LEARNOVATE
Leading Learning Innovation

Exploring Generative AI and the future of Learning Technology

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Learnovate Report

Introduction

In only a very short space of time generative AI has become a huge talking point, sparking debate in fields ranging from the creative arts to the legal profession. Beyond the discussion, generative AI is already having an impact in the real world. Hollywood script writers are currently on strike[1], prompted by concerns about how AI might be used to replace them. Meanwhile, legal professionals are already using generative AI tools to help them to prepare legal documents, sometimes not with the best outcomes[2]. We find ourselves in a somewhat unusual situation when it comes to a new technology, it is not often that the creators of a new technology make it freely available[3]. More importantly, that they do so in a way that makes it accessible to practically anybody with an internet connection. The freedom to try out generative AI tools like ChatGPT, Midjourney, Google Bard, etc. has allowed for an explosion in innovation. Individuals can experiment with using these tools, both for fun and creative purposes as well as for more practical purposes, possibly even in ways and for use cases that the original creators of the technology never even considered.

This innovation and experimentation have started to highlight the potential for generative AI to impact education and learning more generally. Education institutions have already needed to react to the potential for students to use generative AI to produce assignments. While plagiarism has always been a concern, educators had ways to work around this. Work created using generative AI might not be as easy to detect. This change in assessment practices can often be seen in a negative light but others have seen the potential for generative AI to have other more positive impacts. For instance, as a support tool to help teachers in designing lesson plans or as a way to create bespoke content that addresses a specific need. Performance support and point-of-need learning in a workplace learning environment have also been recent topics of discussion. If we have all of this knowledge and information at our fingertips and it can be easily distilled down into just the information that we need to get the job done, in an easily consumable format, then how does that change our approach to learning and development? Indeed, how does that affect the skills that we need to be successful in an AI-powered workplace?

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[1] https://www.npr.org/2023/05/18/1176876301/striking-hollywood-writers-contemplate-ai
[2] https://www.bbc.com/news/world-us-canada-65735769
[3] Tools such as ChatGPT are described as experimental, we don't know if they will choose to restrict access further in the future.

As we all scramble to form a better and more informed understanding of the potential of generative AI, both positive and negative, Learnovate plans to produce a series of short reports. Each report will focus on a specific context or use case and explore the current and future role of generative AI in that context, what is currently happening in that space, what innovations are possible and how we will need to adapt. This series will kick off with 5 topics:

- Point-of-need Learning
- Next Generation Onboarding Experiences
- Supporting and Developing Metacognitive Skills
- Impact on Assessment
- Assisting the Lesson Planning Process

Some more detail about the context and motivation for each of these topics is provided below.

Generative AI

The potential for Artificial Intelligence (AI) to have a significant impact has been a topic of discussion for many years. Generally, the focus tended to be on the automation of repetitive or manual tasks where a machine could be 'trained' to replicate the performance of a human. Examples like processing loan applications[4] as well as more highly specialised tasks such as reviewing medical imagery to detect disease[5]. Common to most use cases has been that they are specific, well-defined tasks. Such tasks have been the focus of AI research for many years and have seen the widest adoption to date in real-world applications. However, this discussion started to change in the second half of 2022 as popular culture started to take notice of the advances that were being made in generative AI, a specific field of AI research that we have all become familiar with. What makes generative AI different is that it aims to create tools that can carry out a range of different tasks, so-called general purpose AI, rather than being highly specialised towards one specific thing.

[4] https://www.linkedin.com/pulse/revolutionizing-industries-impressive-ai-use-cases-applications
[5] This academic paper from a few years ago provides a nice overview of the state of the art at the time without being overly technical https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6268174/

There are a number of different approaches within generative AI but the one that the general public are most familiar with is the Large Language Model or LLM. This is the technology that underpins OpenAI's ChatGPT, a chatbot that allows anybody to ask the AI questions on a seemingly unlimited range of topics and have them answered with, for the most part, plausible responses. ChatGPT is one of a number of generative AI-based tools that are capturing the world's imagination at the moment including Google's Bard and image generation tools such as Midjourney and DALL-E. Large Language Models get their name from the way in which they are created. Huge amounts of text-based content are fed into the LLM and AI techniques are then used to train it to predict what word or phrase is most likely to come next given a specific input. This is where the term generative AI comes from, it generates new content based on the text that it was trained on. The fact that technical terms like 'Large Language Models' are being explained and used by mass media is an indication of how much interest there currently is in the topic. The rate at which generative AI has grown to become such a hot topic is reminiscent of the discussion around Blockchain technology in the previous decade. This is also evident from the pace at which the resulting tools like ChatGPT have acquired millions of users in only a few days[6].

