



Generative AI & Sustainability Education: A Toolkit

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CLIMATE PLAN

Why this toolkit?

- **This toolkit explores how GenAI can be used strategically and responsibly to advance Education for Sustainable Development (ESD).**
- Developed in alignment with:
 - ✓ UNESCO's Education for Sustainable Development: A Roadmap
 - ✓ UNESCO's Guidance for Generative AI in Education and Research
 - ✓ Advance HE's Framework for ESD
 - ✓ University of Leeds GenAI guidance
- This resource promotes the thoughtful integration of GenAI in ways that are inclusive, ethical, and aligned with the priorities of ESD.
- Through a blend of practical strategies, critical questions, and curated resources, the toolkit invites educators, students, and institutions to explore how GenAI can be harnessed to deepen and expand ESD. **It is a call to engage with AI not only as a tool, but as a catalyst for meaningful, values-driven education in an environmentally responsible and ethical way.**

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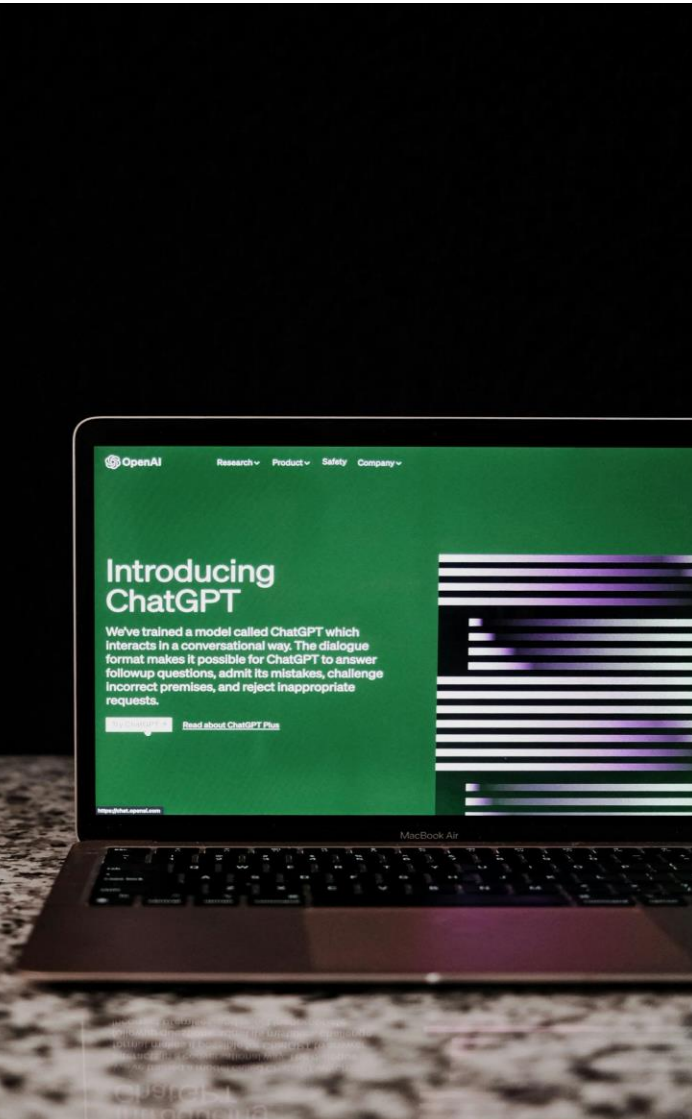
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1) Understanding Generative AI in Education



Introduction to GenAI

- Generative AI (GenAI) is a technology that is programmed to generate new content based on learned language patterns and context.
- Models are typically trained on vast amounts of data, including webpages and online media. Outputs can vary from text, to images, to music, and code.
- Examples of GenAI tools include:
 - Text – ChatGPT, Claude, Gemini, Copilot
 - Imagery – DALL-E3, MidJourney, Firefly, ImageFX
 - Code - Cursor, Copilot, Amazon Q Developer
- The National Centre for AI has created a brief introduction to Generative AI technology and its impact on education. It provides further insights into various tools, including their potential, capabilities, and limitations: A Generative AI Primer



