Original Article

# Readiness for AI-Enabled Curriculum Management: Lessons from Chinese Language Education in Tanzanian Secondary Schools

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**Abstract** Artificial intelligence (AI) can support curriculum planning, assessment, monitoring, teacher deployment and resource coordination, but its contribution depends on the readiness of the education system in which it is introduced. This study assessed readiness for AI-enabled curriculum management through a descriptive case study of Chinese language education in Tanzanian government secondary schools. The study drew on document analysis, semi-structured interviews with 22 education stakeholders, and a survey of 44 Chinese language teachers across 19 schools in 10 regions. Readiness was examined across five interrelated domains: governance and standards, data systems, infrastructure, teacher capacity and financing, with ethics and human oversight treated as cross-cutting conditions. The findings show that Tanzania has established national policy direction for digital education and AI, but operational coordination across curriculum, assessment, teacher-management and school administration institutions remains incomplete. Most curriculum-related records remained paper-based, feedback loops were weak, and institutional databases were not interoperable. Approximately 83% of respondents reported some internet access, yet reliable devices and electricity remained uneven; only 12% reported access to school-provided laptops. Teachers showed strong willingness to learn and use AI-supported tools (91%), but their self-rated technological knowledge and overall technological pedagogical content knowledge were weak. Financing evidence also indicated that schools prioritised basic connectivity over devices, software, technical support, and sustained professional development. Three low-risk entry points were identified: assisted timetable analytics, validated formative item banks and budget dashboards. The study concludes that AI-enabled curriculum management should begin with interoperable data, clear institutional accountability, practical teacher development and human-centred safeguards rather than large-scale automation. Chinese language education offers a manageable pilot to test these foundations before wider application.

***Keywords:*** *AI readiness; curriculum management; Chinese language education; TPACK; Tanzanian secondary schools; educational technology*

**Résumé** L'intelligence artificielle (IA) peut soutenir la planification des programmes d'études, l'évaluation, le suivi, le déploiement des enseignants et la coordination des ressources., mais sa contribution dépend du niveau de préparation du système éducatif dans lequel elle est introduite. Cette étude a évalué la préparation à une gestion des programmes d'études intégrant l'IA à travers une étude de cas descriptive portant sur l'enseignement du chinois dans les établissements secondaires publics de Tanzanie. Les données ont été recueillies à partir de l'analyse documentaire, d'entretiens semi-directifs menés auprès de 22 acteurs de l'éducation et d'une enquête réalisée auprès de 44 enseignants de chinois travaillant dans 19 établissements répartis dans 10 régions. La préparation a été examinée selon cinq domaines interdépendants : la gouvernance et les normes, les systèmes de données, les infrastructures, les compétences des enseignants et le financement, tandis que l'éthique et la supervision humaine ont été considérées comme des conditions transversales. Les résultats montrent que la Tanzanie a établi des orientations politiques nationales en faveur de l'éducation numérique et de l'IA, mais que la coordination opérationnelle entre les institutions chargées des programmes d'études, de l'évaluation, de la gestion des enseignants et de l'administration scolaire demeure incomplète. La plupart des dossiers liés aux programmes d'études étaient encore conservés sur support papier, les mécanismes de rétroaction étaient faibles et les bases de données institutionnelles n'étaient pas interopérables. Environ 83 % des répondants ont déclaré disposer d'un certain accès à Internet, mais l'accès fiable aux appareils et à l'électricité demeurait inégal ; seuls 12 % ont indiqué avoir accès à des ordinateurs portables fournis par leur établissement. Les enseignants ont manifesté une forte volonté d'apprendre et d'utiliser des outils intégrant l'IA (91 %), mais leur niveau de connaissances technologiques autoévalué ainsi que leurs connaissances technologiques, pédagogiques et disciplinaires (TPACK) globales se sont révélés faibles. Les données relatives au financement indiquent également que la connectivité de base était privilégiée au détriment des appareils, des logiciels, du soutien technique et de la formation professionnelle continue. Trois points d'entrée à faible risque ont été identifiés : l'analyse assistée des emplois du temps, les banques d'items formatifs validés et les tableaux de bord budgétaires. L'étude conclut que la gestion des programmes d'études intégrant l'IA devrait commencer par la mise en place de données interopérables, une responsabilité institutionnelle clairement définie, un développement pratique des compétences des enseignants et des mécanismes de protection centrés sur l'humain, plutôt que par une automatisation à grande échelle. L'enseignement du chinois constitue un domaine pilote adapté permettant de tester ces fondements avant leur élargissement à d'autres domaines.

