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Understanding Technology Transfer and Open Educational Resources Uptake Through the Technology Acceptance Model and Diffusion of Innovations Frameworks: Evidence from Secondary School Teachers in Tanzania

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Abstract
This study examines the key factors shaping technology transfer and the adoption of Open Educational Resources (OER) among secondary school teachers in Kigamboni District, Dar es Salaam, Tanzania, anchored in the Technology Acceptance Model (TAM) and Diffusion of Innovations (DOI) theory as complementary analytical lenses. Using a convergent parallel mixed-methods design, data were collected from 160 teachers across eight public secondary schools via structured questionnaires, of which 148 were correctly completed and returned (response rate 92.5%), supplemented by semi-structured interviews with all eight head teachers. The study finds a growing institutional awareness of OER and technology transfer, yet meaningful and sustained implementation remains constrained by poor infrastructure, inadequate professional development, and the absence of coherent institutional policies. Teachers strongly recognise the pedagogical value of OER (82.4%), yet actual adoption rates remain low (47.3%), revealing a persistent gap between awareness and practice. A chi-square test confirmed a statistically significant association between school-level infrastructure quality and OER adoption frequency ($\chi^2 = 14.23$, $df = 3$, $p = .003$). Head teachers consistently attributed low adoption to structural rather than motivational factors. Findings call for coordinated responses: strengthened digital infrastructure, continuous professional development, and explicit policy frameworks supporting equitable technology integration. The study contributes locally anchored, empirically grounded evidence to regional and global conversations on OER uptake in low-resource educational contexts.

Introduction

Around the world, educational systems have experienced a transformative shift with the integration of technology, leading to new teaching methodologies and expanded access to diverse learning materials. In countries with robust digital learning environments, teachers regularly engage with OERs to supplement traditional materials, improve lesson planning, and collaborate among educators (UNESCO, 2023). Across many African nations, governments and development partners have acknowledged the value of digital learning; however, persistent challenges, including inconsistent internet access, inadequate teacher digital competence, and the absence of locally contextualised OERs, continue to constrain meaningful adoption (Tlili et al., 2022).

In Tanzania, the government has shown growing interest in promoting the integration of Information and Communication Technology (ICT) in education through initiatives such as the Tanzania Institute of Education's digital platform and the Secondary Education Quality Improvement Programme (SEQUIP). Despite these efforts, many secondary schools continue to struggle with inadequate ICT infrastructure, low OER awareness, and limited teacher capacity to effectively utilise digital resources in daily instruction (Ngodu et al., 2024; Shekaoneka et al., 2024). These challenges are particularly acute in public secondary schools, where resource constraints, gaps in policy-implementation, and institutional inertia collectively limit the translation of national ICT commitments into classroom practice. This study focuses on Kigamboni District, an urban district in Dar es Salaam that has experienced rapid expansion of educational services yet remains under-researched regarding technology transfer practices and OER utilisation in its public secondary schools.

This study was guided by two specific objectives: (i) to assess the current practices of technology transfer in public secondary schools in Kigamboni District; and (ii) to evaluate the extent to which teachers in these schools utilise OERs in their instructional practices. The study finds that while teachers broadly recognise the pedagogical value of OERs, actual adoption remains constrained by structural barriers, most notably poor infrastructure, inadequate professional development, and the absence of coherent school-level policies, revealing a persistent gap between awareness and practice. Anchored in TAM and DOI theory, the study interprets these patterns as structurally rooted, pointing toward the need for coordinated interventions rather than isolated, individual-level solutions. Findings are intended to provide locally grounded, empirically anchored evidence to inform policy reform, institutional planning, and the design of professional development in public secondary education across Tanzania and comparable low-resource contexts in sub-Saharan Africa.

Theoretical Framework

This study is grounded in two theories that explain technology adoption and innovation diffusion in educational settings: TAM and DOI.

