INTEGRATION OF ONLINE EDUCATION IN RURAL ZIMBABWEAN SECONDARY SCHOOLS: STRATEGIC PATHWAYS UNDER EDUCATION 5.0

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ABSTRACT

The integration of online education has become central to educational reform agendas worldwide, particularly in advancing equity and access in underserved contexts. In Zimbabwe, the Education 5.0 policy framework emphasizes technology-driven learning, innovation, and community engagement as pathways to producing skills-oriented graduates. However, the practical implementation of online education in rural secondary schools remains uneven and underexplored. This study investigates strategic pathways for integrating online education in rural Zimbabwean secondary schools, using selected schools in Mashonaland West Province as case studies. Guided by a pragmatic research philosophy, the study employed a convergent parallel mixed-methods design, combining questionnaire surveys and semi-structured interviews with students, teachers, and headmasters. Structural equation modelling (SEM) was used as the primary analytical technique to examine relationships among technological infrastructure, teacher readiness and digital competency, educational policy effectiveness, and student engagement with online learning platforms. Findings reveal that none of the examined institutional factors had a statistically significant direct effect on student engagement. However, motivation and content relevance emerged as significant drivers of engagement, while policy clarity and curriculum alignment were key components of perceived policy effectiveness. A significant covariance between infrastructural adequacy and policy effectiveness suggests the need for coordinated implementation. The study concludes that while Education 5.0 provides a progressive policy foundation, sustainable integration of online education in rural contexts requires context-sensitive, learner-centred strategies that align infrastructure provision, teacher capacity development, culturally relevant content, and actionable policies. Practical recommendations are offered to support scalable and sustainable online education in rural Zimbabwe.

Keywords: Education 5.0; Online Education; Rural Secondary Schools; Structural Equation Modelling; Zimbabwe

1. INTRODUCTION

The global education landscape is undergoing rapid transformation driven by digital technologies. Online learning has become a critical mechanism for enhancing access, equity, and quality in education, aligning with Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education for all. The COVID-19 pandemic further accelerated the adoption of online and blended learning worldwide. However, disparities persist between urban and rural contexts, particularly in developing countries.

In Sub-Saharan Africa, rural schools face entrenched challenges, including inadequate infrastructure, limited internet connectivity, insufficient digital devices, and low levels of digital literacy, exacerbating existing educational inequalities. In Zimbabwe, the Government's Education 5.0 policy framework seeks to modernize the education system through the integration of teaching, research, innovation, community engagement, and industrialization. Central to this framework is leveraging digital platforms to foster knowledge creation and equip learners with 21st-century skills.

Despite strong policy intent, the implementation of online education remains uneven, particularly in rural secondary schools. Many institutions lack reliable electricity, internet connectivity, trained personnel, and sustainable funding, resulting in a pronounced gap between policy aspirations and on-the-ground realities. Socio-economic barriers, gender disparities, cultural resistance to technology, and limited local-level policy coherence further marginalize rural learners within Zimbabwe's digital education agenda.

While previous studies document infrastructural and socio-economic barriers affecting digital education in rural Zimbabwe, few provide strategic, context-sensitive models aligning online learning with Education 5.0 principles. This study addresses this gap by examining strategic pathways for integrating online education in rural secondary schools, using selected schools in Mashonaland West Province as case studies. It assesses infrastructural adequacy, teacher readiness, student engagement, and policy effectiveness, while proposing practical strategies that are scalable, contextually relevant, and aligned with Education 5.0 objectives.

2. LITERATURE REVIEW

Digital technologies have reshaped education globally, positioning online learning as essential for accessibility, quality, and inclusivity. Zimbabwe's Education 5.0 framework emphasizes innovation, technology-driven learning, and inclusive practices. Yet rural secondary schools, especially in Mashonaland West, struggle with infrastructural deficits, limited digital literacy, socio-economic barriers, and weak institutional readiness. Empirical and theoretical literature highlight the need for strategic planning, stakeholder engagement, capacity building, and cultural localization to support successful integration of online education.

2.1 Theoretical Frameworks
Technology Acceptance Model (TAM) (Davis, 1989) explains technology adoption via perceived usefulness and ease of use. In rural Zimbabwe, TAM is limited because infrastructural and socio-cultural factors strongly influence adoption (Ashaari & Mutanga, 2023). Some extensions integrate social influence and technological readiness, offering stronger explanatory power in resource-limited contexts. Gender, leadership, and cultural norms significantly shape adoption.