Strengths of GenAI

- **Levelling the playing field:** Gen AI can process and interpret human language in a conversational style, which allows it to generate contextually relevant responses to user prompts.
 - It can also reformulate text to simplify or summarise it, which can help people start to understand more complex ideas.
 - Gen AI can also process and generate text in multiple languages. If used appropriately, Gen AI can be a great leveller for those who do not speak English as their first language or may not have the same literacy or language skills as others.
- **Organisational productivity:** Gen AI can be fine-tuned for different domains, so it can be made widely available for a variety of tasks.
 - Some examples include chatbots, content generation and language translation. This can help boost organisational productivity.
 - Gen AI can answer questions in a human-like style, reduce effort on tedious and monotonous tasks, provide accessible summaries of complex topics, produce automatic translations and transcriptions, etc.

Strengths of GenAI

- **Personalisation:** Gen AI models can remember previous interactions, which results in more coherent and relevant conversation experiences for users.
 - You can ask some models to remember your writing style or how you want to present your data.
 - You can even ask a chat tool to test your knowledge against any piece of content.
 - Gen AI can generate quick responses, which produces rapid interactions and real-time applications.
- **Industry applications:** It is anticipated that most industry and workplaces will be using a form of Generative AI in the future to enhance and optimise their work.
 - Gen AI is already integrating into our daily learning and work tools, such as Copilot within Microsoft Office, or the AI content generator in Grammarly. So, it is important to develop your skills in using Gen AI effectively and ethically.

Weaknesses of GenAI

- **Lack of trust and authenticity:** Gen AI can generate information that appears factual but is often inaccurate.
 - This is often called AI hallucinations. We must remember that: although Gen AI models appear to understand the content that they use and generate, they do not understand it. The data that Gen AI models use for training have lots of inaccuracies and biases in them already
 - Gen AI can also easily create fake news, misinformation and 'deep fakes'.
- **Copyright and ownership:** Gen AI output imitates or summarises existing content, mostly without the permission of the original content owners.
 - The output's appearance of creativity and originality generates challenges for us.
 - There are issues of copyright, ownership, intellectual property and lack of authoritative legislation in this rapidly evolving area. It is important to keep this in mind when using Gen AI tools.

Weaknesses of GenAI

- **Feedback loop:** The output of Gen AI is flooding the internet through tools such as ChatGPT. This poses an interesting risk for future GPT (Generative Pre-trained Transformer) models and leads to the concept of model collapse.
- **Ethical, Social and Human costs:** There are issues of exploitation around this work.
 - For ChatGPT, the RLHF reviewers were mostly workers in global south countries such as Kenya. Workers were paid less than \$3 per hour to review the outputs of ChatGPT and identify any objectionable or toxic materials.
 - This work has had a massive negative impact on many of those who were involved, including experiencing trauma.
 - Gen AI also tends to output standard answers that replicate the values and biases of the creators of the data used to train the models. This may constrain the development of plural opinions and further marginalise already marginalised voices.

Weaknesses of GenAI

Uncharted ethical issues:

- **Access and equity:** GenAI systems in education may exacerbate existing disparities in access to technology and educational resources, further deepening inequities.
- **Human connection:** GenAI systems in education may reduce human-to-human interaction and the critical social-emotional aspects of learning.
- **Human intellectual development:** GenAI systems in education may limit learners' autonomy and agency by providing predetermined solutions or narrowing the range of possible learning experiences. Their long-term impact on young learners' intellectual development needs to be investigated.
- **Psychological impact:** GenAI systems that mimic human interactions may have unknown psychological effects on learners, raising concerns about their cognitive development and emotional well-being, and about the potential for manipulation.
- **Hidden bias and discrimination:** As more sophisticated GenAI systems are being developed and applied in education, they are likely to generate new biases and forms of discrimination based on the training data and methods used by the models, which can result in unknown and potentially harmful outputs

Environmental impact of GenAI

- Training generative AI models requires vast computational power, leading to high electricity consumption and increased carbon emissions, while the water needed for cooling AI hardware can strain local water supplies and ecosystems. Additionally, the growing demand for high-performance computing hardware for AI applications contributes to environmental impacts from its production and transportation (Zewe, 2025).