The Technology Acceptance Model, developed by Davis (1989), explains technology adoption through two primary constructs: perceived usefulness and perceived ease of use. These shape behavioural intention to use a technology and ultimately actual usage. TAM has been widely applied in educational contexts to understand the acceptance of OER and ICT. Tang et al. (2021) used a sequential mixed-methods design grounded in TAM to examine K-12 teachers' OER acceptance, finding that ease of use and self-efficacy significantly shaped adoption intentions. Mexhuani (2024) further affirmed TAM's utility in exploring digital tool adoption in teaching, confirming that perceived usefulness and institutional training support remain central predictors.

Diffusion of Innovations theory, advanced by Rogers (2003), explains how new technologies spread within a social system. DOI identifies five adoption attributes: relative advantage, compatibility, complexity, trialability, and observability as determinants of uptake pace. Granić (2022), in a systematic review of educational technology adoption models, confirmed TAM and DOI as the most widely applied frameworks in the literature, noting that self-efficacy, facilitating conditions, and complexity are consistent predictors across settings. Together, TAM and DOI provide complementary lenses for this study: TAM illuminates individual-level perceptions and attitudes, while DOI enables analysis of systemic and contextual factors that facilitate or impede technology integration at the school level.

Method

This study was conducted in Kigamboni District, Dar es Salaam, focusing on eight purposively selected public secondary schools within the government-managed system. A convergent parallel mixed-methods design was adopted, enabling concurrent collection and systematic integration of qualitative and quantitative data, proving particularly suited to the investigation of complex phenomena such as technology transfer and OER utilisation where neither method alone yields sufficient analytical depth (Adhikari et al., 2024; Sharma et al., 2023; Buchanan et al., 2021; Stutchbury et al., 2023; Gbadebo, 2024).

Quantitative data were gathered through structured, self-administered questionnaires distributed to 160 teachers, with exactly 20 teachers systematically selected from each of the eight schools using stratified random sampling based on school affiliation and subject specialisation (sciences, humanities, and languages). Of the 160 questionnaires distributed, 148 were returned correctly completed, yielding a response rate of 92.5%. The instrument, grounded in validated sub-Saharan African tools and incorporating five-point Likert-scale items, was piloted in one public-school not included in the main sample prior to full deployment, yielding Cronbach's $\alpha = .83$ and confirming content validity through expert review. Qualitative data comprised semi-structured interviews with all eight head teachers, one from each school, conducted individually at participants' schools in their preferred language (English or Kiswahili). Interviews were audio-recorded with prior informed consent, transcribed verbatim, and lasted between 45 and 75 minutes each. The interview guide comprised ten open-ended questions covering institutional readiness, infrastructure provision, adequacy of professional development, OER awareness, and perceived impacts of technology integration on teaching and learning outcomes (Rajabalee et al., 2023; Benjamin et al., 2025).

Quantitative data were analysed descriptively and inferentially, including chi-square tests to examine associations between categorical variables. Qualitative data were subjected to Braun and Clarke's (2006) six-phase thematic analysis, with coding informed by TAM and DOI frameworks. Credibility was strengthened through member checking and triangulation (Peregrino et al., 2020), with intercoder consensus achieved during independent thematic coding. Both data streams were integrated at interpretation through systematic comparison and synthesis. Ethical clearance was obtained before fieldwork; all data were anonymised, and participants engaged under full informed consent.

Results

Response Rate and Sample Characteristics

Of 160 questionnaires distributed across the eight public secondary schools (20 per school), 148 were correctly completed and returned, yielding a response rate of 92.5%. Twelve questionnaires were excluded: six were returned incomplete (missing more than 20% of items), four exhibited systematic

response patterns indicative of disengagement, and two were submitted after the data collection deadline. This response rate substantially exceeds the conventional 70% threshold, significantly enhancing the reliability and representativeness of findings. All eight head teachers (one per school) participated in individual semi-structured interviews, resulting in a 100% response rate.

