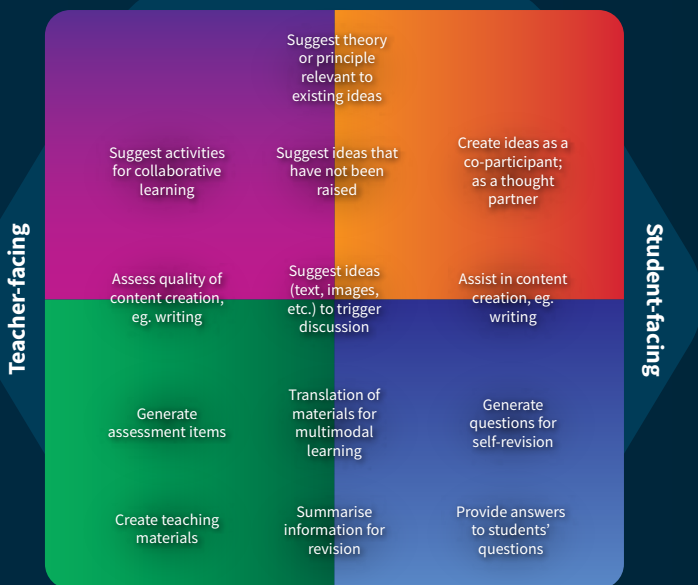# Applications of Generative AI in Teaching and Learning

Generative AI offers various potential applications in teaching and learning. Take for instance, the ways generative AI can be used for teaching and learning in the classroom can be described in a 2 x 2 illustration as follows:

Learning through active participation

	Suggest theory or principle relevant to existing ideas	
Suggest activities for collaborative learning	Suggest ideas that have not been raised	Create ideas as a co-participant; as a thought partner
Assess quality of content creation, eg. writing	Suggest ideas (text, images, etc.) to trigger discussion	Assist in content creation, eg. writing
Generate assessment items	Translation of materials for multimodal learning	Generate questions for self-revision
Create teaching materials	Summarise information for revision	Provide answers to students' questions

Teacher-facing · **Student-facing**

Learning as acquiring knowledge (Copyright NIE 2023)

Figure 1: Ways of using generative AI in teaching and learning

Potential uses of generative AI can be described using Figure 1 - for teachers' use or for students' use on one axis, and learning as acquiring knowledge or learning through active participation (Sfard, 1998)[1] on the other axis.

For instance, educators can utilise generative AI as teaching tools, sparking discussion on topics by generating relevant images. On the other hand, students can use generative AI to assist them with writing, grammar checks, and as personal learning companions. Learning as acquisition involves using generative AI to provide clear explanations, while learning as participation extends students' collaborative knowledge building by generating new ideas during discussions.

Conclusion

Generative AI can enhance teaching and learning if used responsibly. Educators should focus on meaningful learning activities and emphasise critical thinking while upholding academic integrity. By navigating these challenges and embracing the opportunities, educators can shape a future where generative AI enhances teaching and learning and benefits society as a whole.

Acknowledgements

An Institute of

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NIE NATIONAL INSTITUTE OF EDUCATION SINGAPORE

Generative Artificial Intelligence for Teaching and Learning

A statement by the National Institute of Education

[1] Sfard A. (1998). On two metaphors for learning and the danger of choosing just one. Educational Researcher, 27(2), 4–13. doi: 10.3102/0013189X027002004.

> ❝ Generative Artificial Intelligence can enhance teaching and learning if used effectively, responsibly and ethically. ❞

National Institute of Education (NIE) Singapore recognises the importance of responsible and ethical use of Generative Artificial Intelligence (AI) in education. Generative AI is used to enhance teaching and learning to support higher-order cognitive skills including analytical, critical, and metacognitive thinking and the development of human values. The thinking and principles that underpin this statement are provided below.

Introduction

With the pervasiveness of generative AI and an increasing interest among faculty and students in this technology, clarity on how generative AI is used for teaching and learning is needed.