Zewe, A., 2025. Explained: Generative AI's environmental impact. [MIT website: Generative AI's environmental impact](#)

- Some evidence suggests that using AI for tasks like generating images, composing emails, or chatting has environmental costs, with image generation consuming as much energy as fully charging a smartphone. In comparison, generating 1,000 pieces of text requires only 16% of the energy needed for a full smartphone charge (Heikkilä, 2023).

Heikkilä, M., 2023. Making an image with generative AI uses as much energy as charging your phone. *MIT Technology Review*, December, 1, p.2023.

- On the other hand, there is evidence suggesting that while AI's carbon footprint is not insignificant, it is considerably smaller than the emissions produced by humans performing tasks like writing or illustrating. The most effective approach, therefore, is a collaborative one, where AI and human labor complement each other, maximising their respective strengths. However, it is important to also consider the social impacts, such as job displacement and legal implications, in this dynamic (Tomlinson et al., 2024).

Tomlinson, B., Black, R.W., Patterson, D.J. and Torrance, A.W., 2024. The carbon emissions of writing and illustrating are lower for AI than for humans. *Scientific Reports*, 14(1), p.3732.

Five actions for GenAI use in education

UNESCO suggests five actions to 'Monitor and validate GenAI systems for education'.

- The development and deployment of GenAI should be ethical by design.
- Subsequently, once the GenAI is in use, and throughout its life cycle, it needs to be carefully monitored and validated – for its ethical risks, its pedagogical appropriateness and rigour, and its impact on students, teachers and classroom/school relationships.

In this respect, the following five actions are recommended:

Five actions for GenAI use in education



Build validation mechanisms to test whether GenAI systems used in education and research are free of biases, especially gender biases, and whether they are trained on data representative of diversity (in terms of gender, disability, social and economic status, ethnic and cultural background, and geographic location).



Address the complex issue of informed consent, particularly in contexts where children or other vulnerable learners are not capable of giving genuinely informed consent.



Audit whether outputs of GenAI include deepfake images, fake (inaccurate or false) news, or hate speech. If the GenAI is found to be generating inappropriate content, institutions and educators should be willing and able to take swift and robust action to mitigate or eliminate the problem.