The high response rate reflected genuine institutional engagement. Head Teacher at School 3 noted:

> "*Teachers were genuinely eager to participate. Many had been waiting for an opportunity to voice their frustrations about the lack of technology resources and the gap between what the government promises and what actually reaches our classrooms. They saw this study as a channel for their concerns to be heard.*"

This observation was echoed by the Head Teacher at School 7, who added:

> "*We distributed the questionnaires during a staff meeting, and I personally explained the purpose of the study. I think the teachers trusted that the research would be used to improve their working conditions, and that motivated them to participate honestly and completely.*"

Demographic Characteristics

Table 1: Demographic Characteristics of Teacher Respondents (n = 148)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	82	55.4
	Female	66	44.6
Age	21–30 years	44	29.7
	31–40 years	62	41.9
	41–50 years	32	21.6
	51+ years	10	6.8
Teaching Experience	Less than 5 years	28	18.9
	5–10 years	52	35.1
	11–15 years	38	25.7
	16+ years	30	20.3
Subject Area	Sciences	46	31.1
	Arts/Humanities	38	25.7
	Languages	30	20.3
	Others	34	23.0
School Type	Public/Government only	148	100.0

Source: Field Data (2025)

The modal age category (31–40 years, 41.9%) suggests a teaching workforce characterised by professional maturity and openness to technological innovation, consistent with research indicating that this cohort often balances experience with receptiveness to professional development (Mexhuani, 2024). Experience concentration in the 5–10-year range (35.1%) indicates teachers possessing substantial familiarity with school practices while remaining in career stages where capacity building can yield sustained impact. All respondents were drawn from public secondary schools, reflecting the study's deliberate focus on the government school system, which is shaped directly by national ICT and OER policy directives.

Current Status of Technology Transfer and OER Utilisation

Table 2: Teachers' Perceptions of Technology Transfer and OER Utilisation (n = 148)

No.	Item	Agreement n (%)	Interpretation
1	Technology transfer is actively encouraged in my school	98 (66.2%)	Moderate encouragement
2	I feel confident implementing technology transfer practices	84 (56.8%)	Moderate confidence
3	My school provides adequate institutional support for OER utilisation	76 (51.4%)	Limited support
4	OERs significantly enhance student learning experiences	122 (82.4%)	Strong perceived benefit
5	I frequently utilise technology transfer in my teaching	70 (47.3%)	Low-moderate frequency
6	Professional development for technology integration has been effective	60 (40.5%)	Low effectiveness
7	My school adequately addresses technology and OER challenges	64 (43.2%)	Weak institutional response
8	My school collaborates with external organisations for technology support	52 (35.1%)	Limited collaboration
9	Technology transfer contributes meaningfully to my professional growth	88 (59.5%)	Moderate contribution
10	I am satisfied with resources available for OER utilisation	56 (37.8%)	Low satisfaction

Source: Field Data (2025)

The findings reveal a complex picture of recognised potential alongside substantial implementation gaps. Although 66.2% of teachers perceive moderate institutional encouragement for technology transfer, confidence in implementing such practices is notably lower (56.8%), signalling a critical gap between institutional rhetoric and actual capacity development. Only 51.4% perceived adequate institutional support for OER use, while satisfaction with available resources was markedly low (37.8%).

Inferential Analysis. A chi-square test of independence was conducted to examine the association between teachers' level of teaching experience and their frequency of OER utilisation (Item 5). Results indicated a statistically significant association ($\chi^2 = 14.23$, df = 3, $p = .003$, Cramér's V = .31), suggesting a moderate relationship between experience and adoption frequency. Teachers with 5–10 years of experience reported the highest OER utilisation rates, while those with less than 5 years or more than 15 years reported notably lower utilisation rates. A second chi-square analysis examined the relationship between perceived adequacy of professional development (Item 6) and OER adoption frequency, yielding a significant result ($\chi^2 = 18.76$, df = 3, $p < .001$, Cramér's V = .36), confirming that teachers who rated professional development as effective were significantly more likely to report frequent OER use. These findings lend inferential support to TAM's proposition that ease of use, operationalised here as training adequacy, is a significant predictor of technology adoption behaviour.

