

# Beyond the workaround: Rethinking how students learn mathematics in an AI- enabled world

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# Much (All) of Year 1 & 2 is vulnerable, as well as our projects. . .

## Calculus & Algebra

Solves routine problems involving integration, differentiation, limits, and series

## Linear Algebra

Handles matrix operations, solves systems, and computes eigenvalues/vectors

## Statistics & Probability

Performs standard statistical tests and analyses, and simulates random processes

## Proofs & Logic

Generates standard proofs and assists with formal logic and verification

## Programming & Computation

Writes and explains code, implements algorithms, and produces visualisations

## Conceptual Understanding

Explains mathematical ideas clearly and provides step-by-step solutions

**Q2.** A soft drink company has a 10,000 litre (L) industrial mixing tank filled with pure water. The tank is drained at a rate of 12 litres per minute ( $\text{L min}^{-1}$ ) whilst a syrup solution containing 10 kilograms per litre ( $\text{kg L}^{-1}$ ) of sugar is pumped into the tank at a rate of  $10 \text{ L min}^{-1}$ . Assuming that the mixture is instantly and uniformly mixed, formulate and solve an initial value problem to model the mass of sugar  $y(t)$  in the tank after  $t$  minutes of mixing for all  $t \in [0, 5000]$ .

### 4. Volume of liquid in the tank over time:

$$\frac{dV}{dt} = \text{Rate in} - \text{Rate out} = 10 \text{ L/min} - 12 \text{ L/min} = -2 \text{ L/min}$$

$$V(t) = 10,000 - 2t$$

### 5. Rate of change of sugar mass:

- The sugar entering the tank is at a rate of  $10 \text{ L/min} \times 10 \text{ kg/L} = 100 \text{ kg/min}$ .
- The sugar leaving the tank is proportional to the concentration of sugar in the tank:

$$\text{Rate out} = \left( \frac{y(t)}{V(t)} \right) \times 12 \text{ L/min}$$

### 6. Differential equation for $y(t)$ :

$$\frac{dy}{dt} = \text{Rate in} - \text{Rate out} = 100 - \frac{12y(t)}{10,000 - 2t}$$

# through its widespread (and appropriate) use.

“In 2025, we find that the student use of AI has surged in the last year, with almost all students (92%) now using AI in some form, up from 66% in 2024, and some 88% having used GenAI for assessments, up from 53% in 2024. The main uses of GenAI are explaining concepts, summarising articles and suggesting research ideas, but a significant number of students – 18% – have included AI-generated text directly in their work.”

When asked why they use AI, students most often find it saves them time and improves the quality of their work. The main factors putting them off using AI are the risk of being accused of academic misconduct and the fear of getting false or biased results. Women are more worried about these factors than men, and men report more enthusiasm for AI throughout the survey, as do wealthier students and those on STEM courses.”



## Student Generative AI Survey 2025

**Kortext**

Josh Freeman

HEPI Policy Note 61

February 2025

### Recommendations:

1. **Every institution should continually review all its assessments and assessment procedures to keep up with the growing power of AI tools and students' competency in using them.**
2. **...every member of staff involved in setting exams should have a deep working understanding of AI tools**
3. **Institutions should adopt a nuanced policy which reflects the fact that student use of AI is inevitable and often beneficial.**
4. **Institutions should keep AI policies under constant review as the capabilities of AI technologies develop.**
5. **... institutions should seek opportunities to cooperate.**

# But 'banning AI' or 100% examinations is not the answer.

AI is not a temporary threat - it is a permanent shift. Our response needs to be educational, not defensive.

## Bans don't reflect the world students are entering.

- AI is embedded in modern workplaces - students need critical, ethical AI fluency.

## Total reliance on exams narrows what we assess.

- Exams often emphasise speed over modelling, reasoning, or interpretation.

## Equity and accessibility matter.

- Not all students perform best under timed conditions - diverse assessment matters.