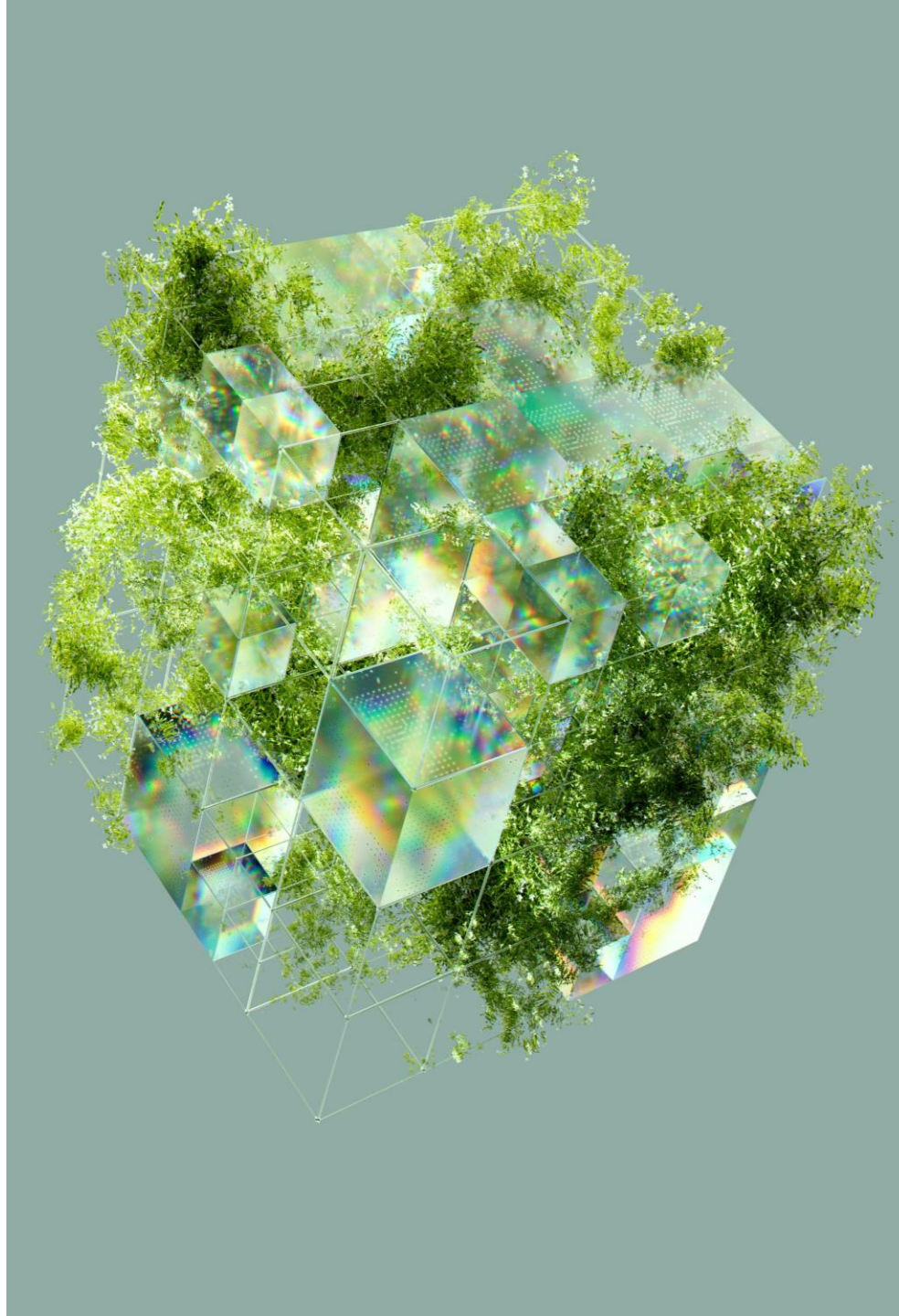


Exercise strict ethical validation of GenAI applications before they are officially adopted in educational or research institutions (i.e. adopt an ethics-by-design approach).



Before making decisions on institutional adoption, ensure that the GenAI applications in question do no predictable harm to students, are educationally effective and valid for the ages and abilities of the target learners, and are aligned with sound pedagogical principles (i.e. based on the relevant domains of knowledge and the expected learning outcomes and development of values).

2) Frameworks for ESD



What is ESD?

The goal of Education for Sustainable Development is to empower all members of society with the knowledge and skills necessary to meet their present needs while ensuring that future generations can also fulfill their needs without compromising the planet's well-being.

Education for Sustainable Development (ESD) focuses on cultivating **sustainability competencies**, a set of knowledge, skills, values, and attitudes essential for addressing complex global challenges.

These competencies include:

Systems thinking – ability to analyse complex systems.

Anticipatory - ability to understand and evaluate multiple scenarios for the future.

Normative - ability to understand and reflect on the norms and values that underlie one's actions.

Strategic – ability to develop actions that further sustainability.

Collaboration – ability to understand, relate to and be sensitive to others.

Critical thinking - ability to question norms, practices and opinions.

Self-awareness – ability to continually evaluate and further motivate one's own actions.

Integrated problem-solving – ability to apply different problem-solving frameworks to complex sustainability problems and develop solutions that promote sustainable development.

2) UNESCO's ESD: A Roadmap

- The ESD Roadmap is part of the global effort to align educational systems with the 17 Sustainable Development Goals (SDGs), with special attention to:
 - Individual
 - Transformation
 - Societal transformation
 - Technological advances

Priority action areas within this framework include:

Advancing policy

Transforming
learning
environments

Building
capacities of
educators

Empowering and
mobilizing youth

Accelerating local
level actions

Advance HE's Framework for ESD

- Advance HE's Framework for ESD is a focused resource aimed at deepening and unifying understanding of ESD across institutions.
- This framework aligns with the Professional Standards Framework (PSF) 2023, ensuring that the integration of ESD meets current professional expectations and enhances teaching and learning outcomes.
- Priority action areas within this framework include:
 - Institution
 - Educators
 - Students

