and at school 93% and 88 % respectively, followed by no internet connection (85%), too few computers for all students (82.1%), Computers not working / poorly maintained (77.4%), lack of time due to household chores (74.8%) and Cultural/family restrictions (68.9 %). How ever, fear of damaging equipment (59.5 %) was reported less frequently. The result was consistent with previous studies which identified inadequate electricity, limited internet connectivity, shortage of ICT resources, and sociodemographic constraints as major barriers to ICT integrations among students. (Tondeur. J., 2017) (Pelgrum, 2001). Qualitative data further confirmed frequent power interruptions, limited computer access, and family responsibilities reduce students' opportunities to use ICT for learning.

3.4.4. Factors associated with teachers' ICT competences

Table 16: Bivariate logistic Regression of Factors that Affect Teachers' ICT competence in Konso Zone Schools

Variable	Category	ICT competency		COR (95% CI)	P-value
		Poor (<10)	Good (≥10)		
Age	<35	26	30	2.27 (1.04-4.96)	0.039
	≥35	16	42	1	
Sex	Female	2	9	2.86(0.59-13.9)	0.194
	Male	40	63	1	
Education level	Diploma	3	2	0.371(0.06-2.32)	0.289
	Degree and above	39	70	1	
Teachers experience	<10	3	3	2.238(.42-12.02)	0.348
	10-20	18	22	1.222(0.22-6.81)	0.819
	>20	21	47	1	

School name	KSP	18	58	25.778(3.02-220.21)	0.003
	ArSP	12	1	0.667(0.04-12.27)	0.785
	GSP	4	12	24.00(2.25-255.94)	0.008
	AySP	8	1	1	
School location	Rural	20	2	0.031(0.007-0.145)	<0.001
	Town	22	70	1	
Internet access	No	27	24	0.278(0.125-0.618)	0.02
	Yes	15	48	1	
Computer laboratory availability	No	20	2	0.031(0.007-0.145)	<0.001
	Yes	22	70	1	
ICT resource index	<0.5	38	46	0.186(0.06-0.58)	0.004
	≥0.5	4	26	1	

Bivariate binary logistic regression was performed to determine crude odds ratio and p-value of the association between the independent factors and the dependent factor. Those independent factors with p-value less than 0.25 were selected for a multivariate binary logistic regression.

Table 17: Multivariate logistic Regression of Factors that Affect Teachers' ICT competence in Konso Zone Schools

Variable	Category	ICT competency		AOR (95% CI)	P-value
		Poor (<10)	Good (≥10)		
Age	<35	26	30	2.41(0.86-6.74)	0.094
	≥35	16	42	1	
Sex	Female	2	9	2.961(0.449-19.54)	0.260
	Male	40	63	1	
School name	KSP	18	58	22.512(1.85-273.88)	0.015*
	ArSP	12	1	0.552(0.028-10.88)	0.696
	GSP	4	12	18.70(1.69-206.46)	0.017*
	AySP	8	1	1	
Internet access	No	27	24	1.23(0.27-5.62)	0.791
	Yes	15	48	1	
Computer laboratory availability	No	20	2	0.031(0.007-0.145)	0.02*
	Yes	22	70	1	
ICT resource index	<0.5	38	46	0.373(0.102-1.371)	0.138
	≥0.5	4	26	1	

Multivariate binary logistic regression was performed to determine adjusted odds ratio and p-value of the association between the independent factors and teachers ICT competency. Teachers from Konso Secondary and preparatory school where 22.51 times more competent (AOR=22.52, p=0.015) compared with Aylota Secondary and preparatory school teachers, similarly teachers from Gumaide Secondary and preparatory school were 18.7 times more competent (AOR=18.7, P=0.017) compared with Aylota secondary and Preparatory school teachers. This suggests that ICT competency varies by school type, likely due to difference in ICT infrastructure and resources. This is in line with Avido-Ungar and Eshet-Alkali (2011), who reported that school environment strongly influences teachers' ICT skills. Teachers in schools without computer laboratory had 97% lower odds of ICT competency. This indicate that lack of computer access reduces opportunities for practice and development. This finding is consistent with OCECD (2015) which emphasized access is a key determinant of teachers' ICT competency.

3.5. Socio Cultural and Linguistic Inclusiveness of Digital Learning Content

3.5.1. Gender equity perceptions

Table 18: Equal Opportunity for Boys and Girls in Konso Zone Schools

Variable	Category	Frequency	%
Equal opportunity for boys and girls	Yes	11	9.6
	No	103	90.4

Reason for inequality	Household responsibilities for girls	Yes	69	67
		No	34	33
	Cultural expectations	Yes	50	48.5
		No	53	51.5
	Safety concern	Yes	29	28.2
		No	74	71.8
	Lack of encouragement from teachers	Yes	34	33.0
		No	69	67.0
	Boys dominate ICT space	Yes	50	48.5
		No	53	51.5

