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Beyond Detection:
Designing AI-Resilient Assessment for *Authentic Learning* in STEM Education



Think Visible | Learn Authentically | Lead with AI | Shape the Future

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ASSESSMENT IN THE AGE OF GENERATIVE AI

The defining educational challenge of our time.

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THE CHALLENGE

Assessment in the age of generative artificial intelligence is one of the defining educational challenges of our time.

THE SCENARIO

We set assessments to explain concepts, solve problems, analyse data, code, design experiments or write reports.

THE OUTCOME

A week later, submissions arrive — excellent writing, impressive structure, correct calculations, working code, convincing references, sophisticated conclusions.

THE QUESTION

It looks like outstanding student work.
But we are left with one uncomfortable question...
What did my student actually learn?

THE REALITY

That, for me, is the assessment challenge of the AI era.

KEY TAKEAWAYS

- AI is here and evolving
- Excellence in outcomes is no longer enough
- We must look beyond the final product
- Focus on learning, thinking and understanding
- Redesign assessment for authentic and meaningful learning



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Moving Beyond the Wrong Question

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Let's shift from policing AI use to designing assessment that makes **learning meaningful and visible.**

THE DOMINANT QUESTION

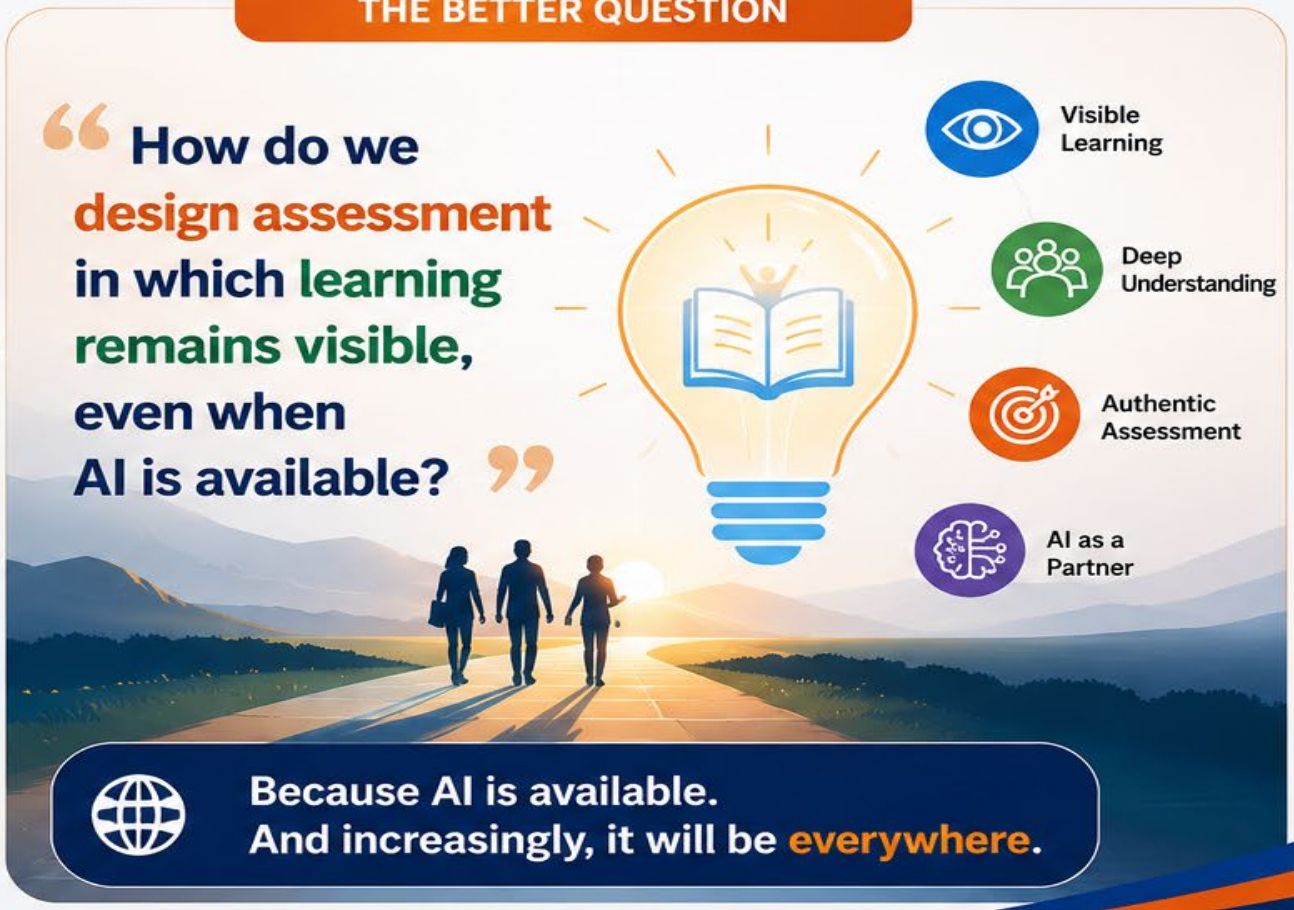
"How do we **catch students using AI?**"