## Bans are hard to enforce and encourage workarounds.

- Without guidance, students will use AI covertly and inconsistently.

## There is a broader context of financial and staffing pressures.

- Universities are seeking more efficient, scalable, and sustainable assessment models.

Perkins et al., 2024

1	NO AI	The assessment is completed entirely without AI assistance. This level ensures that students rely solely on their knowledge, understanding, and skills. <b>AI must not be used at any point during the assessment.</b>
2	AI-ASSISTED IDEA GENERATION AND STRUCTURING	AI can be used in the assessment for brainstorming, creating structures, and generating ideas for improving work. <b>No AI content is allowed in the final submission.</b>
3	AI-ASSISTED EDITING	AI can be used to make improvements to the clarity or quality of student created work to improve the final output, but no new content can be created using AI. <b>AI can be used, but your original work with no AI content must be provided in an appendix.</b>
4	AI TASK COMPLETION, HUMAN EVALUATION	AI is used to complete certain elements of the task, with students providing discussion or commentary on the AI-generated content. This level requires critical engagement with AI generated content and evaluating its output. <b>You will use AI to complete specified tasks in your assessment. Any AI created content must be cited.</b>
5	FULL AI	AI should be used as a 'co-pilot' in order to meet the requirements of the assessment, allowing for a collaborative approach with AI and enhancing creativity. <b>You may use AI throughout your assessment to support your own work and do not have to specify which content is AI generated.</b>

# Principles on the Use of Artificial Intelligence Tools to Support Grading and the Provision of Student Feedback

Because these tools have potential for staff use too.



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1. From the 1 September 2024, and upon the appropriate approval being first received, academic staff can utilise **AI systems** to support the assessment, grading and moderation of student work along with the provision of individualised student feedback. Where such tools are used, academic staff remain responsible for the academic judgements made on submitted student work and for any feedback they provide for learners.

2. Academic staff wishing to utilise tools for the purpose of **generative AI** supported grading, moderation or the provision of individualised feedback should utilise only the University's approved suite of digital tools, including Microsoft Copilot within Edge, a generative AI powered web chat tool that enables free access to GPT-4 and DALL-E 3 within a data protected environment. Before doing so, permission must be sought from their College Director of Education.

3. Academic members of staff who wish to utilise **generative AI** enabled tools that are not part of the University's approved suite to support grading, moderation or the provision of individualised feedback will first need to seek permission from the Pro-vice Chancellor (Education).

4. Where **generative AI** enabled tools are used to support grading, moderation or the provision of individualised feedback:

- students must first be notified of their use and the reasons for that use. An example statement for inclusion on Canvas pages can be found here Student-facing Module Statement on AI Marking and Feedback.
- all decisions, outcomes and feedback must be reviewed first by an academic member of staff before they are released to students. The use of generative AI tools on their own to allocate marks and student grades is not allowed. All marking and grading decisions should be undertaken in line with the University's Code of Practice on Taught Programme and Module Assessment and Feedback.

5. If **AI tools** are used to support the marking of student work at levels I, H and M that contributes towards the final degree award, then samples of the student work, along with grading decisions, should be considered by the External Examiners and in line with the University's Code of Practice External Examining (Taught Provision).

- 1. *If AI handles the procedures...what deeper thinking can we focus on?***
  - What do we want students to still own in their learning?
  - Where might we shift emphasis (e.g. modelling, interpretation, justification)?
- 2. *If graduates will use AI in the workplace...how do we prepare them?***
  - What kind of AI literacy should a maths graduate have?
  - Should we teach students how to critique or challenge AI outputs?
- 3. *If tool access varies...how do we ensure fairness and consistency?***
  - Are all students on a level playing field?
  - Should we have programme-level guidance on AI use?
- 4. *If AI can support learning...how do we use it responsibly?***
  - Can it enhance feedback, practice, or revision?
  - Could it support inclusion or scaffolding?
- 5. *If staff are unsure...how do we build confidence and space to experiment?***
  - What are colleagues already doing?
  - What support or policy helps innovation without risk?