Head teachers provided corroborating qualitative evidence. The Head Teacher at School 1 stated:

> *"We encourage teachers to use OERs, but encouragement alone is not enough. Without working computers, a stable internet, and time in the timetable to prepare digital lessons, even the most willing teacher will eventually give up and return to the textbook. The gap between our policy rhetoric and classroom reality is wide."*

Similarly, the Head Teacher at School 5 noted:

> "*The few teachers who use OERs consistently are those who have attended at least one structured external training. Teachers who have only received in-school, informal orientation do not use OERs regularly. This tells us that the quality and consistency of professional development matters enormously.*"

Challenges and Barriers

Table 3: Major Challenges in Technology Transfer and OER Utilisation (n = 148)

Challenge	Frequency	Percentage (%)
Poor infrastructure (unreliable internet, electricity)	88	59.5
Limited access to technology devices	82	55.4
Limited time for lesson preparation and resource adaptation	76	51.4
Inadequate professional development and training	74	50.0
Limited awareness of available OERs and how to access them	68	45.9
Lack of technical skills for effective integration	66	44.6
Resistance to changing established teaching practices	54	36.5

Source: Field Data (2025)

Poor infrastructure (59.5%) constitutes the single most pressing barrier, directly constraining teachers' ability to access digital resources or implement technology-enhanced instruction consistently. Limited device access (55.4%) exacerbates this constraint, while insufficient professional development (50.0%) and limited OER awareness (45.9%) reflect systemic capacity gaps. Resistance to change, while present (36.5%), ranks below structural and capacity barriers.

Head teacher interviews enriched these quantitative patterns with vivid institutional accounts. The Head Teacher at School 2 described the infrastructure reality in stark terms:

> "*We have a computer laboratory with 24 machines, but only nine are currently functional. The internet connection comes through a dongle that runs out of data within two weeks of each month. After that, there is simply no connectivity. How can we expect teachers to use OERs under these conditions?*"

The Head Teacher at School 6 highlighted the time constraint:

> "*Our teachers carry very heavy teaching loads; some teach up to 30 periods per week. Finding time outside of teaching to search for OERs, download materials, and adapt them to our curriculum is practically impossible. Unless we reduce the teaching, load or create protected time for digital lesson preparation, OER adoption will remain minimal.*"

The Head Teacher at School 8 added:

> "*We received five tablets from a donor project two years ago. The teachers were initially excited, but there was no follow-up training, no content loaded onto the devices, and no technical support when two of them developed faults. They are now sitting unused in my office. Equipment without training and support is just furniture.*"

Perceived Strategies for Enhancement

Table 4: Perceived Opportunities and Strategies for Enhancement (n = 148)

Strategy / Opportunity	Agreement n	Percentage (%)
Improved access to functional devices for classroom use	118	79.7
Enhanced, ongoing teacher training and professional development	110	74.3
Strengthening institutional policies supporting technology integration	96	64.9
Encouraging systematic collaboration among teachers within schools	88	59.5
Establishing partnerships with external organisations and technology providers	72	48.6

Source: Field Data (2025)

Teachers identified improved device access (79.7%) and enhanced ongoing professional development (74.3%) as the most critical priorities, directly mirroring the top-ranked barriers in Table 3. Strengthening institutional policies (64.9%) reflects recognition that individual efforts alone prove insufficient without organisational frameworks, implementation guidelines, and administrative commitment. Head teachers affirmed these priorities, as one noted at School 4:

> *"What teachers need is not motivation; they are already motivated. What they need is working equipment in classrooms, not in storage rooms, and training that is practical, relevant, and repeated, not a one-off workshop that we forget about in three months."*

Impact on Student Learning Outcomes

Table 5: Perceived Impact on Student Learning Outcomes (n = 148)

Impact Dimension	Agreement n	Percentage (%)
Technology integration enhances student engagement with learning content	120	81.1
OERs improve students' access to quality learning materials	128	86.5
Technology fosters critical thinking and analytical skills	104	70.3
OERs promote collaborative learning among students	110	74.3
Technology increases student motivation to learn	112	75.7
Technology enhances students' digital literacy skills	118	79.7
OERs improve students' capacity for independent, self-directed learning	106	71.6
Technology and OER use improves overall academic performance	98	66.2

Source: Field Data (2025)

Teachers reported strongly positive perceptions across all eight learning dimensions. Student access to quality materials through OERs (86.5%) and enhanced engagement (81.1%) were most strongly endorsed. Perceived improvement in overall academic performance (66.2%), while still substantive, was the lowest-rated dimension, suggesting that external structural constraints limit technology's full impact on measured outcomes.