- Short-term focus
- Arms race we can't win
- Controls not learning

THE BETTER QUESTION

"How do we **design assessment** in which **learning remains visible,** even when AI is available?"



Because AI is available.
And increasingly, it will be everywhere.

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Which student deserves the higher mark?

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Student A



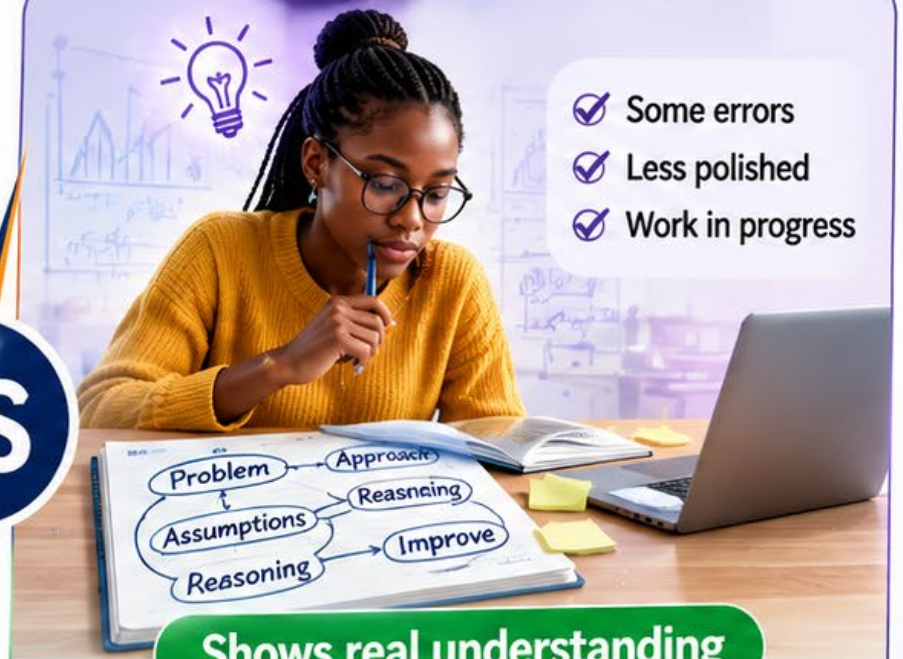
- Polished
- Accurate
- Well presented
- Correct

Great final product

Struggles to explain

VS

Student B



- Some errors
- Less polished
- Work in progress

Shows real understanding

- ✓ Explains reasoning
- ✓ Defends approach
- ✓ Adapts solution

Which student deserves the higher mark?



What do our rubrics really reward?

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Moving from product to understanding

Are we fighting the wrong battle?

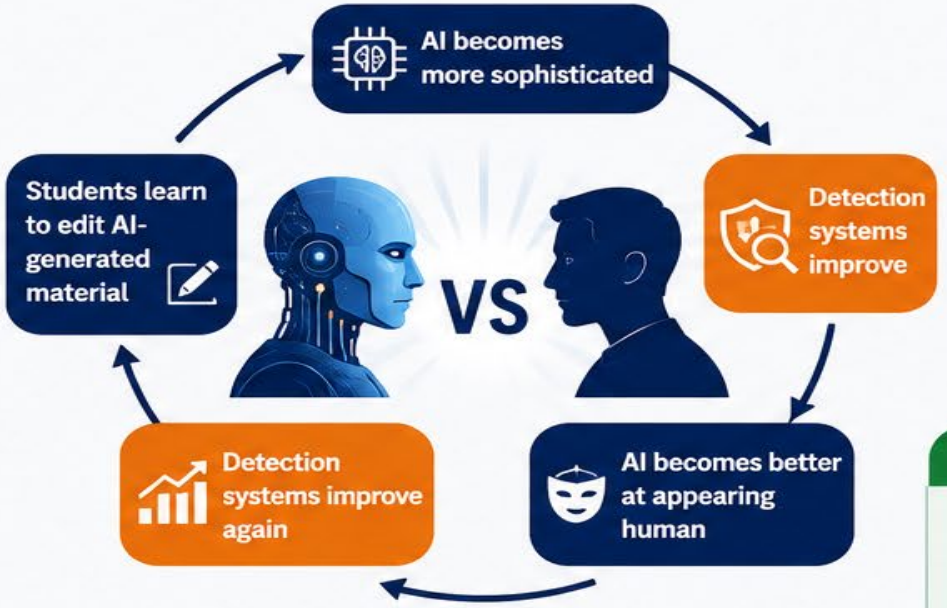
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INITIAL FOCUS: DETECTION