**Mots-clés:** *préparation à l'IA; gestion des programmes d'études; enseignement du chinois; TPACK; établissements secondaires tanzaniens; technologie éducative*

## 1. Introduction

Artificial intelligence is increasingly discussed as a means of strengthening teaching, learning, assessment and educational administration. Existing applications include adaptive learning, automated assessment, learning analytics, resource recommendation, prediction of learner performance and support for academic and administrative work (Ahmad et al., 2022; Ouyang et al., 2022). At organisational level, AI can also transform large quantities of text, numerical records and

administrative data into recommendations that support professional decision-making (von Krogh, 2018). These capabilities create potential value for curriculum management, including planning, design, implementation, assessment, monitoring, evaluation, teacher support, and resource allocation.

However, technological capability alone does not establish readiness. AI systems depend on reliable data, interoperable information systems, appropriate infrastructure, competent users, sustainable financing and clear accountability. Where these foundations are weak, AI may accelerate fragmented decision-making, reproduce inequities or create unwarranted confidence in machine-generated recommendations. Research on automation bias shows that users may overlook system failures or follow automated advice despite contradictory evidence (Skitka et al., 2000). For this reason, international guidance emphasises that AI in education should remain human-centred, inclusive, transparent and aligned with educational purposes (Miao et al., 2021; UNESCO, 2023).

The readiness question matters especially in resource-constrained education systems. Digital initiatives may be introduced while schools still face unstable connectivity, limited access to devices, uneven teacher preparation and fragmented administrative data. Such conditions make the distinction between technological availability and institutional readiness essential. Readiness is therefore understood in this study as the capacity of an education system to adopt AI-supported practices responsibly, sustainably and in ways that strengthen rather than replace professional judgement.

Tanzania provides a timely setting for this inquiry. The Education and Training Policy 2014, 2023 Edition recognises information and communication technology as an important component of education reform (Ministry of Education, Science and Technology [MoEST], 2023). More recently, the National Digital Education Strategy 2025-2030 and the National Guidelines for Artificial Intelligence in Education have provided explicit national direction for digital transformation and AI use (MoEST, 2025a, 2025b). These frameworks are an important policy achievement, but implementation still requires operational standards, institutional coordination, data governance, school-level capacity, and financing.

Chinese language education offers a useful pilot case for examining these requirements. Introduced in selected government secondary schools through Tanzania-China educational cooperation, the subject is nationally regulated but remains comparatively small. Its management involves MoEST, the Tanzania Institute of Education (TIE), the President's Office - Regional Administration and Local Government (PO-RALG), the National Examinations Council of Tanzania (NECTA), schools and partner institutions. It therefore connects curriculum design, teacher preparation and deployment, assessment, monitoring, instructional materials and resource allocation within a manageable policy field. Studies of Chinese language education in Tanzania have highlighted the influence of language policy, institutional partnerships, teacher preparation, localisation and employment-related expectations (Ammann & Masanilo, 2024; Kambaya & Hong, 2024; Likoko & Wu, 2025). Assessment research has also identified concerns about standardisation, teacher assessment literacy and alignment with communicative competence (Mbalu & Ikowelo, 2026).

Despite increasing research on AI in education, most studies focus on classroom applications, higher education, online learning or learner performance. Less attention has been given to system-level curriculum management in African secondary education. This study addresses that gap by examining how ready Tanzanian secondary education is for AI-enabled curriculum management, using Chinese language education as a diagnostic case. It asks how current conditions in governance, data, infrastructure, teacher capacity and financing enable or constrain responsible adoption, and which low-risk applications may provide realistic entry points.