GenAI and ESD



The nature of ESD as education that empowers learners with sustainability competences to make ethical decisions considering their social, environmental, cultural, economic and political dimensions requires a responsible and systemic approach towards learning



ESD prioritises a Whole Institution Approach which takes into account the organisational, operational, research as well as community aspects of Higher Education and this requires a responsible approach towards the integration of GenAI and its impact



ESD focuses on educators and aims to empower them with competences to offer transformative learning experiences for students so they need to be prepared for the responsible integration of GenAI tools in their teaching as well as promote critical thinking among their students in terms of GenAI use.

3) Strategies for Students



GenAI Strategies for Students

How students can leverage GenAI:

- Helping students to craft narratives. AI could help with creativity for future sustainability solutions and creating compelling arguments for promoting these.
- Provide un-biased support to students who are struggling with their own organisation of ideas.
- Ensure safe online spaces by detecting harmful content, flagging false information, and promoting factual discussions, fostering constructive and inclusive communication.
- Help to organise ideas and consolidate things in a way that may not be considered before.
- Spark emotional urgency and empathy through immersive experiences (e.g., VR simulations of environmental impacts), helping students feel the consequences of their choices and motivating sustainable action.
- Produce simulations to help students better connect real life actions to environmental consequences.
- Produce visualisations in place of text, since it would be easier for some people to understand visuals instead of reading a lengthy article.

GenAI Strategies for Students

Create

- Create gamified activities, reflective prompts, and marketing materials to increase participation and connect co-curricular experiences with broader sustainability objectives.

Highlight

- Highlight success stories, curate relevant resources, and guide students towards sustainability-related career paths, helping students recognise their potential to shape a sustainable future.

Facilitate

- Facilitate real-time translation, support language learning, and power interactive platforms for global youth to engage in discussions and collaborate on sustainability projects.

4) Strategies for Educators



GenAI strategies for Educators

How educators can leverage GenAI:

- Design problem-based projects that combine multiple fields of study and teamwork strategies to address real-world sustainability challenges.
- Analyse data to identify real-world problems, tailor challenges to student preferences, and continually update scenarios with real-time data.
- Integrate different disciplines into challenges, simulate stakeholder interactions, and outline realistic constraints that mirror real-world complexities.
- Facilitate digital platforms for sharing project results and track the impact of projects implemented beyond the classroom.
- Offer continuous feedback during problem-solving and simulate the potential impacts of students' solutions to enhance understanding of real-world.
- Analyse shared data to identify successful practices, create dynamic maps to visualise where these practices are implemented, and facilitate international challenges for collaborative strategy exchange.

Risks & Challenges for Educators



Addressing AI-generated misinformation



Managing student AI use in assessments



AI's impact on academic integrity



Environmental and social impact of GenAI

Case Study: Creating SDGs Scenarios

- The case study comes from the module **Introduction to Creating Sustainable Futures** for Year 1 Undergraduate students and aimed to help students develop skills in scenario analysis and strategic thinking. Multiple scenarios were created using the GenAI tool Microsoft Copilot.
- Specifically the students:
 - Explored Sustainable Development Goals (SDGs) framework.
 - Engaged with business scenarios aligned with the Sustainable Development Goals.
 - Leveraged GenAI technology, for collaborative insights and practical applications in sustainable decision-making.
- The students were given four scenarios of companies who are facing sustainability challenges and would like to adopt more sustainable strategies:
 - EcoFresh Distributors
 - MineralSustain Mining Co.
 - OceanHarmony
 - GreenTech Innovations

Case Study: Creating SDGs Scenarios

- The students worked in groups to understand the scenarios and select UN SDGs that align with their allocated scenario
- They had to discuss in groups ideas for sustainable solutions for the business in each scenario. They were encouraged to use Copilot to generate ideas and asked to think critically about the solutions provided by the genAI tool.
- Then they had to assess the solutions based on a set of criteria such as:
 - Resource availability
 - Scalability
 - Ease of integration into existing business processes
 - Costs, benefits, and long-term financial implications and Ethics
- The students were given the option to use Copilot again in the assessment. Apart from the scenarios, the students were given access to the UN SDGs, guidance on prompting with Copilot, and a Padlet on which they recorded their responses.
- After they completed the activity each group presented their solutions, as well as the assessment of the best possible option and reflected on the use of Copilot in their learning.