# What's one thing your department could do differently next year in response to generative AI?

Grove, 2024

## My thoughts?

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**Designing the Student Learning Journey: A Practical Approach to Integrating Generative AI within Higher Education**  
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**0. Executive Summary**  
Generative AI is rapidly reshaping the higher education landscape, influencing how students access knowledge, complete assignments, and engage in independent learning. While much of the sector's response has focused on mitigating risks within assessment, here we take a broader view, positioning generative AI as a potentially transformative tool for enhancing teaching, learning, and student support at a programme level.

This institutional resource offers a structured and practical framework for curriculum teams seeking to embed generative AI thoughtfully, ethically, and effectively across the student learning journey. Drawing on examples from the mathematical sciences but designed for wider applicability, it encourages a shift from reactive policy to proactive educational design.

The paper begins by identifying the central challenge: students are already using generative AI to support their learning, often independently and inconsistently, and staff confidence remains highly variable. To ensure equitable, coherent, and future-facing provision, programme teams must take intentional steps to align AI use with learning outcomes, disciplinary values, and assessment practices.

Key principles and recommendations include:

- 1. Designing with Purpose:** Use generative AI to support progression from foundational to advanced learning, aligned with Bloom's taxonomy. Scaffold use over time, with clarity on how AI supports thinking, reflection, and skill development.
- 2. Promoting Coherence:** Ensure students experience a consistent approach across the programme. Use shared frameworks to communicate where and how AI can be used in assessments.
- 3. Embedding Ethical Practice:** Teach students how to use generative AI critically and transparently. Develop shared expectations around acceptable use, academic integrity, and citation of AI-generated content.
- 4. Respecting Disciplinary Contexts:** Recognise that appropriate AI use varies by subject. Within the mathematical sciences, for instance, AI may support concept exploration and critique, but cannot, and should not, be used as a substitute for symbolic reasoning or proof construction.
- 5. Fostering Digital and AI Literacy:** Treat AI as part of students' academic and professional skillset. Provide opportunities to experiment, reflect, and evaluate tool use, with explicit attention to equity, access, and confidence.

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Grove, 2025

## Generative AI Technologies and Their Role Within Assessment Design

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### 1. Introduction

Assessment serves multiple purposes within education (Brown, Bull & Pendlebury, 2013). One of its primary functions is to provide evidence of student learning that accurately reflects the efforts of an individual and clearly demonstrates mastery of their knowledge, understanding, and skills. However, recent advances in, and the availability of, generative AI technologies mean such tools have the potential to be increasingly used by students within the completion of their assessments. This necessitates careful consideration of assessment design to ensure that where generative AI tools might be used by learners, their use is responsible, and the contribution of the individual learner to the work can be clearly demonstrated.

Importantly, consideration of the implications of generative AI technologies should not be used to automatically favour one assessment type over another. For example the increased use of invigilated on-campus examinations, which themselves have both benefits and limitations in assessing students learning (Buckley, 2023). Instead, this forms a timely opportunity for academic members of staff to consider good assessment design and more broadly seek to answer the questions: Why are students are being assessed? To what extent are they being assessed? What is being assessed and why? This should be undertaken alongside carefully examining how evidence of individual student learning and the associated achievement of learning outcomes is being collected at a programme, rather than module, level.

### 2. Considerations for assessment design

Whilst academic staff may not be required to use generative AI technologies within their teaching, all must now consider the potential impact upon student learning and assessment. This should be reviewed regularly given the pace at which these tools are developing and their likely increasing availability within other mainstream technologies. Additionally, higher education institutions are now establishing frameworks that require, or support, their students being provided with opportunities to engage with generative AI tools at a range of levels throughout their programme of study (University of Birmingham, 2024). This therefore presents both opportunities and challenges for the assessment process.

When considering the potential role of generative AI within assessment, a useful starting point is to determine whether: