North-West University | NSTF Forum

When AI Meets the Real Classroom

STEM, access, language and human learning in South Africa's classrooms

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What do you see?



The human approach

AI makes the humanities more important to STEM, not less

AI can generate code, calculations and content. It cannot supply judgement, ethics, cultural context or the ability to communicate a finding responsibly to another human being. The humanities are therefore not an add-on to STEM. They are part of what makes STEM trustworthy and reliable.

Critical thinking & ethics

Philosophy, logic and ethics train learners to question an AI's output, not accept it, the exact skill STEM now needs most.

Language & communication

Explaining scientific findings clearly, across South Africa's languages, is a humanities skill that AI cannot own on a learner's behalf. Interaction with AI is based in language input

Culture & context

History and social science help learners ask who a technology serves, whose knowledge counts and who may be left out.

Social responsibility

Understanding law, policy, identity and human impact turns technical STEM skill into responsible practice.

This is the case for STEM: mathematics, science, and engineering supply the how; the humanities keep asking why, for whom, and with what consequences.

AI is reshaping language itself, not only how we teach it

Language models don't just process language; they model it statistically and increasingly shape how learners encounter, practice and produce it. For a multilingual country like South Africa, that is not a side issue. It sits at the centre of what AI in education means.

42 African languages have meaningful support across current language models, out of more than 2,000 languages on the continent. Coverage remains uneven and English remains dominant.

The problem

- **Models trained mainly on English and other high-resource languages can flatten dialect, idiom and register**
- **AI support is often weakest in the languages many learners use for meaning-making**
- **Outsourcing drafting skips the cognitive work of composing thought into language**
- **Heavy AI-assisted writing can smooth away a learner's developing voice before it has formed**

The promise

- **Feedback on grammar, structure and vocabulary can extend support beyond class time**
- **Scaffolding can help learners write academically in an additional language without replacing their own drafting**
- **Local language tools can support documentation and revitalisation when developed with communities**
- **Low-stakes language practice can build fluency and confidence**

Why the human stays central: language carries thought, identity and culture, not only information. The teacher decides when learners draft alone, when AI may assist and how learner voice is protected.

AI and STEM: The central argument

1. **Access**

   Who has the devices, data, electricity and language access to benefit?

2. **Rigour**

   Does AI build STEM reasoning, or let learners skip the work of explaining and proving?

3. **Humanity**

   How do we keep teachers, identity, language and human judgement at the centre?

> Artificial intelligence has arrived in classrooms before policy, infrastructure and teacher preparation are fully ready. The question is no longer whether AI belongs in education. The question is whether AI will strengthen learners' STEM reasoning, language, identity and agency, or quietly replace the human work through which learning develops.

Any AI strategy meets a real South African classroom

1	**Overcrowded classes**	Many schools teach large classes, so AI is often framed as individual support. It must not become a substitute for teacher judgement.
2	**Multilingual learners**	South Africa has 12 official languages. Many learners learn STEM through a language that is not their strongest language, while most AI tools remain strongest in English. What are our learners' language competencies in order to use AI?
3	**Unequal resources**	Schools are included in one national system but work with very different levels of funding, devices, connectivity and teacher support.
4	**Teachers under pressure**	Curriculum coverage, marking and administration stretch teacher time. Any AI tool must protect that time and improve learning, not add another burden. Teachers lack seficiant AI literacy.

Context: Statistics South Africa, 2025; DBE, 2024; UNESCO, 2024.

A Global South lens

Most AI-in-education models were not built for our classrooms

Many commercial AI-in-education products assume reliable power, constant broadband, one device per learner and content in the learner's language. These assumptions do not hold evenly in South African classrooms. South Africa needs to adapt critically, not import uncritically.

Power

Electricity interruptions make always-online AI tools unreliable, especially in contexts already carrying educational disadvantage.

Bandwidth

Cloud-based AI assumes constant connectivity. South African classrooms need offline-first and low-data tools.

Language

Large language models remain inconsistent across languages. Learners should not be forced into English-only AI support for STEM learning.

Cost

Subscription tools can become another hidden school fee, widening rather than closing opportunity gaps.