The current study showed that 90.4 % of teachers believed boys and girls don't have equal opportunities to participate in digital learning. Teachers identified girls' household responsibilities (67%), cultural expectations (48.5 %) and boys' dominance in ICT space (48.5%) as the major barriers. This finding is consistent with UNESCO (2023), which reported that girls often face greater domestic responsibilities and restrictive gender norms that limit their engagement with digital technologies. Similarly, Anthony and Tuffley (2014) found that sociocultural expectations contribute to an equal access to ICT and lower participation of girls in technology related activities. Hilbert (2011) also demonstrated that cultural norms and unequal resource distribution create persistent gender disparity in digital access and skill development. In the African context, Hennessy et al. (2010) reported that girls frequently have fewer opportunities to use ICT because of household workloads and perceptions that technology is primely a male domain. These findings suggest that gender based sociocultural barriers continue to undermine equitable participation in digital learning and contribute to the persistence of the digital divide.

3.6. Policy-Practice Gap and Last-Mile Challenges

Table 19: Policy Awareness of Teachers in Konso Zone Schools

Variable	Category	Frequency	%
Aware of Digital Ethiopia 2025	Yes	83	72.8
	No	31	27.2
Receive Government ICT training	Yes	32	28.1
	No	82	71.9

The finding revealed that 72.8 % of the teachers are aware of Digital Ethiopia 2025 strategy, but only 28.1% of the teachers were received government sponsored ICT training. This suggests that awareness of national digital education policy doesn't necessarily translate to capacity building opportunities for teachers. This finding aligns with the argument of Pressman and Wildavsky (1984) that policy success depends not only on policy formulation mechanisms. Additionally, the FGD participants reported the existence between national digital education policy objectives and their implementation at the school level. participants acknowledged "policies exists but resources never reach our school". Similarly, another participant indicated that current educational policies emphasize, digital competency development and equitable access to technology. However inadequate infrastructure, shortage of digital devices, unreliable electricity and internet service and insufficient financial and technical support constrain implementation efforts.

3.6.1. Infrastructural gap relative to digital Ethiopia 2025 Target

The finding revealed substantial infrastructural gap relative to the goals of digital Ethiopia 2025. Also, the national strategy emphasizes universal digital inclusion, school connectivity expansion, and equitable ICT access, considerable disparities were observed across schools in konso zone. Internet access remained limited, particularly in rural schools, while access to advance digital learning resources such as tablets and educational software/applications was minimal. Furthermore, the observed urban rural disparities contradicted the national objective of insuring equal digital opportunities across geographic regions.

Table 20: Infrastructural Gap of Konso Zone Secondary School Relative to Digital Ethiopia 2025

Indicator	National Target	Observed Status in Konso
School internet access	Expansion toward universal connectivity	55%
Schools connected digitally	50% of schools connected	Rural schools poorly connected
Digital tools in curriculum	40% implementation	Limited ICT supported teaching observed
Digital inclusion	Equal digital opportunity	Significant urban rural disparity observed
ICT skill development	Expansion of digital literacy	ICT competency remained low among rural teachers
Access to digital devices	Increased digital accessibility	Tablet access was extremely limited
Inclusive digital transformation	Equitable participation	Local language digital content was inadequate

This finding reflects policy implementation gap that has been documented in previous studies. Hennessy et al. (2010) found that while ICT policies were widely promoted across Sub Saharan Africa, schools often lacked adequate resource and teacher to implement them effectively. Similarly, Kozma (2011) argued that awareness of ICT policies alone is insufficient unless accompanied by investments in infrastructure, professional development, institutional support. Research by Unwin and Timmers (2021)further demonstrated that digital transformation policies in Africa frequently face implementation challenges due to funding constraints and unequal resource distribution.

4. Conclusions and Recommendations

4.1. Conclusion

This study assessed post-pandemic digital learning policy implementation in Konso Zone secondary schools, focusing on ICT infrastructure, digital competencies, inclusiveness, and implementation challenges. The findings revealed significant urban-rural disparities in ICT access, limited digital infrastructure, and gaps in teachers' and students' advanced ICT skills. Limited local-language digital content and socio-cultural barriers, including gender-related challenges, further affected digital inclusion. The study also identified gaps between Digital Ethiopia 2025 policy goals and school-level implementation due to inadequate resources, training, and institutional support. Overall, digital learning in Konso Zone requires targeted interventions to ensure equitable and inclusive access.

4.2. Recommendations

The Ministry of Education, regional education bureaus, and schools should prioritize equitable ICT infrastructure development, especially in rural areas, by improving access to digital devices, internet connectivity, and learning resources. Teacher professional development should be strengthened to enhance ICT pedagogical skills, digital assessment, and effective use of online learning platforms. Digital learning materials should be developed in local languages, including Afa Konso, to promote inclusiveness. Schools should establish ICT integration plans, provide continuous teacher support, maximize available technologies such as smartphones, and encourage equal participation of female students. Future researchers should further investigate the long-term impact of Digital Ethiopia 2025, mobile learning effectiveness, gender barriers, local-language digital resources, and regional variations in digital education implementation.

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