The release of ChatGPT – a conversational Chatbot using the GPT (Generative Pre-trained Transformer) generative AI model capable of producing human-like texts by OpenAI in late 2022, has attracted attention from various media platforms. Generative AI uses neural networks to find patterns in data to generate new text, images, sounds, and computer codes. After ChatGPT was released, academics recognised its potential in multiple domains and examined its implications, emphasising the need for its ethical and responsible use.
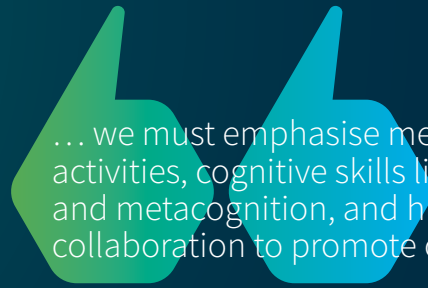
Guidelines for Teaching and Learning

In order to use generative AI effectively in teaching and learning, we must first identify and leverage on the strengths of generative AI, such as the ability to process and draw inferences from large amounts of data, to personalise interactions with a large number of students on an individual basis at any one time and to consistently deliver instructions. On the other hand, humans can create new ideas, interact with emotions and passions, detect nuanced meaning in speech, and bring in multiple perspectives which include those of ethics and moral reasoning. A true collaboration between humans and AI will need to tap on their respective advantages.

The design of learning with generative AI entails:
- knowing the learning objectives.
- knowing the critical cognition and processes that students need to develop.
- knowing when to bring in the generative AI.
- understanding the respective strengths of human and AI capability to leverage their respective advantages in the learning process.

Indeed, it is important for students to develop a critical awareness of generative AI as a new technological tool, to understand and be aware of its affordances and limitations. In short, students need to have critical AI literacy.

To harness generative AI effectively in teaching and learning, we must emphasise meaningful learning activities, cognitive skills like critical thinking and metacognition, and human-AI collaboration to promote original thinking.

> ❝ … we must emphasise meaningful learning activities, cognitive skills like critical thinking and metacognition, and human-AI collaboration to promote original thinking. ❞

We should design meaningful learning activities supported by generative AI, rather than designing tasks surrounding technologies. For example, learning tasks based on simple fact finding will be undermined by generative AI, but activities that require students to demonstrate their abilities to synthesise ideas, perform in-depth analysis, and work creatively will allow the generative AI to be used as a tool rather than an end itself.

While AI can be used to facilitate or enhance learning, a key principle to consider is that it should not take away the critical aspects of learning that students need to experience. For example, if developing students' ability to create new ideas is an important learning objective, generative AI should not be used at the outset, but could be used to help students generate ideas that they have not surfaced as the activity progresses.

Assessment with Generative AI

Assessment using generative AI can also be described as either for teachers' or students' use. Where students use generative AI, we must be able to design assessment tasks, processes and rubrics that will examine the critical aspects of learning. For example, assessment tasks may require further application or evaluation of facts that can be easily obtained from generative AI. As such, the rubrics must be designed to measure higher cognitive functions that go beyond simple description or explanation. When teachers use generative AI to support formative and summative assessments, they have to be mindful that such assessments are meaningful, fair and transparent.

Regardless of the tools used, assessments should follow the established principles that promote effective teaching and learning. The principles for good assessment include:

1. Assessment should be central for effective teaching and learning.
2. Assessment inferences should be valid and reliable.
3. Assessment should be explicit, transparent and accessible.
4. Assessment should promote and improve learners' capacity for self-directedness.
5. Assessment should take into consideration the impact on learner's well-being.

Assessment tasks and criteria must be carefully designed so that knowledge, skills and abilities of students can be assessed with valid and reliable evidence.

Ethics and Academic Integrity

As educators, we need to equip students with the knowledge, skills and dispositions to use generative AI productively in an ethical and critical manner. Students are expected to practise the highest standards of academic integrity when using generative AI.

At NIE, our faculty are required to adhere to the following guidelines regarding the use of generative AI:

1. Ensure that students are well-informed of the University's prevailing expectations and policies regarding the use of generative AI. Communicate clearly to students how they should document their use of such tools. For instance, whether generative AI is used to generate key ideas, to assist in generating the first draft or for language improvement.
2. Make the course assessment and grading rubrics where generative AI is used and accessible to students from the start of the semester. Students must have a comprehensive understanding of the evaluation criteria.
3. Require students to declare explicitly their use of generative AI in their assignments. This declaration will aid in maintaining academic honesty and openness.