While the interest in, and resistance to, generative AI (GenAI) technology is relatively recent, it should be noted that this technology is not brand-new as it was introduced in the 1960s in chatbots. However, it was not until 2014, with the introduction of Generative Adversarial Networks, or 'GAN's - a type of machine learning algorithm - that GenAI could begin to create convincingly authentic images, videos and audio of real people.

While the opportunities for the use of GenAI in learning contexts such as the development of rich educational content and advances in Large Language Models (LLMs) have begun to provide benefits in a learning technology context, there are associated challenges and fears around its use, particularly in relation to ChatGPT, Dall-E and Bard are some of the more well-known generative AI interfaces, with ChatGPT-4 released in March 2023. The popularity and importance of ChatGPT, in particular, cannot be underestimated, with Microsoft

[6] https://explodingtopics.com/blog/chatgpt-users

announcing a significant new investment into OpenAI and an integrated version of GPT into its Bing search engine.

Research Topics

The 5 initial topics that we will explore in this series of research reports span a wide range of contexts from point-of-need learning in workplaces to lesson planning for post-primary teachers. At the same time, this is likely to only scratch the surface when it comes to the wide-ranging potential of generative AI-enabled tools and techniques.

Point-of-need Learning

With a move from more traditional forms of learning, such as via Learning Management Systems & formal courses, towards more bite-sized or microlearning, how can generative AI support this type of experience?

Learners often need their learning quickly and don't have time to search through long courses or large .pdfs to find what they need. With Google and YouTube being the primary go-tos for people needing to learn something quickly, these tools are providing that JIT (Just-In-Time) learning experience that modern-day learners require to get the job done.

With GenAI providing the opportunity for learners to obtain information quickly, the challenges associated with this may relate to the accuracy and quality of the information received and the trust of the interface by the user. However, as interfaces such as ChatGPT are further developed, accuracy and trust may no longer be the challenge, but rather, the development of an authentic relationship between the GenAI assistant or mentor and the learner.

For example, a recent consumer survey from the Capgemini Research Institute found that 73 percent of consumers globally trust content created by generative artificial intelligence[7], (from research from data aggregator tools and a quantitative survey of 10,000 consumers in a dozen countries globally). However, how can we look to develop that relationship further where the generative AI tool or platform is seen as a trusted mentor to assist the learner when they need point-of-need learning?

[7] https://www.yahoo.com/lifestyle/consumers-too-much-trust-generative-142108302.html

What elements of the user experience can be optimised to develop an authentic version of this relationship that is both user-friendly, engaging, and most importantly, valuable?

Although the authenticity of the experience can benefit all types of learners, it can be more beneficial for a non-tech savvy group of learners. One question that needs to be addressed in this context will be how might we enhance the perception of authenticity of the experience for this group and promote meaningful interactions and develop a genuine relationship. Examples of methods we can use to achieve this are improving the conversation design to be more human-like, personalisation and integration of emotional intelligence.

Generative AI has the capability to provide learners with timely information, but how might we develop this relationship further to develop a more effective and engaging learning experience that elicits useful data? This could be an interesting area for future research.

Next Generation Onboarding Experiences

What is the onboarding experience for a non-tech person in using a GenAI tool or suite of tools for a particular learning or training use case?

For example, when it comes to relatively new technologies such as generative AI, sometimes as part of a Learning Management System or other learning tool, how do we onboard non-technical people to ensure that they understand what they are doing and how to do it?

Onboarding is a process that is often overlooked. With many tech solutions and apps, it is often left up to the user to figure out how things work which can be frustrating and discouraging. It is important from a user experience perspective to make users feel in control of their experience, and not to put barriers in their way.

Supporting and Developing Metacognitive Skills

How might we use generative AI to support the metacognitive skills of learners in the context of a formal learning setting (school/university)?