“

I enjoyed using copilot to help with a topic/subject I hadn't really looked at before

”



“

Linking the sustainability goals with real life scenarios helped to fully understand them

”



“

The most important aspects of the activity for my learning were:

- SDGs and linking them to real world issues.
- Analysing solutions and weighing their pros and cons.
- How businesses can balance profit with social and environmental sustainability.

”

Case Study: Student Quotes



“

Copilot helped come up with solutions I wouldn't have thought of. It would take me a long time to come up with them

”



“

It helped my learning and developed new ideas. It was a little hard for me to assess the solutions.

”

Case Study: Student Quotes

5) Strategies for Institutions

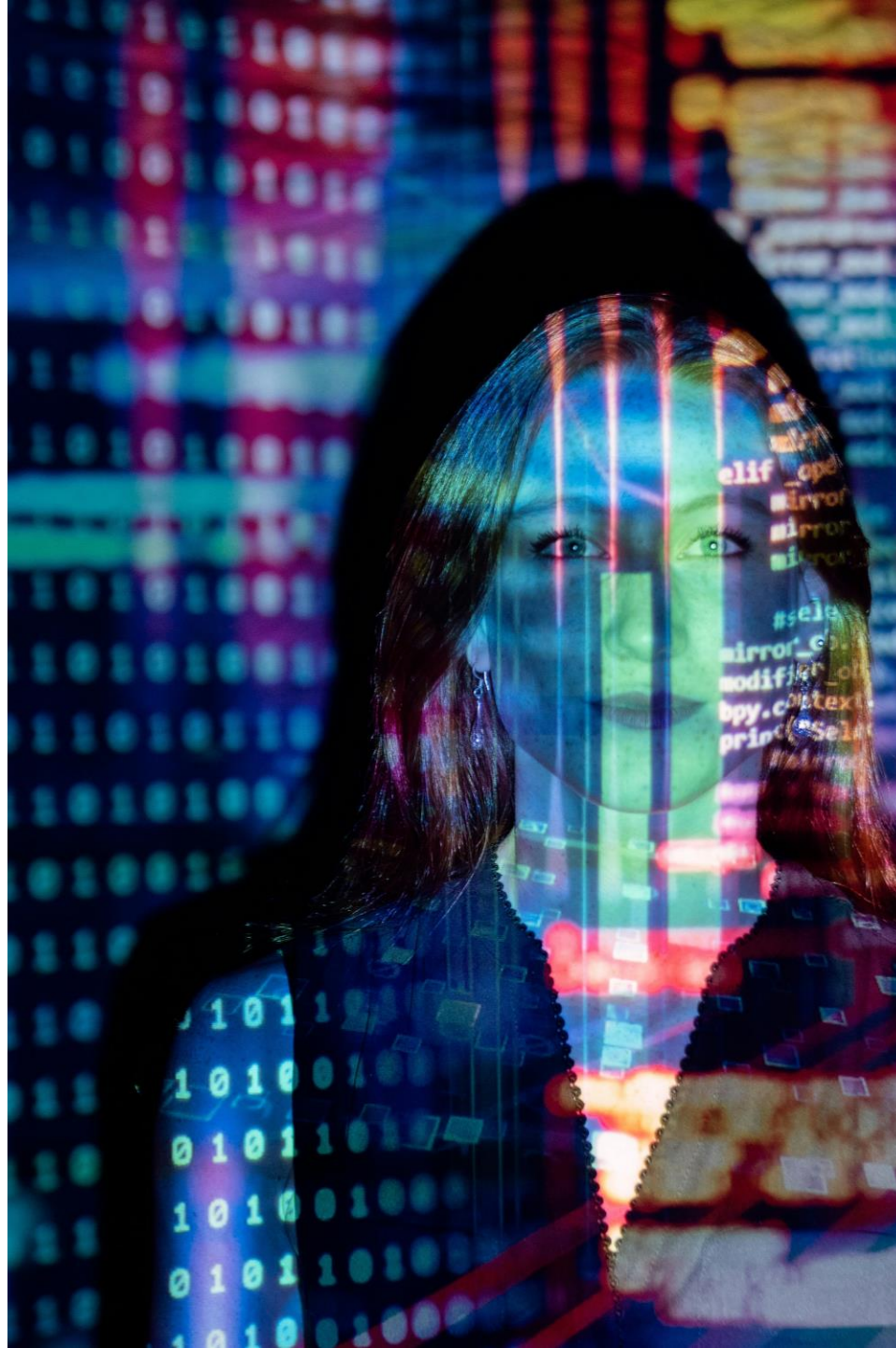


GenAI strategies for institutions

How institutions can leverage GenAI:

- Enhancement of virtual learning environments, reducing the need for physical resources and travel, contributing to sustainability efforts.
- Help design rubrics and criteria for assessing ESD integration, analyse course performance data, and ensure consistency across subjects and levels.
- Provide comparisons between curriculum content and ESD frameworks to make recommendations for better integration of sustainability concepts.
- Assist in creating systems to track ESD integration, generate automated reports, and offer continuous improvement suggestions for curriculum design and review.
- Creation of customised sustainability training for staff, simulating virtual environments for testing initiatives, and provision of impact assessments to ensure alignment with sustainability principles across all projects.

6) Key takeaways



Key takeaways

GenAI presents an opportunity for HE institutions to deepen their commitment to sustainability. Opportunities include the use of GenAI to enhance curriculum design, enable smarter decision-making, and support staff development.

- **For Students:**
Using GenAI to co-create compelling narratives, visualise ideas, and simulate real-world impacts to inspire informed, creative action for sustainability.