### 1.1 Objectives and research questions

The study pursued four objectives:

- To assess readiness for AI-enabled curriculum management across governance, data, infrastructure, teacher capacity and financing.
- To identify the principal gaps and risks that could constrain responsible AI adoption.
- To identify practical, low-risk applications that could be piloted within Chinese language curriculum management.
- To propose a phased and human-centred pathway for implementation.

The study was guided by the following research questions:

- What is the current level of readiness for AI-enabled curriculum management in government secondary schools offering Chinese language?
- What gaps exist across governance, data systems, infrastructure, teacher capacity and financing?
- Which AI-supported applications could be introduced as low-risk, high-value pilots?
- What safeguards and implementation sequence are required for responsible scaling?

## 2. Literature Review and Conceptual Framework

### 2.1 AI in education and curriculum management

AI in education has evolved from intelligent tutoring and automated assessment to broader applications in learning analytics, prediction, content generation, and administrative decision support. Ouyang et al. (2022) found that AI applications in online higher education were used to predict learning status, recommend resources, automate assessment, and improve learning experiences. Xu and Ouyang (2022) argue that these applications should be interpreted within a complex educational system comprising technologies, learners, teachers, information, institutional conditions and learning environments.

This system's perspective is directly relevant to curriculum management. Curriculum decisions rely on multiple forms of evidence, including syllabi, teacher qualifications, enrolment, timetables, assessment outcomes, monitoring reports, instructional resources and budgets. AI-supported tools may assist with pattern identification, reporting, scheduling, item generation and resource tracking. Their value nevertheless depends on the quality and representativeness of input, the clarity of decision rights and the capacity of professionals to interpret outputs. AI should therefore be framed as decision support rather than autonomous authority.

### 2.2 Readiness domains and ethical conditions

Drawing on policy guidance and the empirical characteristics of the Tanzanian case, this study conceptualised readiness through five interrelated domains. Governance and standards concern policy direction, institutional roles, accountability and procedures for approving and reviewing AI-supported decisions. Data readiness concerns availability, quality, digitisation, interoperability, ownership and feedback. Infrastructure readiness includes connectivity, electricity, devices, software and technical support. Capacity readiness concerns teachers' and leaders' technological, pedagogical, ethical and analytical competence. Financing readiness concerns both initial investment and recurring costs for maintenance, training, data protection and evaluation.

Ethics and human oversight cut across all five domains. Generative AI may produce inaccurate or culturally inappropriate content, disclose confidential information or embed bias. UNESCO (2023) stresses the importance of privacy, age-appropriate use, transparency and human agency. Tanzania's national AI guidelines provide a relevant policy foundation, but effective implementation requires translating these principles into institutional routines, procurement standards, access controls, validation procedures, and clear accountability at national and school levels (MoEST, 2025b).

### 2.3 Teacher readiness and the TPACK framework

Teachers are central users of any curriculum-management technology because they generate implementation data, interpret assessment results, prepare learning materials and respond to curriculum requirements. The Technological Pedagogical Content Knowledge (TPACK) framework explains effective technology integration through the interaction of content knowledge, pedagogical knowledge and technological knowledge (Mishra & Koehler, 2006). It also distinguishes their intersections: pedagogical content knowledge, technological content knowledge, technological pedagogical knowledge and integrated TPACK.

TPACK is relevant beyond classroom presentation. Teachers using AI-supported tools for assessment design, reporting or resource selection must understand both the curriculum content and the pedagogical implications of technological outputs. They must also be able to question accuracy, detect bias and decide when human judgement should override a recommendation. Studies of teacher adoption further indicate that perceived usefulness, effort, cost and confidence shape willingness to use generative AI (Lu et al., 2024). Effective professional development should therefore combine technical practice, curriculum alignment and ethical judgement rather than provide generic demonstrations. This emphasis is consistent with UNESCO's (2024) competency framework, which links human-centred thinking, AI ethics, foundations and applications, pedagogy and professional learning.