Metacognition can be defined as the awareness and control of one's own cognition or, put another way, the process of thinking about one's own thinking and learning. It is an

important concept because 'the consistent finding in over 30 years of research is that more-successful students exhibit higher levels of metacognitive knowledge about a given domain and are more skilled at regulating their cognitive processes than less-successful students'.[8]

At a basic level, metacognition involves the dynamic and accurate monitoring and regulation during any learning activity such as reading, writing, thinking, reasoning, and problem-solving, including when engaging with AIED (Artificial Intelligence in Education) systems.[9]

Until now, most approaches to metacognitive strategies that measure learning during the process have heavily relied on self-reporting and pre-and post-testing of the learning. New advances in technologies and computing might make it clearer how meta-cognitive processes contribute to learning with AIED systems and bring opportunities for AI to interpret students' metacognitive processes, judgements, evaluations, and reflections during the learning process, and in real-time. This could make human-machine interaction more seamless and personalised.

An example from the research shows that intelligent tutors like MetaTutor, can be effective in improving metacognitive awareness and provide opportunities to practise metacognitive and regulatory processes while receiving real-time individualised, adaptive feedback from embedded artificial intelligence agents.

GenAI has the potential to boost metacognition by making learners' thinking more apparent to themselves, their learning peers, and their tutors. It can do this by providing adaptive, tailored feedback and support that helps learners carefully build knowledge and skills. For example, this can take the form of tailored assessments and it has been argued that GenAI is seeing the emergence of a new formative assessment model called 'Metacognitive Continuous Learning' that helps the learner understand, monitor, and regulate their cognitive and metacognitive processes.[10] In this new model, GenAI breaks down the

[8] https://www.sciencedirect.com/topics/medicine-and-dentistry/metacognition
[9] Theories of Metacognition and pedagogy applied to AIED systems, Roger Azvedo and Megan Wiedbusch, 2023
[10] https://medium.com/@guylevi.57/transforming-education-in-the-generative-ai-era-4c7e177a8415

distinction between learning and meta-learning since the assessment becomes an integral part of the learning process and the learning becomes an essential part of the assessment process.

The research on metacognition in AIED systems still has a long way to go. The expectation and hope expressed in terms of what is next in the existing research field are twofold:

1. The research field should begin to develop intelligent agents that can meta-reason and make inductive and deductive reasoning decisions outside of hard-coded production rules.
2. Environments should be developed that present learners with complex and challenging problems while intelligent agents provide developmentally appropriate metacognitive scaffolding that is individualised and adaptable. This will allow both learners and agents to develop new skills and approaches to challenges.

Ultimately, approaches that utilise machine-learning techniques (such as NLP and Explainable AI) that can provide real-time individualised, adaptive scaffolding and feedback for addressing each student's specific learning needs. This will accelerate the potential of addressing metacognition with AIED systems.

Impact on Assessment

Assessment of, for, and as learning, is one area where generative AI has many implications with the potential to have an impact on all stakeholders, learners, educators, schools and organisations as well as the wider economy. What are the challenges/opportunities offered with the introduction of generative AI?

Is the long format essay dead as an assessment technique and if so what do we do instead? Educators have already had to react to the potential for students to use generative AI to produce assignments. While plagiarism has always been a concern, there were ways to mitigate against it. For example, the Turnitin service is commonly used. However, work created using generative AI might not be as easy to detect. The challenge for educators is that even if they themselves aren't familiar with these tools, their students definitely are. The flip side of this argument is that perhaps this represents an opportunity to reconsider our general approach to assessment. If we accept that learners can and will use ChatGPT

and the like, can we embrace this and create innovative assessments that incorporate the use of these technologies? At the same time does this present an opportunity to focus on assessing higher-order thinking?

Much of the current assessment related conversation on generative AI focuses on summative assessment but it could also be a powerful tool when it comes to supporting formative assessment at scale in ways that could empower educators to incorporate formative feedback into their teaching much more frequently.

Another area where generative AI might represent a significant opportunity is the assessment of transversal skills. Collaboration, communication, leadership, etc. are seen as being difficult to assess, especially at scale and in a consistent and repeatable way. The ability of a generative AI powered chatbot like ChatGPT to understand the meaning or intent of a natural dialogue and create very natural sounding responses could offer the potential to create more authentic and context specific assessment scenarios.

Case Study: Assisting the Lesson Planning Process

The last years have been seen as some of the most relevant years for technology to be introduced in the classroom. LMS, Mobile technology, AR, Digital games and analytics have enhanced the learning experience in different manners. It may sound like it has been a very successful process as teachers have embraced some of the benefits and enjoy the innovation, but they still highlight time constraints and lack of resources when planning their lessons to be engaging and effective and assessing the learning of skills and knowledge.