Head teachers offered nuanced qualitative perspectives on these patterns. The Head Teacher at School 3 observed:

> *"When a teacher uses a video or an interactive diagram from the internet, the class comes alive in a way that a textbook simply cannot achieve. Students ask more questions, discuss among themselves, and remember the lesson. I have seen this myself during classroom observations.*

> *But this happens maybe once a week at best not because teachers don't want to do it more often, but because the infrastructure doesn't allow it."*

The Head Teacher at School 7 raised the issue of assessment alignment:

> *"Our national examinations still reward memorisation over critical thinking. So even when technology improves students' analytical skills and collaborative capacities which I believe it does, this improvement is not always captured in examination scores. The assessment system has not caught up with the pedagogy that OERs support."*

Discussion

Technology Transfer Practices in Public Secondary Schools

The patterns identified in Kigamboni's eight public secondary schools are theoretically interpretable through the lenses of both TAM and DOI. From a TAM perspective, the disparity between institutional encouragement (66.2%) and teacher confidence in implementation (56.8%) reflects the inadequacy of awareness campaigns in the absence of structured, skills-building support. TAM posits that perceived ease of use is a proximate determinant of adoption intention; where professional development is episodic and rated as ineffective by the majority, perceived ease of use cannot improve regardless of teacher motivation (Tang et al., 2021; Mexhuani, 2024). From a DOI perspective, limited technology diffusion across schools reflects the absence of the observability and trialability conditions that Rogers (2003) identifies as central accelerators of innovation adoption: where technology use is neither visible in colleagues' practice nor supported by low-risk experimentation opportunities, diffusion stagnates.

These interpretations are consistent with comparable Tanzanian research. Ngodu et al. (2024) demonstrated that capacity building and infrastructure investment are the most context-relevant enablers of ICT integration outcomes in Tanzanian secondary schools, a finding this study corroborates and extends to the OER domain. Shekaoneka et al. (2024) similarly concluded that inadequate ICT skills, limited infrastructure, and poorly defined procedures collectively constrain digital adoption in Tanzanian schools, patterns structurally identical to those documented here.

OER Utilisation: Awareness Versus Practice

The study's most theoretically significant contribution lies in the inferential confirmation of the awareness-practice gap. While 82.4% of teachers perceive OERs as beneficial, only 47.3% report frequent utilisation, a 35-percentage-point divergence that TAM attributes to insufficient perceived ease of use and DOI attributes to compatibility and complexity barriers. The chi-square finding ($\chi^2 = 18.76$, df = 3, $p < .001$) operationalises this interpretation statistically, confirming that professional development adequacy is a significant predictor of OER adoption frequency independently of motivation. This finding has direct policy implications: investment in training is not merely desirable but is empirically demonstrated to be a determinant of behavioural change.

Tlili et al. (2022), in a systematic African review, identified cultural and dissemination gaps, including the neglect of open educational practices as a mechanism for embedding OER in teaching culture, as underappreciated contributors to adoption gaps. Rajabalee et al. (2023) found that productivity and infrastructure were the strongest predictors of OER adoption intention in a comparable secondary school context, reinforcing that readiness conditions, not merely positive attitudes, determine whether awareness translates into practice. The qualitative evidence from head teacher interviews in this study provides institutional depth to these regional patterns, revealing how resource scarcity operates as a practical ceiling on even highly motivated teachers' adoption behaviour.

The Role of Institutional Policy and Leadership

The weak institutional response to technology challenges (43.2%) and limited external collaboration (35.1%) point to a structural deficit that extends beyond individual teacher capacity. Head teacher interviews consistently revealed a policy-implementation disconnect: national ICT and OER policies exist but have not been translated into school-level implementation plans, resource allocation frameworks, or accountability mechanisms. This finding aligns with Benjamin et al.'s (2025) observation that Tanzanian school heads demonstrate uneven ICT readiness, with urban schools benefiting unevenly from available resources and training, a paradox this study documents in Kigamboni, an urban district where proximity to the capital has not automatically yielded infrastructure parity.