- **For Educators:**
Harness GenAI to design interdisciplinary, data-informed challenges with real-world constraints, offering continuous feedback and deeper systems understanding.
- **For Institutions:**
Deploy GenAI to align curricula with ESD goals, enhance virtual learning, and support strategic planning through automated analysis and impact tracking.

Key takeaways

The integration of GenAI in ESD needs to be a '**human-centred and pedagogically appropriate interaction**' approach. Institutions and educators should prioritise human agency and responsible, pedagogically appropriate interaction between humans and AI tools when deciding on whether and how to use GenAI. This includes the following five considerations:

1. Use of the tool(s) should contribute to humans' needs and make learning or research more effective than a no-tech or other alternative approach.
2. Educators' and learners' use of the tool(s) should be based on their intrinsic motivation.
3. Process of using the tool(s) should be controlled by the human educators, learners or researchers.
4. The choice and organisation of the tool(s) and the content they generate should be proportionate, based on the learners' age range, the expected results, and the type of target knowledge (e.g. factual, conceptual, procedural, or metacognitive) or target problem (e.g. well-structured or ill-structured).
5. The usage processes should ensure humans' interactive engagement with GenAI and higher-order thinking, as well as human accountability for decisions related to the accuracy of AI-generated content, teaching or research strategies, and their impact on human behaviours.

6) Resources and further reading

Internal resources

[AI Fridays | A Digital Education Enhancement blog series on Generative AI efficiencies \(leeds.ac.uk\)](#)

[Curated list of useful AI bookmarks](#) - Resources, research, ethics, training, copilot etc.

[GEN AI website](#)– contains latest policy, guidance for staff and students, FAQs.