Diffusion of Innovations Theory (Rogers, 2014) explains how innovations spread through social systems via relative advantage, compatibility, complexity, trialability, and observability. Early adopters, teachers, school leaders and community figures play critical roles in influencing peers. Contextual factors such as internet access and training are crucial for adoption. Pilot projects and community-driven demonstrations enhance acceptance.

Socio-Cultural Theory (Vygotsky, 1978/2018) says that learning is socially and culturally mediated; knowledge is co-constructed within communities. Zone of Proximal Development (ZPD) emphasizes guidance by more knowledgeable others. Community engagement, culturally relevant content, and local languages improve learning outcomes. Peer mentoring and social support structures strengthen digital literacy and platform engagement.

2.2 Empirical Evidence

Studies indicate that while digital platforms expand access, rural schools face challenges including poor connectivity and limited teacher capacity (Demissie et al., 2022; Tsimba et al., 2021). Mobile learning in South Africa improves engagement but suffers from network instability (Chabaya et al., 2019). Localized platforms in Kenya highlight the importance of teacher training, community participation, and indigenous language content (Wainaina et al., 2020). Rural digital education programs often fail without stakeholder engagement (Mavhemwa et al., 2017). Policies frequently focus on technology provision but neglect cultural adaptation and community ownership.

2.3 Strategic Pathways for Rural Online Education

Synthesizing theory and evidence, effective integration requires:

i.   Community engagement which involves parents, teachers, and leaders in co-creating content and managing technology.

ii.   Cultural and linguistic relevance using Shona or Ndebele languages and indigenous knowledge to enhance comprehension and engagement.

iii.   Training and scaffolding, building teacher capacity in interactive, collaborative pedagogy.

iv.   Collaborative digital platforms which facilitating discussion, peer review, and virtual community-building.

v.   Local digital champions who are trusted community members supporting digital literacy and troubleshooting.

These pathways demonstrate that technological, social, and cultural integration is essential for sustainable adoption, aligning with Education 5.0 objectives.

3. METHODOLOGY

This study adopted a pragmatic research philosophy, emphasizing practical solutions to real-world challenges (King, 2022). A convergent parallel mixed-methods design was used, allowing simultaneous collection and integration of quantitative and qualitative data (Creswell & Plano Clark, 2018). A descriptive research design capturing trends and contextual factors influencing online learning adoption was also employed.

Forms 4 to 6 students, teachers, and headmasters across seven districts in Mashonaland West constituted the study population. Multi-stage sampling was used. The first stage was at the district level, where three districts were randomly selected from the seven districts in the province. The second stage was at the school level, where one school was selected from each

chosen district. At both levels, simple random sampling was applied. Students were selected using stratified sampling at each school. All headmasters were included in the sample. Both quantitative and qualitative data were collected using questionnaires and interviews. Structural equation modelling (SEM) was the main analytical technique.

4. DATA ANALYSIS AND FINDINGS

This section presents the analysis of the collected data, with SPSS-AMOS used to generate figures and tables illustrating the findings.

Of the respondents, 51.46% were female and 48.54% male. The majority were students under 20 years of age. Most teachers and all headmasters held bachelor's degrees. The hypothesis that there is no association between gender and education level was tested. The Pearson chi-square p-value was 0.253 (> 0.05), indicating no statistically significant association. Therefore, the null hypothesis was not rejected.

Structural equation modelling was the primary analysis technique. Table 1 presents the variable codes and constructs used in the model.

Table 1: Full Narrations of variable codes

B1-B7- Availability & Adequacy of Technological Infrastructure (AATI)	
B1	Infrastructure adequacy and access
B2	Internet Reliability and Affordability
B3	Adequacy and Functionality of ICT devices for teacher/student use
B4	Dedicated ICT gadgets for online learning
B5	Reliability and Affordable Power supply
B6	Budget Allocation adequacy for maintenance and upgrade
B7	Hardware and Software issues Technical Support
C1-C5. Teacher Readiness and Digital Competency (TRDC)	
C1	Professional Development for Digital Skills
C2	Teacher Training for Improving Digital Competencies
C3	Integration of Online Learning Tools in Teaching Practices
C4	Training and Support to Improve Digital competencies in Teaching
C5	Students Assessment and Feedback using digital tools
D1-D6. Student Engagement Online Education Platforms (SEOEP)	
D1	Regular Access to Online Learning Platforms
D2	Motivated and Actively participate in Online Learning Activities
D3	Relevance and easy to Understand of Online Learning Materials
D4	Feedback of Online School Work from Teachers
D5	Student Improvement on Engaging Online Learning Materials
D6	Necessary Skills to Navigate E-Learning Platforms
E1-E5. Effectiveness of Educational Policies (EFP)	
E1	Education 5.0 Framework's effectiveness in the Integration of Online Learning
E2	Government Support in Implementing E-learning in Rural Schools
E3	Current Curriculum Support Online and Digital tools in learning
E4	Practicality and Clearness of Policy Guidelines in the Implementation of E-learning
E5	The influence of Education 5.0 in the Adoption of Online Learning