### 2.4 Chinese language education as a pilot case

Chinese language education in Tanzania has grown through national policy support and international cooperation. The tripartite memorandum of understanding among PO-RALG, MoEST and the Confucius Institute Headquarters clarified responsibilities for curriculum support, teacher deployment and educational cooperation (PO-RALG, MoEST, & Hanban, 2020). The programme now operates across several regions and links government schools to national curriculum and assessment structures.

The subject also illustrates the pressures facing newer curriculum areas. Research has identified shortages of trained teachers, the need for localised materials and sustained professional development, and the importance of stronger assessment systems (Likoko & Wu, 2025; Lyanga, 2021; Mbalu & Ikowelo, 2026). These characteristics make it a productive pilot: it is small enough for controlled experimentation but sufficiently embedded in national institutions to reveal system-level constraints that would also affect other subjects.

### 2.5 Research gap and analytical proposition

Existing research provides strong evidence on AI applications and teacher technology integration, but less evidence on whether curriculum-management systems in African secondary education are institutionally prepared to use AI. This study therefore advances a simple analytical proposition: the educational value of AI-enabled curriculum management depends less on the novelty of the tool than on the strength of the surrounding governance, data, infrastructure, capacity, financing and ethical safeguards. The empirical analysis tests this proposition within Chinese language education.

## 3. Methodology

### 3.1 Research design and context

The study adopted a descriptive case study design with a mixed-methods orientation. A case study was appropriate because it examined Chinese language education as a bounded curriculum programme within its real-life institutional context (Yin, 2018). The mixed-methods approach allowed integration of qualitative evidence from documents and interviews with descriptive survey data (Creswell & Plano Clark, 2018). The study did not test causal relationships or estimate national effects; it aimed to diagnose readiness conditions and identify practical implications.

Fieldwork was conducted in Tanzania Mainland during July and August 2025. The study covered 19 government secondary schools offering Chinese language in 10 regions. At the time of the fieldwork database, the programme involved 48 active Chinese language teachers. The study also included national and institutional actors responsible for curriculum development, assessment, teacher administration, and policy implementation.

***Table 1:*** *Participation by data source*

| Data source / category | Participants | Role in the study |
|---|---|---|
| Teacher survey | 44 | Access, technology use, TPACK, professional development and attitudes towards AI |
| Chinese language teacher interviews | 10 | Curriculum implementation, assessment, reporting and practical constraints |
| Heads of schools / administrators | 8 | School supervision, infrastructure, timetable and resource allocation |
| TIE curriculum developer | 1 | Curriculum design, materials and implementation support |
| NECTA examination officer | 1 | National assessment and examination arrangements |
| MoEST coordinator | 1 | Policy direction and programme coordination |
| PO-RALG coordinator | 1 | Teacher deployment, school administration and supervision |
| Total key informant interviews | 22 | Multi-level qualitative evidence |

### 3.2 Participants and sampling

Purposive sampling was used because the study required participants with direct knowledge of Chinese language curriculum implementation, school administration, curriculum development, national assessment or education policy. The teacher survey reached 44 of the 48 active Chinese language teachers. Twenty-two key informants were interviewed. Table 1 reports participation by data source; some interviewed teachers may also have completed the survey, so the figures should not be added to produce a count of unique individuals.

### 3.3 Data sources and instruments

Three sources of evidence were used. First, document analysis examined the Education and Training Policy, the Chinese language syllabus, the memorandum of understanding, assessment-related materials, research permits and relevant institutional records (Tanzania Institute of Education [TIE], 2023, 2024). The documentary corpus was updated during manuscript revision to include the National Digital Education Strategy 2025-2030 and the National Guidelines for Artificial Intelligence in Education. Document analysis followed an organised process of selection, review and interpretation focused on governance, implementation, assessment, data, resources and digital readiness (Bowen, 2009).

Second, semi-structured interviews explored institutional roles, decision-making, data collection and use, teacher deployment, monitoring, infrastructure, professional development, financing and possible AI-supported applications. Third, a structured teacher questionnaire assessed access to devices and connectivity, technology use, professional development, and willingness to adopt AI and self-rated TPACK. The TPACK items were adapted from the survey developed by Schmidt et al. (2009) and were rated on a five-point scale.