- Was this written by AI?
- How much of this was generated by AI?
- Can plagiarism software identify AI text?
- Can we recognise AI-style language?
- Can we prohibit certain tools?

Important questions when integrity is at stake.

THE ARMS RACE NOBODY WINS



AI becomes embedded in everyday tools
Where exactly do we draw the line?

DETECTION ASKS THE WRONG QUESTIONS

- Where an answer came from →
- Whether learning actually occurred →

Tells us little about learning.
Focuses on origin, not understanding.

THE FUNDAMENTAL SHIFT

From policing the origin » To evaluating the quality of learning

- AI is everywhere (invisible, embedded, inevitable).
- Detection cannot be the foundation of our long-term assessment strategy.
- What matters most: **Meaningful learning**, not just monitoring.

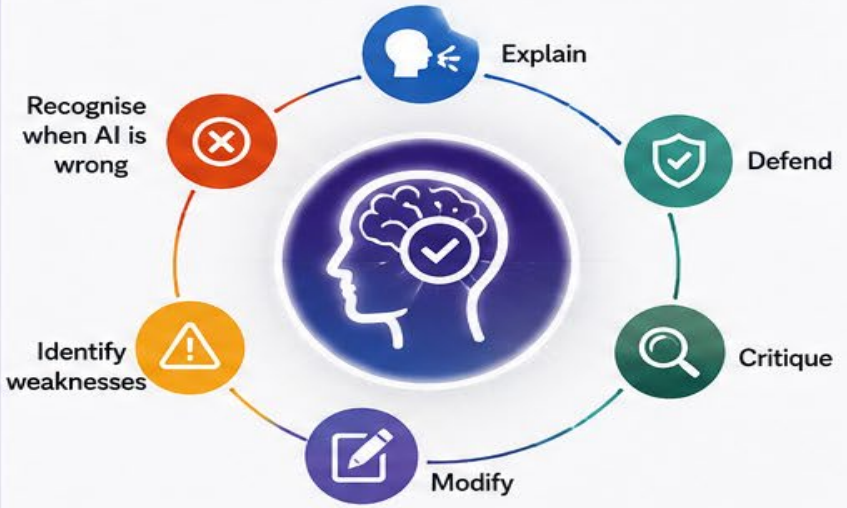
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From authorship to intellectual ownership

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TRADITIONAL FOCUS	AI-ERA FOCUS
Did the student **produce this?**	Can the student **explain** this?
Is the answer **correct?**	Can the student **justify** why it is correct?
Did the student **use AI?**	How did the student use AI, and what **intellectual contribution** did they make?
Can students **reproduce** knowledge?	Can students **apply, critique, verify** and **adapt** knowledge?

INTELLECTUAL OWNERSHIP



A richer view of assessment integrity.

An AI-resilient assessment is one in which a student cannot achieve the learning outcomes merely by outsourcing cognition to AI.

AI may participate in the task. » The learner must remain intellectually accountable.

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Is this simply another calculator moment?

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NOT THE FIRST DISRUPTION

- Calculators → Search engines → Wikipedia → Computational software → Smartphones
- Each disrupted educational practices
- Education adapted
- We changed what students were expected to demonstrate