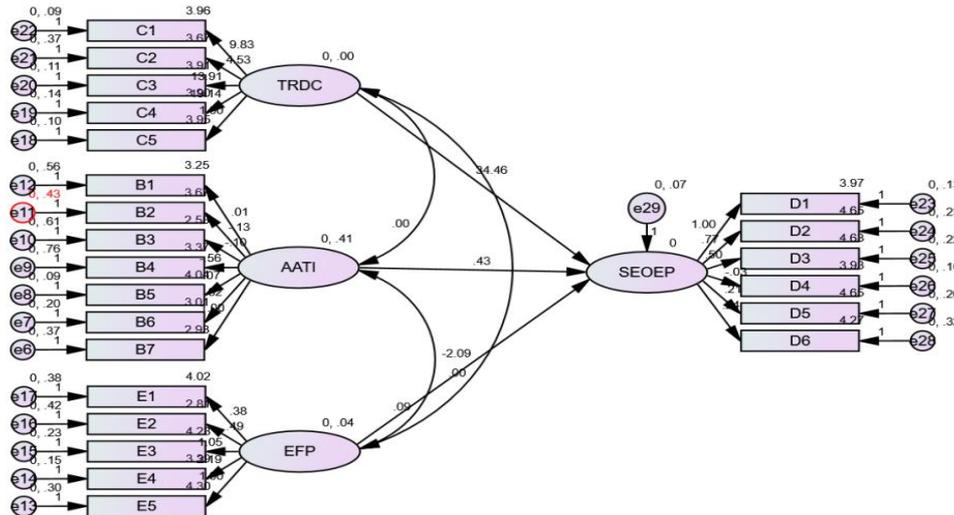**A Path Diagram showing the effect of TRDC, AATI and EEP on SEOEP**

Figure 1

Table 2: Model fit statistics

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.079	.065	.093	.001
Independence model	.096	.084	.107	.000

The RMSEA in table 2 has a value of 0.079, which is smaller than 0.08. This suggests that the Structural Equation Model shown in the path diagram in figure 1 provides a good fit to the data.

Table 3: Regression coefficients (AATI → B variables)

		Estimate	S.E.	C.R.	P	Label
B7	<--- AATI	1.000				
B6	<--- AATI	.319	.112	2.847	.004	par_1
B5	<--- AATI	.066	.060	1.101	.271	par_2
B4	<--- AATI	-.563	.209	-2.696	.007	par_3
B3	<--- AATI	-.097	.149	-.653	.514	par_4
B2	<--- AATI	-.132	.127	-1.038	.299	par_5
B1	<--- AATI	.013	.141	.089	.929	par_6

The regression coefficients show that only B6 (budget allocation) and B4 (dedicated ICT gadgets) significantly load onto AATI.

The results indicate that perceptions of technological infrastructure are significantly shaped by maintenance funding (positive effect) and the availability of dedicated devices (negative effect), while other indicators are statistically insignificant.

Table 4: Regression coefficients (TRDC → C variables)

		Estimate	S.E.	C.R.	P	Label
C5 <---	TRDC	1.000				
C4 <---	TRDC	19.141	47.903	.400	.689	par_11
C3 <---	TRDC	13.910	34.841	.399	.690	par_12
C2 <---	TRDC	4.530	12.257	.370	.712	par_13
C1 <---	TRDC	9.829	24.661	.399	.690	par_14

None of the predictors (C1–C4) significantly explain TRDC (p > 0.05), with C5 as the reference variable. This suggests that teacher readiness and digital competency are not adequately captured by training and professional development alone and may depend on broader institutional and contextual factors.