This recognised pain point in the learning journey is the focus of this case study. The question is now how to interrogate the current new technology, generative AI, and see the opportunities and challenges that it brings to the plate. The research question that drives this piece of work reads as:

RQ: Generative AI has many implications for assessment from the perspective of all stakeholders (learner, tutor, organisation, economy). What are the challenges/opportunities offered with the introduction of generative AI?

Teachers have been using different approaches when assessing learning in the classroom. While some will still tend to rely on summative assessment, most teachers have turned towards the use of formative assessment and integrated different assessment activities along the learning journey: short quizzes, group work and presentations, role-playing or even reflection exercises. With the incorporation of technology, teachers can enhance these formative assessments by automating some of the subtasks or diversifying the format of the output.

Thoughtful lesson planning will be key at this point. All these activities will obviously require a certain amount of time from the teacher when producing the right strategy, choosing the appropriate resources, guiding students through the activity flow and finally collecting the results and assessing the knowledge learnt or new skills acquired.

Here is where generative AI may help teachers to create these innovative authentic assessment approaches. In a recent webinar [11], Dr. Stephen Murgatroyd from the University of Toronto, explains how he uses ChatGPT to create effective short courses with relevant material and instructions for students to follow the activities within the course. For Dr. Murgatroyd, it would be crucial to choose the right language and explain to ChatGPT the role it will be playing in the conversation, noting hallucination with the responses, looking for justification, the accuracy of responses and deepness.

In a similar presentation, Prof. Mark Sharples from Open University [12] also reflects on the positive potential uses of generative AI in education, highlighting that teachers can improve their assessment strategies with the use of ChatGPT and other AI tools as they seek to move *to more authentic assessments, such as project work.*

Generative AI has been gaining multiple uses in the last year [13], including visual, audio, text-based, code-based, and other sector-based applications. Teachers can choose from this pool of tools, test their benefits and try to incorporate them into the classroom.

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[11] https://teaching.utoronto.ca/resources/generative-artificial-intelligence-in-the-classroom/

[12] https://blogs.uoc.edu/elearning-innovation-center/es/mike-sharples-apuesta-por-explotar-los-beneficios-de-la-inteligencia-artificial-en-la-educacion-superior/

[13] https://research.aimultiple.com/generative-ai-applications/

In the same vein Dr. Murgatroyd and others [14] have used to explain the value of ChatGPT when enhancing the assessment methods in the classroom aiming at a more authentic approach, this case study will follow the story of Carol, a fictitious Primary School teacher with the mission to design next year's assessment for the class on World History. As a curious and innovative teacher, she wants to stay away from summative assessment and prefers formative assessment but it is not sure if she will be able to find the appropriate resources for her class, if she will be able to develop the material, transfer it to students and finally get evidence of learning with some sort of new innovative assessment method.

The Learnovate Centre team will introduce Carol to the potential of ChatGPT. Together, we will start a conversation to see if the generative AI is able to solve Carol's problem:

*How might Carol use generative AI to design a learning journey that includes engaging and impactful small assignments on a variety of History topics that will serve as an **assessment** method?*

The plan is to evolve from a well-phrased initial prompt (because the output whether content or assessment is as good as the prompt) and try to validate the potential of ChatGPT in this scenario of bringing more authentic assessment methods into the classroom successfully. For example, we could kick off the conversation with *Hi! Could you be my history class assistant this morning? I need 5 examples of scenarios to play with my 5th-class students to help them understand what democracy was in Greece* and progress from there.

Also, a different tool called AgentGPT [15] can be used to see if the approach that we followed can be replicated by an AI agent. Note that this tool works with AI Agents that help you solve a complex problem by dividing it into small tasks and giving you the answers to those, which is basically what we are trying to do when supporting Carol with her lesson planning.

The next step is to call for teachers in the sector to join this quest of testing ChatGPT to produce these role-play scenarios in a way that will serve teachers and engage the students, focusing on the assessment methodology improvement. Teachers can help evaluate the viability of this process and the final outputs of the experience.

[14] https://themindfulteacher.medium.com/how-im-using-chatgpt-as-a-school-teacher-1e82b8e2b101
[15] https://agentgpt.reworkd.ai/

Next Steps

Over the next several months we will be publishing these reports as the research evolves. This is a fast moving area so our aim is to make the findings from our exploration of the topics available as soon as they get to a stage where there are practical insights that can be shared. Throughout this process, we also expect to uncover new topics to explore. Our hope is that collectively this series will provide a useful stepping stone into this new generative AI enabled world and guide the direction of future work.