Gbadebo (2024) argues convincingly that transformative digital integration in sub-Saharan Africa requires simultaneous action across five dimensions: infrastructure, equitable access, capacity building, policy, and partnerships. The findings of this study demonstrate that in Kigamboni's public secondary schools, all five dimensions require concurrent attention, and that progress on any single dimension in isolation will be insufficient to close the awareness-practice gap documented in this study.

Conclusion

This study set out to assess technology transfer practices and OER utilisation among teachers in eight public secondary schools in Kigamboni District, Tanzania, using TAM and DOI as interpretive lenses within a convergent parallel mixed-methods design. The findings present a coherent and sobering picture: teachers are aware of the value of OERs and broadly supportive of technology integration in principle, yet are systematically constrained by poor infrastructure, inadequate professional development, limited access to devices, and the absence of coherent institutional policies. The 92.5% questionnaire response rate and 100% head teacher interview participation rate enhance confidence in the reliability and representativeness of the evidence base.

Theoretically, the study affirms the complementary value of TAM and DOI in explaining the awareness-practice gap in under-resourced public-school contexts. TAM illuminates how infrastructural and training deficits suppress perceived ease of use, constraining adoption even where perceived usefulness is high. DOI reveals how the absence of observability and trialability channels slows the diffusion of innovation across the system. The inferential statistics — particularly the chi-square test confirming a significant association between professional development adequacy and OER adoption frequency ($\chi^2 = 18.76$, $p < .001$) — provide quantitative grounding for conclusions previously confined to qualitative or descriptive evidence in comparable studies.

Empirically, the study contributes locally grounded, mixed-methods evidence to the growing body of research on OER adoption in Tanzanian secondary education. The rich qualitative data from eight head teacher interviews provide institutional depth rarely present in quantitative-only studies, capturing the lived realities behind the numbers. The study's limitation to eight public schools in a single district cautions against uncritical generalisation; however, the structural patterns identified infrastructure deficits, training gaps, policy-implementation disconnects, align closely with findings from comparable sub-Saharan African contexts, suggesting broad transferability of conclusions and recommendations.

Prioritise ICT infrastructure investment in public secondary schools, with specific targets for reliable electricity supply, broadband internet connectivity, and a minimum device-to-teacher ratio across all government schools in Dar es Salaam and comparable districts. Develop and enforce a national OER

Integration Policy Framework that translates existing ICT policy commitments into school-level implementation plans, accountability mechanisms, and measurable adoption targets. Establish a dedicated, recurring budget line for digital infrastructure maintenance and OER-related professional development to ensure sustainability beyond project-based donor funding.

Head teachers should institutionalise structured, peer-led professional development on OER use and ICT integration, leveraging digitally confident teachers as internal facilitators and reducing dependence on sporadic external workshops. Schools should develop and enforce written ICT integration policies specifying expectations, support mechanisms, and resource allocation for technology use in instruction. Administrators should actively pursue and formalise partnerships with NGOs, technology companies, and higher education institutions to supplement government resources with technical expertise, devices, and sustained training support.

Teachers are encouraged to engage proactively with available OER repositories, including AI tools, educational video platforms, and open-access databases and to document and share successful integration practices with colleagues through structured peer-learning groups. Subject departments should allocate scheduled time within professional development calendars for OER exploration, adaptation, and lesson planning, normalising OER use as part of routine teaching practice.

Future studies should examine the impact of specific professional development models, including peer coaching, technology-integrated lesson study, and MOOCs, on OER adoption rates in public secondary schools. Longitudinal research tracking changes in teacher OER adoption and student outcomes following targeted infrastructure and training interventions would provide stronger causal evidence. Comparative studies across urban and rural districts in Tanzania are needed to contextualise the generalisability of these findings.

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