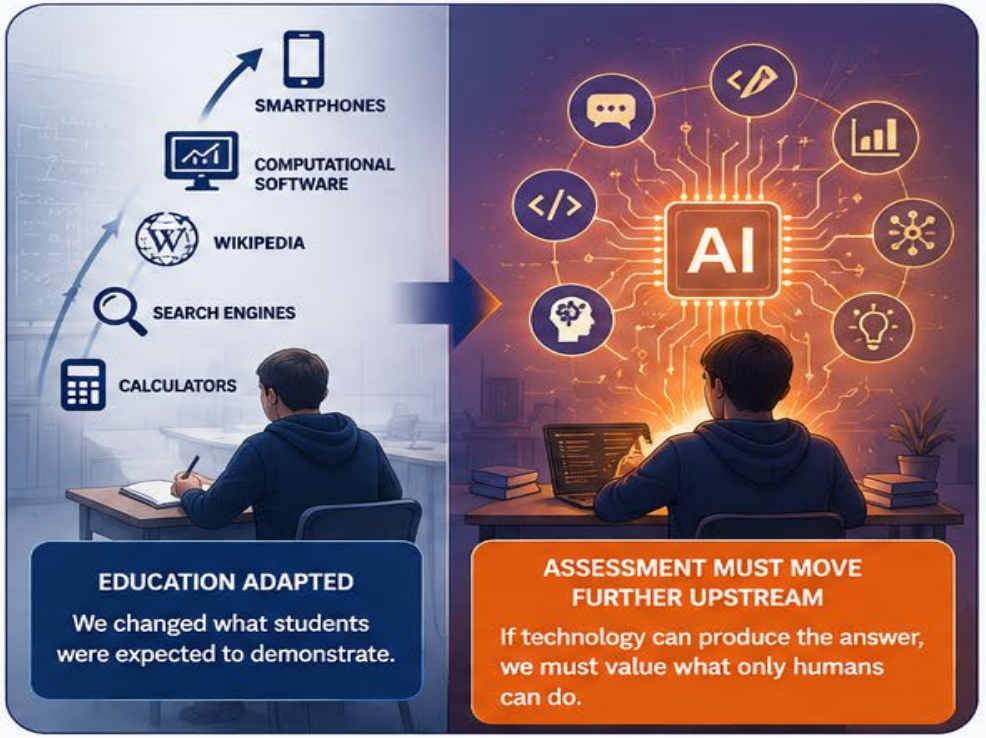
THEN AND NOW

- Calculator automated **calculation**
- Google automated **information retrieval**
- Generative AI automates **cognitive academic work**

GENERATIVE AI GOES FURTHER

- Explain
- Summarise
- Write
- Code
- Analyse
- Synthesise
- Propose solutions
- Simulate reasoning

AI systems increasingly perform sequences of tasks on our behalf.



THE NEW IMPERATIVE

Judgement | Reasoning | Verification | Application | Adaptation | Intellectual Ownership

Education must develop human capabilities that AI cannot replace.

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The TRACE Framework

AI-resilient assessment that leaves a trace of learning

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Evidence of cognition | Academic integrity | Graduate readiness

TRACE

T — Thinking must be visible



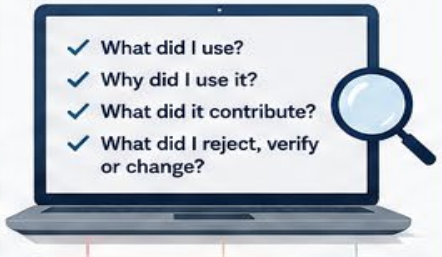
- Capture the thinking, not just the final answer
- Show the process, decisions, failures and revisions
- Assesses understanding and computational thinking

R — Real-world context



- Use authentic, local and messy problems
- Include data, constraints, uncertainty and competing priorities
- Require judgement and ethical considerations

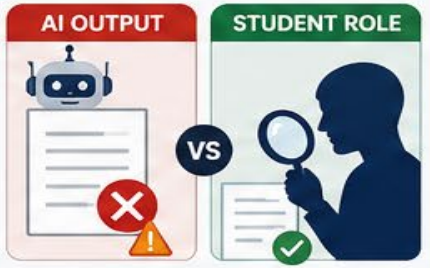
A — AI use is transparent



RED	AMBER	GREEN
AI prohibited	AI with conditions	AI expected

- Declare AI use clearly
- Promotes honesty and clarity
- Builds responsible AI literacy

C — Critique and verification



- Interrogate, challenge and verify AI output
- Find errors, test assumptions, check calculations, code and references
- Produce a better, evidence-based solution

E — Explain and defend



- Add short oral components (micro-viva)
- Demonstrate understanding, reasoning and adaptability
- Shows intellectual ownership and accountability

From product (to answers) → To process (to thinking)

From authorship (to who wrote it) → To intellectual ownership (to who understands it)

Assess the learner, not just the output.

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Let us redesign an assessment

From a traditional task to an AI-resilient, learning–visible assessment

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TRADITIONAL TASK

"Write a 2,000-word report explaining applications of artificial intelligence in renewable-energy systems."