### 3.4 Data analysis, integration and quality

Interview and documentary evidence were analysed thematically through repeated reading, coding, categorisation and comparison of recurring patterns (Braun & Clarke, 2006). Survey data were analysed descriptively using frequencies, percentages and mean scores in SPSS version 26. Percentages were rounded to whole numbers and based on valid responses for each item; consequently, minor denominator variation should be expected.

Evidence was integrated through triangulation. Claims were compared across policy documents, institutional interviews, school-level accounts and teacher survey patterns. Caution was applied to financial and infrastructure data. Because budgeting formats and reporting practices were not sufficiently standardised for robust cross-school cost comparison, financing findings are reported mainly as patterns rather than precise comparative estimates. Similarly, regional internet speed figures contained in an earlier draft were removed because the available school counts did not support defensible regional percentage estimates.

### 3.5 Ethics and limitations

The study formed part of an approved doctoral research project. Research clearance and institutional permissions were obtained before fieldwork. Participation was voluntary, informed consent was obtained, and responses were anonymised. No personally identifiable information is reported.

The study has five limitations. First, it focused on government schools offering Chinese language and does not represent all Tanzanian secondary schools. Second, the teacher survey was descriptive and relied partly on self-assessment, which may not reflect demonstrated technological competence. Third, the study was cross-sectional and did not evaluate the performance of an implemented AI system. Fourth, school financial information was not standardised enough for precise cost-effectiveness analysis. Fifth, Tanzania's AI and digital-education policy environment was evolving during and after fieldwork. The updated document review addresses this change, but implementation should be reassessed as national guidance is operationalised.

## 4. Results

### 4.1 Governance and standards readiness

Several institutions shared curriculum management for Chinese language education. MoEST provided national policy direction; TIE developed curricula and teaching and learning materials; PO-RALG managed school administration, teacher deployment and supervision through local-government structures; and NECTA was responsible for national assessment. The institutional architecture therefore contained the main functions required for curriculum management, but a single integrated coordination or information system did not support them.

Interview participants repeatedly described delays arising from separate mandates, reporting lines and approval procedures. In the teacher survey, approximately 67% perceived delays in curriculum-related decisions, including approval of materials and communication of assessment arrangements. Respondents commonly described decision cycles of four to six months for new initiatives, compared with a preferred period of one to two months. These findings indicate that formal institutional roles exist, but the routines connecting them remain weak.

The updated document review showed that Tanzania now has explicit national direction through the National Digital Education Strategy 2025-2030 and the National Guidelines for Artificial Intelligence in Education (MoEST, 2025a, 2025b). This corrects the earlier conclusion that no AI-specific national guidance existed. The remaining readiness gap is therefore not the complete absence of policy, but limited operationalisation at curriculum-programme and school levels. Participants did not identify established procedures for sharing AI-relevant data, validating AI-generated outputs, assigning accountability or auditing decisions within Chinese language curriculum management.

### 4.2 Data systems readiness

Schools routinely collected information on enrolment, attendance, assessment, subject allocation and curriculum implementation. However, 73% of surveyed teachers reported relying mainly on paper-based records for curriculum-related information, while 27% reported using digital tools. Interview evidence indicated that curriculum, examination and teacher-deployment data were held by different institutions and could not easily be combined.

This fragmentation restricted system-level analysis. AI-supported planning would require dependable links among curriculum requirements, teacher qualifications, deployment, school timetables, enrolment, assessment performance and resource availability. Where records are incomplete, differently formatted or inaccessible across institutions, automated analysis may produce partial or misleading recommendations.

Feedback loops were also limited. Only 22% of surveyed teachers reported receiving regular feedback based on the information they submitted. Data largely moved upwards for reporting, with comparatively little information returning to teachers and school leaders in a form that supported improvement. Data readiness therefore requires more than digitisation: it requires common definitions, validation rules, clear ownership, interoperable systems, and useful feedback to support implementation.