Table 5: Regression coefficients (SEOEP → D variables)

		Estimate	S.E.	C.R.	P	Label
D1 <---	SEOEP	1.000				
D2 <---	SEOEP	.769	.176	4.363	***	par_15
D3 <---	SEOEP	.496	.137	3.617	***	par_16
D4 <---	SEOEP	-.026	.077	-.335	.738	par_17
D5 <---	SEOEP	.208	.126	1.656	.098	par_18
D6 <---	SEOEP	.239	.141	1.697	.090	par_19

Student engagement is significantly driven by D2 (motivation/participation) and D3 (content relevance and clarity). D4–D6 are statistically insignificant.

Table 6: Regression coefficients (EFP → E variables)

		Estimate	S.E.	C.R.	P	Label
E5 <---	EFP	1.000				
E4 <---	EFP	2.187	.777	2.815	.005	par_7
E3 <---	EFP	1.050	.426	2.464	.014	par_8
E2 <---	EFP	.493	.393	1.255	.209	par_9
E1 <---	EFP	.383	.365	1.048	.295	par_10

E4 (policy clarity) and E3 (curriculum alignment) significantly predict EFP, while E1 and E2 are insignificant.

Table 7: Effects of TRDC, AATI, and EFP on SEOEP

		Estimate	S.E.	C.R.	P	Label
SEOEP <---	TRDC	34.462	87.743	.393	.694	par_20
SEOEP <---	AATI	.433	.503	.860	.390	par_21
SEOEP <---	EFP	-2.088	2.072	-1.008	.314	par_22

All paths are statistically insignificant (p > 0.05), indicating no direct effects of these constructs on student engagement.

Table 8: Covariances between pairs of variables

	Estimate	S.E.	C.R.	P	Label
AATI <--> EFP	.092	.038	2.425	.015	par_23
TRDC <--> AATI	.001	.004	.361	.718	par_24
TRDC <--> EFP	.002	.005	.395	.693	par_25

Only AATI and EFP are significantly correlated (p = 0.015). Other covariances are insignificant.

5. DISCUSSION, CONCLUSION, AND RECOMMENDATIONS
5.1 Discussion of Findings

Technological infrastructure (AATI) did not have a statistically significant direct effect on student engagement, although budget allocation and access to dedicated devices were significant indicators. Qualitative findings revealed outdated equipment, limited devices, frequent power outages, and poor connectivity, consistent with Unwin et al. (2020).

All indicators of teacher readiness (TRDC) were statistically insignificant, reflecting limited training, lack of learning management systems, and low confidence among teachers. This aligns with the TPACK framework (Koehler & Mishra, 2009).

SEM revealed no significant direct relationships between AATI, TRDC, EFP, and student engagement. However, the significant covariance between AATI and EFP suggests alignment between infrastructure provision and policy direction.

Educational policy effectiveness did not directly influence engagement, though curriculum alignment and policy clarity were significant components. This supports Fullan's (2016) emphasis on implementation capacity.

Overall, Education 5.0 offers a progressive foundation, but its impact in rural schools is constrained by infrastructural inadequacies, low teacher competence, and contextual barriers. Student engagement depends more on motivation and content relevance than on institutional structures alone.

5.2 Conclusion

Education 5.0 provides a progressive vision, but effective online education in rural Zimbabwe requires practical, context-sensitive interventions integrating infrastructure, teacher competence, learner-centred design, and actionable policies. Although initiatives such as Starlink, solar energy, and ICT laboratories have improved access, sustainability depends on consistent funding, maintenance, structured teacher training, and affordability. Effective support must balance policy, infrastructure, and learner-centred interventions to ensure enduring integration (UNESCO, 2023; World Bank, 2024; Mthethwa, 2023).

5.3 Recommendations

Optimizing online education in rural Zimbabwe requires a coordinated, multidimensional approach that takes into account the following recommendations:
1.   Sustainable Infrastructure: Reliable power, long-term ICT funding, device access

2.   Continuous Teacher Training: Hands-on development aligned with Education 5.0
3.   Culturally Relevant Content: Simple, interactive materials in local languages
4.   Contextualized Policy Frameworks: Clear, actionable, locally adapted guidelines
5.   Integrated Interventions: Align infrastructure, capacity building, and learner support

5.4 Future Research

Future studies should adopt longitudinal designs to track implementation and long-term impacts of online education initiatives. Comparative rural–urban studies are needed to identify structural disparities and policy effects. Further research should also examine public–private partnerships and community-led initiatives. Mixed-methods approaches are recommended to provide deeper insights into how infrastructure, policy, teacher capacity, and student engagement interact across contexts.

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