Generative AI can produce a competent answer in seconds.

REDESIGNED: AI–RESILIENT ASSESSMENT

1 GIVE A SPECIFIC PROBLEM

Provide real or realistic context with data, constraints and stakeholders.

Anchor the task in reality.

2 DIAGNOSE THE PROBLEM

Identify key issues, causes, assumptions, uncertainties and impacts.

Show your understanding.

3 DEVELOP AN INITIAL SOLUTION

Propose your own solution or approach with justification.

Your thinking first.

4 USE AI TO GENERATE ALTERNATIVE SOLUTION

Use an AI tool to propose an alternative solution.

Engage AI purposefully.

5 COMPARE AND ANALYSE

Compare your solution with AI's. What agrees? What differs? What did each miss?

Deepen critical thinking.

6 VERIFY AI CLAIMS

Check important AI claims against credible scientific evidence, data or sources.

Evidence over plausibility.

7 PRODUCE IMPROVED SOLUTION

Create an improved solution incorporating what you learned from comparison and verification.

Synthesis and improvement.

8 AI-USE STATEMENT + ORAL DEFENCE

Submit a brief AI-use statement and defend one important decision in a short oral viva.

Own and defend your choices.

WHAT HAS HAPPENED?

- ✓ AI is not removed.
- ✓ AI is made pedagogically useful.
- ✓ Student thinking is made visible.

THIS ASSESSMENT NOW ASSESSES:

- Disciplinary knowledge
- Critical thinking
- Evidence evaluation
- AI literacy
- Reflection
- Professional judgement

Not just the answer, but the intellectual journey.

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Our rubrics must change too

Rubrics communicate our real priorities.

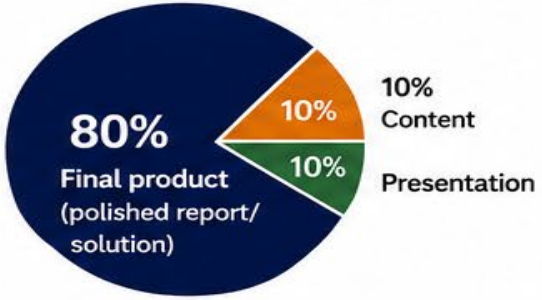
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WHAT WE SAY WE VALUE

- Critical thinking
- Reasoning
- Verify AI-generated information
- Responsible AI use
- Reflection

BUT

WHAT THE MARKS ACTUALLY REWARD



Students look at the marks. They understand what we really value.

IF IT MATTERS, MARK IT.

If reasoning matters	Mark reasoning.
If verification matters	Mark verification.
If responsible AI use matters	Mark responsible AI use.
If reflection matters	Mark reflection.
If transparency matters	Mark transparency.

A STEM ASSESSMENT RUBRIC THAT REFLECTS OUR PRIORITIES

1. DISCIPLINARY KNOWLEDGE — Accuracy, depth and breadth of subject knowledge. — 20%

2. REASONING & DECISION-MAKING — Quality of analysis, assumptions, logic, and decisions. — 20%

3. APPLICATION & SOLUTION — Appropriateness and creativity in applying concepts to context. — 20%

4. VERIFICATION & CRITIQUE — Evaluation of evidence, testing, critique of AI outputs and limits. — 20%

5. REFLECTION & AI TRANSPARENCY — Reflection on learning, AI-use statement and transparency. — 20%

Our rubrics communicate our real educational priorities far more powerfully than our policies do.

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The South African and African dimension

AI resilience must not become AI privilege.

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THE REALITY: UNEQUAL ACCESS

- Not every student **has the same device.**
- Not every student **has stable connectivity.**
- Not every student can **afford premium AI access.**
- Not every student has **the same level of AI literacy.**
- AI systems do not always perform equally across languages, cultures and contexts.

The digital divide risks evolving into an **AI capability divide.**

OUR IMPERATIVE

- AI-resilient assessment must be **AI-aware and inclusion-aware.**
- Universities cannot simply tell students to "use AI responsibly" without ensuring **equitable opportunities.**
- This requires investment in access, infrastructure, literacy, language, staff development and inclusive assessment design.
- Authentic learning must **remain accessible learning.**



WHAT INSTITUTIONS MUST INVEST IN

ACCESS & INFRASTRUCTURE
Devices, connectivity, platforms and support that reach all students.

DIGITAL & AI LITERACY
Build capabilities to use, evaluate and apply AI confidently and critically.