### 4.3 Infrastructure readiness

Basic digital access was present but uneven. Approximately 83% of respondents reported some form of internet access, mainly through mobile networks. Access did not necessarily mean reliable or affordable connectivity. Participants described differences in signal quality, data cost and the ability to sustain online work.

Teacher access was concentrated in personally owned devices. Seventy-eight per cent reported a personal smartphone, 34% reported access to a tablet and only 12% reported access to a school-provided laptop. Student access to digital devices was below 5%. Although the surveyed schools had electricity, 45% reported recurring power interruptions, commonly two or three times per week. These results suggest that early applications should be teacher- or administrator-facing, mobile-friendly, low-bandwidth and capable of offline or delayed synchronisation.

### 4.4 Teacher capacity readiness

Teachers' self-assessments showed stronger subject and pedagogical knowledge than technology-related knowledge. Table 2 presents mean scores on the five-point TPACK scale. For descriptive interpretation, scores from 1.00 to 2.99 were treated as weak, 3.00 to 3.99 as moderate and 4.00 to 5.00 as strong. These categories are interpretive summaries rather than validated diagnostic cut-offs.

***Table 2:*** *Teachers' self-rated TPACK competencies*

| TPACK component | Mean | Descriptive interpretation |
|---|---|---|
| Content knowledge (CK) | 4.2 | Strong |
| Pedagogical knowledge (PK) | 3.9 | Moderate |
| Technological knowledge (TK) | 2.8 | Weak |
| Pedagogical content knowledge (PCK) | 3.7 | Moderate |
| Technological content knowledge (TCK) | 2.5 | Weak |
| Technological pedagogical knowledge (TPK) | 2.3 | Weak |
| Overall TPACK | 2.4 | Weak |

Content knowledge had the highest mean (4.2), followed by pedagogical knowledge (3.9) and pedagogical content knowledge (3.7). Technological knowledge (2.8), technological content knowledge (2.5), technological pedagogical knowledge (2.3) and overall TPACK (2.4) were weak.

The pattern indicates that the principal capacity constraint was not subject expertise but the ability to connect technology with curriculum content, pedagogy, assessment and professional decision-making.

Despite these limitations, willingness was high: 91% expressed readiness to learn and use AI-supported tools, particularly where they could reduce routine workload, support lesson preparation, assist assessment or improve access to resources.

Professional development was limited, however. Teachers reported an average of 3.2 days of technology-related training in the preceding year; 84% considered the training too short, too general or lacking follow-up, and only 21% had received training specifically related to curriculum-management tasks. Teachers also reported an average of 42 hours per week on teaching and administrative work. Capacity-building would therefore need to be practical, embedded in work routines and supported over time.

### 4.5 Financing readiness

Financing readiness was the least standardised domain. Schools reported some expenditure on internet access and data bundles, but fewer systematic provisions for devices, software, subscriptions, technical support, maintenance or technology-focused professional development. Participants were often more familiar with immediate operating expenses than with the total recurrent cost of digital transformation.

The evidence therefore does not justify precise comparative school budgets or national cost projections. Instead, it shows a recurring pattern: schools fund basic connectivity episodically, while the less visible costs of sustained implementation are poorly planned. Any AI initiative would require a costed lifecycle covering procurement or development, hosting, data protection, maintenance, user support, professional development, evaluation and eventual replacement.

### 4.6 Low-risk opportunities and readiness synthesis

Participants identified three recurring problems that could be addressed through limited, decision-support applications rather than full automation. Table 3 summarises these opportunities. They are described as low-risk because they address existing administrative and pedagogical tasks, can be piloted within a small programme and allow human experts to validate every consequential output.