[Guidance to Staff on the use of Artificial Intelligence | Secretariat](#)

[How University systems use AI](#) – Digital Education Systems Sharepoint

Sustainable Curriculum in Leeds:

<https://sustainability.leeds.ac.uk/our-work/leeds-sustainable-curriculum/>

<https://sustainability.leeds.ac.uk/our-work/leeds-sustainable-curriculum/sustainable-curriculum-for-students/>

<https://www.youtube.com/watch?v=MFe8UsP3Jak>

External resources (GenAI)

- [AI in HE community monthly meetups](#)
- [Digital skills in AI and generative AI – JISC question set](#)
- [Enhance teaching and learning with Microsoft Copilot – Microsoft Learn training](#)
- [GenAI Academic Prompt Bank | 301 | The University of Sheffield](#)
- [JISC Digital capabilities](#) - Find out about your own digital capability through a series of reflective questions.
- National Centre for AI – JISC AI literacy webinar series
- [Online training on AI in education - Itec \(kuleuven-kulak.be\)](#)
- [The 12 Days of AI – A self-directed online course to learn about AI in higher education \(arts.ac.uk\)](#)
- [Using Text based AI tools to support student learning](#) – University of Arts London

External resources (ESD)

- <https://www.unesco.org/en/sustainable-development/education>
- <https://www.unesco.org/en/sustainable-development/education/toolbox>
- <https://www.advance-he.ac.uk/knowledge-hub/education-sustainable-development-guidance>
- <https://www.advance-he.ac.uk/knowledge-hub/education-sustainable-development-curriculum-design-toolkit>
- <https://efsandquality.glos.ac.uk/>
- https://www.taylorfrancis.com/books/oa-mono/10.4324/9781003467007/education-learning-sustainable-futures-thomas-macintyre-daniella-tilbury-arjen-wals?_gl=1*16w19bd*_ga*MjA1OTU1Mjk2Ni4xNzM5NDYzOTE0*_ga_0HYE8YG0M6*MTczOTQ2MzkxNC4xLjAuMTczOTQ2MzkxNC42MC4wLjA.*_gcl__au*MjAzNTg0NjI1MS4xNzM5NDYzOTEy
- <https://www.mdpi.com/2071-1050/11/21/6104>

Free AI Tools: Glossary (alphabetical)

Adobe Enhance

An AI-powered audio enhancement tool that automatically removes background noise from recordings and improves voice quality. In education, it can be used to clean up lecture recordings, student presentations, or podcast projects, ensuring clear audio for better comprehension and accessibility.

Adobe Firefly

A free AI image generator known for its accurate prompt-to-image output. Educators and students can use this tool to create custom illustrations for presentations, visual aids for lessons, or to explore creative projects.

ChatGPT

An AI-powered chatbot by OpenAI capable of holding conversations, writing, and problem-solving. In education, it can assist with research, brainstorming ideas, explaining complex concepts, providing writing feedback, and even helping with coding tasks. It's a versatile tool for both teachers and students across various subjects.

ChatPDF

A tool that allows users to interact with PDF documents by asking questions about their content. This can be invaluable for students and researchers to quickly extract information from academic papers, textbooks, or lengthy reports without reading the entire document.

Claude

An AI assistant created by Anthropic, proficient in analysis, writing, and problem-solving. In educational settings, Claude can help with essay writing, research assistance, answering subject-specific questions, and providing explanations on complex topics across various disciplines.

Free AI Tools: Glossary (alphabetical)

Elicit

Elicit is an AI research assistant that automates time-consuming tasks such as searching and summarising papers, extracting data, and synthesising findings

Microsoft Copilot

Microsoft Copilot is an AI assistant integrated into Microsoft products. It could potentially help students and educators with tasks in Office applications, enhancing productivity and assisting with document creation, data analysis, and presentations.

Microsoft Designer

An AI tool for creating designs such as posters, illustrations, and campaign artwork based on user prompts. In education, it can be used for visual arts projects, creating materials for student presentations, or designing educational infographics and posters for classroom use.

NoteGPT

An AI tool that generates music based on user prompts. You simply input a description of the music, click the "create" button, and within a few seconds, your music will be generated. You can listen to it online or download it as an mp3 or mp4 file.

Perplexity AI

An AI-powered search engine using GPT-4 that provides intelligent search results and allows follow-up questions. This tool can enhance research capabilities for students and teachers, offering more nuanced and interactive search experiences compared to traditional search engines.

Voicemod Text to Song

A free AI tool that converts text into full songs, offering choices of genres and singers. In music education, this can be used to explore composition, lyric writing, and different musical styles. It could also be incorporated into language learning or creative writing exercises.