LANGUAGE & CULTURE
Design assessments that are linguistically and culturally responsive.

STAFF DEVELOPMENT
Equip educators to design, assess and guide AI-aware learning.

INCLUSIVE ASSESSMENT DESIGN
Multiple means of demonstrating learning; contextual and fair.

Bridging the digital divide to close the AI capability divide.

Equity today. Capability for tomorrow.

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What does the STEM graduate of 2030 need?

Beyond knowledge. Towards judgement. For impact.

The future advantage is not prompting AI. It is **knowing when AI is wrong.**

A 2030 STEM GRADUATE MUST...

KNOW
Strong foundational disciplinary knowledge remains essential.

APPLY
Apply knowledge to solve real-world, complex problems.

CREATE
Design, innovate and build new solutions and possibilities.

VERIFY
Check, test and validate information, results and assumptions.

CHALLENGE AI
Interrogate outputs, test logic, uncover flaws and biases.

COLLABORATE WITH AI
Use AI as a partner to augment human capability.

KNOW WHEN NOT TO USE AI
Exercise judgement on when human expertise must lead.

KNOW WHEN AI CAN BE WRONG

- When the AI-generated answer is wrong.
- When the evidence is inadequate.
- When the dataset is biased.
- When the recommendation is inappropriate for the local context.
- When the proposed solution is unethical.
- When professional judgement should override automation.
- When a human being must take responsibility for the final decision.

WHY IT MATTERS IN STEM

Incorrect decisions in STEM are not just academic errors—
they can have real-world consequences.

BRIDGES · SOFTWARE SYSTEMS · INFRASTRUCTURE · HEALTHCARE · ENVIRONMENTS · HUMAN LIVES

STEM graduates of 2030 must combine knowledge, critical thinking, AI literacy and ethical judgement to make **responsible decisions** that create a **better, safer and more sustainable future.**

**The future belongs to graduates who don't just use AI—
but understand it, question it, and know when not to use it.**

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THREE QUESTIONS FOR EVERY STEM ASSESSMENT

Start small.
Start with one.
Make it count.

1

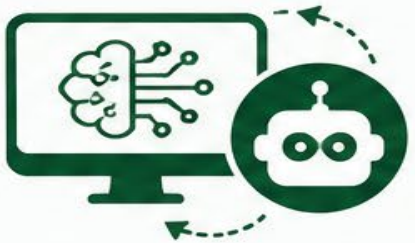
What thinking are we actually assessing?



Not content. Thinking.

2

Could that thinking be outsourced entirely to AI?



If yes, rethink the task.

3

What evidence would demonstrate that the student genuinely owns the learning?

- Oral defence
- Reflection
- Drafts
- Decision trail
- Critique of AI output
- Apply to an unfamiliar problem
- Or all of these

Make thinking visible. Show ownership.

If AI can complete the entire assessment while the student learns almost nothing, we may have discovered an assessment-design problem—not an AI problem.

And that is something within our power to change.

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BEYOND DETECTION

Redesign assessment for a future of integrity.

AI will keep getting over the wall. Redesign what happens inside.

FROM...	TO...
PRODUCT What is produced.	**PROCESS** How thinking unfolds.
ANSWER The final response.	**REASONING** The thinking behind it.
POLICING Focus on catching issues.	**TRANSPARENCY** Open about AI use and choices.
RECALL Remembering information.	**JUDGEMENT** Applying, evaluating, deciding.
AI AVOIDANCE Restricting or banning AI.	**AI LITERACY** Using AI critically and responsibly.
AUTHORSHIP Did the student produce this?	**INTELLECTUAL OWNERSHIP** Can the student explain, defend, adapt and own it?

The goal is not to build higher walls, but to build better assessments that develop competence, character and confidence for a complex world.

Assessment integrity is not about stopping AI.
It's about developing authentic human capability in an AI-rich world.

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CLOSING

Not AI-proof assessments.

Student **thinking** must be visible.

Think with AI. **Don't surrender** your thinking to AI.



QUESTIONS FOR DISCUSSION

01 What STEM competencies must remain **demonstrably human?**

02 Should **responsible AI use** be an explicitly assessed graduate competency?

03 If **ChatGPT** can score 80% today, what does that tell us?

ASSESSMENTS THAT DEVELOP KNOWLEDGE. JUDGEMENT. IMPACT.

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Thank YOU!





Together, let's shape authentic, inclusive and AI-resilient assessment for meaningful learning.

THINK | VERIFY | COLLABORATE | INNOVATE | LEAD

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INSPIRING GREATNESS