The Global South case is not less AI. It is locally accountable AI, designed around real constraints from the start.

STEM is never only technical

Every STEM pathway depends on language, identity and judgement

Concept formation

Naming and noticing

- Learners name, compare and explain patterns
- Teachers build vocabulary for mathematical and scientific ideas
- Home language supports understanding, not only translation

Evidence and argument

Reading and writing science

- Learners read graphs, justify methods and write conclusions
- Personalised NSC exam revision
- Identity matters when learners imagine themselves in STEM futures

Practice and safety

Workplace communication

- Simulations require language for instructions, warnings and teamwork
- Practical competence needs human sign-off
- Technical skill carries ethical and social responsibility

Knowledge production

Research and public trust

- AI can support searching and coding, not scholarly judgement
- Students must communicate findings clearly and honestly
- Personalised learning in large first-year cohorts

At every stage, AI may assist the task, but language, identity and human judgement make the learning meaningful and trustworthy.

The genuine opportunity

Used well, AI can support teachers without replacing human learning

✓

Marking & admin relief

Automating routine marking and records can give teachers more time for explanation, feedback and support.

✓

Differentiated practice

AI can generate additional examples, but the teacher must decide which examples fit learners' language, context and prior knowledge.

✓

Virtual labs & simulations

Simulations can extend practical STEM exposure where labs are limited, but they still need discussion, interpretation and safety reasoning.

✓

Multilingual support

AI can support multilingual explanation, but translation must be checked for concept accuracy, register and cultural fit.

✓

Early error diagnosis

AI can flag misunderstanding, but a teacher must interpret the error and decide the next pedagogical move.

✓

STEM exposure & guidance

AI can widen STEM exposure, but examples must affirm learners' identities and communities rather than present STEM as elsewhere.

Efficient use of AI

AI as a learning support, not an answer machine

The same technology can support learning or quietly hollow it out. The difference lies in whether AI strengthens explanation, dialogue and teacher judgement, or replaces the learner's effort.

ACTIVE

AI as learning support

- Supports the teacher's plan and pacing
- Offers alternative explanations in accessible language
- Gives hints that prompt the learner's own next step
- Surfaces misconceptions for human follow-up
- Frees teacher time for dialogue and feedback

PASSIVE

AI as answer machine

- Produces a finished answer on demand
- Skips the explanation where reasoning develops
- Gives generic responses detached from local context
- Hides misunderstanding instead of surfacing it
- Weakens learners' confidence in their own voice

The goal is capability, not dependency on an app

This should be the test for every AI tool proposed for a South African classroom: does it build learners' capability, language and agency, or does it quietly replace the need for them?

Builds capability	Breeds dependency
Learner critiques an AI solution and explains the error	Learner copies an AI solution as the final answer
AI explains a method, learner practises and verbalises it	AI does the exercise so the learner avoids the thinking
Teacher decides when AI is pedagogically useful	AI use happens invisibly, outside teacher oversight
Learner is taught to question, verify and communicate	Learner treats AI output as automatically correct

What responsible rollout requires

01

Design for electricity constraints

Offline-first tools that cache content and sync when power and connectivity return.

02

Design for low data

Lightweight, low-bandwidth tools rather than assuming constant high-speed connectivity.

03

Invest in teacher development

Prepare teachers to evaluate, adapt and limit AI use pedagogically.

04

Build local-language capability

Invest in South African language datasets, terminology and tools, with communities involved.

05

Fund access equitably

Fund devices, connectivity and data so schools with fewer resources are not left behind.

06

Set clear rules of use

Provide guidance on acceptable use, assessment integrity, privacy, bias and human oversight.

Aligned with UNESCO AI Competency Framework for Teachers, human agency, ethics and pedagogy.

A call to the NSTF community

This is a multi-stakeholder problem

Policymakers

Set guidance on AI use, assessment integrity, data protection and equitable access in schools.

Industry & funders

Fund infrastructure, access and local-language development, not only pilot apps.

Researchers

Build the evidence base on what improves STEM learning, language access and learner agency here.

Teacher training institutions

Embed AI literacy, language-aware pedagogy and critical use into initial and in-service teacher education.

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