**Table 3:** *Low-risk AI-supported curriculum-management opportunities*

| Area | Current challenge | Proposed function | Required safeguard |
|---|---|---|---|
| Timetable analytics | Teacher allocation and contact hours are difficult to compare across schools. | Flag conflicts, compare planned and actual contact hours, and support allocation review. | School and district officers verify all recommendations before changes are made. |
| Formative item banks | Teachers prepare syllabus-aligned assessments individually and assessment quality varies. | Organise validated items, generate draft quizzes and summarise performance patterns. | TIE and assessment specialists approve item quality, language, difficulty and curriculum alignment. |
| Budget dashboards | School leaders have limited consolidated visibility of technology and instructional-resource expenditure. | Track planned and actual expenditure, resource needs and maintenance alerts. | Authorised officers validate data and retain responsibility for financial decisions. |

Across the readiness domains, teachers' willingness to learn and experiment was the strongest enabling condition. The weakest conditions were interoperable data, practical institutional coordination, technology-related teacher competence, reliable access to school-owned devices, recurrent financing and operational ethical safeguards. The findings do not support large-scale automation. They support foundational investment followed by controlled pilots.

## 5. Discussion

### 5.1 Chinese language education as a diagnostic pilot

The findings confirm that Chinese language education is an appropriate diagnostic pilot for AI-enabled curriculum management. It is relatively small, but it requires the same system functions found in larger curriculum areas: curriculum design, teacher deployment, instructional support, assessment, monitoring and resource allocation. A pilot within this subject can therefore reveal institutional constraints while limiting financial and operational exposure.

The pilot framing also prevents AI from being reduced to a language-learning application. The principal readiness gaps identified were organisational: fragmented decisions, separated databases, weak feedback, limited equipment and insufficiently sustained professional development. These findings support the systems perspective advanced by Xu and Ouyang (2022), in which AI outcomes are shaped by the interaction of technological, human, informational and institutional elements.

### 5.2 Policy direction is necessary but not sufficient

Tanzania's 2025 digital-education strategy and AI guidelines represent a stronger policy foundation than the earlier manuscript acknowledged. Their existence changes the diagnosis from policy absence to an implementation gap. The central task is now to translate national principles into operational arrangements for curriculum work: which institution owns which data, who authorises access, which outputs require expert validation, how errors are corrected and who remains accountable for decisions.

This distinction matters because an AI tool cannot resolve unclear governance. If TIE, NECTA, PO-RALG, and schools continue to

operate through disconnected systems, automation may speed up fragmented processes without making them more coherent. Governance readiness should therefore precede procurement. A lead coordination mechanism, shared data standards, and documented human-review procedures matter more than sophisticated predictive tools.

### 5.3 Data and infrastructure as foundations

The predominance of paper records and weak feedback loops shows that data readiness is not simply a technical issue. Data that move upwards but do not return as actionable feedback have limited value for teachers and school leaders. Interoperability must therefore be useful: systems should reduce duplicate reporting, make validation visible, and return information that supports local curriculum decisions.

Infrastructure findings also caution against a uniform national model. High personal smartphone access does not compensate for the low availability of school-owned laptops, limited student access or unstable electricity. Early tools should work on existing devices, minimise data requirements and preserve core functions during connectivity interruptions. Equity monitoring should be built into pilots so that schools with weaker infrastructure are not systematically excluded.

### 5.4 Teacher capacity and professional agency

The TPACK results reveal a favourable but incomplete readiness profile. Teachers were confident in content and pedagogy and showed high willingness to learn, yet they lacked confidence in applying technology to curriculum and pedagogical decisions. This suggests that resistance is not the main barrier. The challenge is to convert willingness into competence through repeated, contextualised practice.

Professional development should therefore focus on real tasks rather than abstract AI literacy alone. Teachers could learn by reviewing AI-generated assessment items, checking timetable outputs, interpreting dashboards and identifying inaccurate or biased recommendations. Such activities would develop technological knowledge while preserving curriculum expertise and professional agency. This approach is consistent with the TPACK framework and research showing that perceived usefulness and manageable effort influence adoption (Lu et al., 2024; Mishra & Koehler, 2006).

### 5.5 Ethics, human oversight and risk

Human oversight is essential because curriculum-management decisions affect teacher workload, learner opportunity, assessment and resource distribution. Automation bias may lead users to accept apparently precise outputs without adequate verification (Skitka et al., 2000). In the Tanzanian context, weak data quality could compound this risk: a technically correct model can still generate an unfair recommendation from incomplete or historically unequal data.

Responsible implementation should therefore require data minimisation, role-based access, documented validation, appeal and correction procedures, audit trails and periodic review for regional or school-level bias. AI-generated assessment content should never enter classroom or national use without subject and assessment specialists confirming linguistic accuracy, cultural appropriateness and syllabus alignment. These safeguards operationalise the human-centred principles in national and international guidance (MoEST, 2025b; UNESCO, 2023).

### 5.6 A phased implementation pathway

The evidence supports three phases of implementation. The phases are developmental rather than fixed calendar periods; progression should depend on demonstrated readiness and evaluation.

***Table 4:*** *Phased pathway for AI-enabled curriculum management*

| Phase | Priority actions | Evidence required before progression |
|---|---|---|
| 1. Foundational digital | Clarify institutional roles; standardise core data; digitise priority records; establish access and validation rules; provide practical TPACK and AI-ethics training. | Accurate baseline data, functioning feedback loops, named accountability and minimum infrastructure in pilot schools. |
| 2. Assisted analytics | Pilot timetable checking, validated item banks and budget dashboards; maintain human approval; document errors, workload effects and equity implications. | Independent evaluation showing useful, accurate and equitable support without weakening professional judgement. |
| 3. Targeted AI | Introduce narrowly defined predictive or generative functions that passed earlier evaluation; integrate monitoring, privacy controls and bias audits; scale gradually to other subjects. | Sustained financing, technical support, transparent governance and evidence that benefits exceed risks and recurrent costs. |

## 6. Conclusion and Recommendations

This study assessed readiness for AI-enabled curriculum management in Tanzanian government secondary schools using Chinese language education as a pilot case. The system has important enabling conditions: national digital and AI policy direction, established curriculum institutions, routine collection of education data and strong teacher willingness. Readiness nevertheless remains uneven because coordination is fragmented, records are largely paper-based, institutional databases are not interoperable, school-owned devices are limited, technology-related

TPACK is weak, and financing is not organised around the full lifecycle of digital systems.

The central conclusion is that Tanzania should strengthen curriculum-management foundations before pursuing large-scale AI automation. The most appropriate starting point is a controlled pilot that supports, rather than replaces, human judgement. Assisted timetable analytics, validated formative item banks, and budget dashboards are plausible first applications because they address existing problems and can be evaluated within a manageable programme.

### 6.1 Recommendations

- **Establish an inter-institutional governance mechanism.** MoEST, TIE, PO-RALG and NECTA should define data ownership, access, validation, decision rights, accountability and timelines for AI-supported curriculum-management processes.
- **Develop a minimum interoperable dataset.** The pilot should link school coverage, teacher qualifications and deployment, enrolment, timetables, curriculum requirements, assessment results, materials, infrastructure and professional-development records using common definitions and validation rules.
- **Translate national AI guidance into operating procedures.** The National Guidelines for Artificial Intelligence in Education should be accompanied by programme-level protocols on privacy, acceptable use, human review, appeals, audit trails, procurement and incident reporting.
- **Provide task-based professional development.** Training should use real curriculum tasks, combine TPACK with AI literacy and ethics, and include coaching and follow-up rather than one-off workshops.
- **Pilot only low-risk decision-support tools initially.** Timetable analytics, item banks and budget dashboards should be tested in selected Chinese language schools with expert validation and clearly defined success criteria.
- **Adopt lifecycle financing.** Budgets should include development or procurement, hosting, maintenance, connectivity, user support, training, data protection, evaluation and replacement rather than only initial acquisition.
- **Evaluate before scaling.** Pilots should be assessed for accuracy, workload, usability, equity, privacy, cost and effects on professional judgement. Scaling to other subjects should occur only when evidence demonstrates sustainable benefit.

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**Ethics and consent:** Research clearance and institutional permission were obtained before data collection. Participation was voluntary, all participants provided informed consent, and data were anonymised.

**Data availability:** The underlying data are not publicly available because of confidentiality and institutional restrictions. Selected anonymised information may be made available by the corresponding author upon reasonable request and subject to relevant approvals.

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