Australian Education Research Organisation

Discussion paper

Strengthening the evidence on how GenAI can improve teaching and learning

June 2024

The Australian Education Research Organisation (AERO) is Australia's national education evidence body, working to achieve excellence and equity in educational outcomes for all children and young people.

Acknowledgement

AERO's work is made possible by the joint funding it receives from Commonwealth, state and territory governments.

Acknowledgement of Country

AERO acknowledges the Traditional Custodians of the lands, waterways, skies, islands and sea Country across Australia. We pay our deepest respects to First Nations cultures and Elders past and present. We endeavour to continually value and learn from First Nations knowledges and educational practices.

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How to cite

Australian Education Research Organisation. (2024). *Strengthening the evidence on how GenAI can improve teaching and learning: Discussion paper*. https://www.edresearch.edu.au/research/research-reports/strengthening-evidence-how-genai-can-improve-teaching-and-learning

Publication details

ISBN 978-1-923066-31-1 (online)
Cover image: AERO

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Introduction

GenAI has the potential to improve learning outcomes for all, but it also comes with risks. This discussion paper explores how we can get a better understanding of how to best harness GenAI tools for teaching and learning.

The arrival of ChatGPT in late 2022 sparked a global education firestorm. Since then, teachers, school leaders and education policymakers have grappled with how to navigate the potential benefits and risks of ChatGPT and similar educational technology (EdTech) powered by generative artificial intelligence (GenAI) (Australian Government Department of Education [AGDE], 2023; Australian Institute for Teaching and School Leadership [AITSL], 2023a, 2024; Organisation for Economic Co-operation and Development [OECD], 2023). Responses have ranged from fear of GenAI to fear of missing out. Initially, most Australian jurisdictions blocked access to GenAI while they raced to develop guidelines for its use. Focus has now shifted to questions about its effectiveness, which are harder to answer. These include how we can harness GenAI to improve learning outcomes for all students while ensuring safe, ethical and responsible use (Klopfer et al., 2024; Loble & Hawcroft, 2022).

As part of its 2024 Research Agenda, the Australian Education Research Organisation (AERO) is undertaking research to help schools and systems make more informed decisions about how to use GenAI tools to reverse growing inequity in student learning outcomes. The potential of GenAI may be vast, but there's a lot we need to find out. We invite contributions from the education research community to help AERO kickstart our research.

Glossary

Educational technology (EdTech) refers to both hardware (e.g., smartboards) and software (e.g., learning management systems and learning applications) used in schools to enhance teaching and learning.

Generative artificial intelligence (GenAI) uses machine learning algorithms to produce text, images, art, video, codes and data based on input it has been trained to use (Gartner, 2023). Examples include ChatGPT and Gemini, which use previously learned information to generate content in response to questions posed by the user.

GenAI tools refer to EdTech that uses GenAI. Examples include tools that provide personalised and adaptive tutoring for students (e.g., Khanmigo) or can generate lesson materials for teachers (e.g., Diffit).

Using GenAI to improve teaching and learning in ways that reduce inequity

GenAI is already in the hands of students and teachers. Like other EdTech that has come before, to be effective and advance equitable outcomes, GenAI tools need to:

- build on what we already know about effective teaching and learning
- integrate with existing educational policies, systems and structures to enable teachers and students to use them easily
- be targeted and tailored to meet the needs of students who stand to benefit most.

Much discussion about GenAI tools to date has rightly centred on fears about information security and privacy. Other concerns focus on students' use of GenAI tools. Could early-adopting students use GenAI to gain an unfair advantage? Could students use it to shortcut the effortful thinking needed to learn important skills and knowledge? While we need to consider these risks, we also need to balance them with a more rigorous understanding of GenAI's potential, particularly with regard to issues of inequity. GenAI could be a gamechanger when it comes to tackling persistent education challenges in Australia. However, for this to be true, we need evidence – not just promises from EdTech companies. Evidence requires further research, particularly in 3 key areas:

1. **Student achievement:** National testing shows that Australian student achievement in core areas – including reading, writing and numeracy – has stagnated or declined over time (Australian Curriculum, Assessment and Reporting Authority, 2022; AERO, 2023). We need to better understand if GenAI tools can help improve core skills such as reading, writing and numeracy. If they can, we need to know how and in what contexts. This will help schools and teachers make informed decisions about whether to use tools and how to use them in their classrooms. For example, we need to know more about:
   a. whether (and which) GenAI tools can accurately diagnose student needs and effectively customise learning
   b. how GenAI tools could be used to support individual or small-group learning for students not yet meeting proficiency standards
   c. the professional learning and support needed for teachers to successfully use GenAI tools to improve student learning outcomes (AITSL, 2024).

2. **Teacher workload:** Current demands on teacher time make it difficult to focus on what matters most – student learning. They can also lead to teacher burnout (AITSL, 2023b) and reduced instructional quality (Hunter, et al. 2022a). Teacher shortages also pose a big challenge, as schools struggle to recruit and retain staff. This is intensified when teacher expertise in specific subject areas or for distinct student groups is unavailable (AGDE, 2023). Disadvantaged and remote schools have greater workload demands and teacher shortages than others. We, therefore, need to know more about:
   a. whether GenAI tools can simplify teachers' tasks and reduce their workload
   b. whether GenAI lesson planning tools can help teachers, especially new teachers or those who need to teach outside their field.

3. **Equity:** Some students, including those from disadvantaged backgrounds, continue to face barriers to academic achievement. National testing shows that our education system has not yet enabled all students to reach proficiency in reading, writing and numeracy. Systems and schools need greater support to reduce persistent and growing inequities in achievement (Goss et al., 2016; Loble & Hawcroft, 2022; Schleicher, 2019). We need to know more about:
   a. how any benefits of GenAI can be made accessible to students and schools in poorly resourced contexts
   b. which design features and tools help teachers work effectively with students who are not yet meeting year-level standards, including those experiencing disadvantage.

By producing research that will address these knowledge gaps, AERO can provide advice to systems, schools and EdTech providers about how to realise the promise of GenAI in ways that benefit all students, particularly those not achieving proficiency in reading, writing and numeracy.

Reducing the risk of GenAI reinforcing inequities

If GenAI tools live up to their promise to reduce teacher workload and improve student learning, the gains to students and teachers may be significant. However, without appropriate attention to issues of digital divide (i.e., unequal access to adequate hardware and expertise), these gains will simply continue to reinforce inequities. These include inequities in access to effective teaching and inequitable outcomes in student learning. Relevant factors include differences in:

- access to the necessary hardware and infrastructure (e.g., personal computers and stable and fast wi-fi) to use GenAI tools (Lamb et al., 2022; OECD, 2023)
- financial resources to buy the most effective GenAI tools
- resourcing and capability to integrate GenAI tools into school programs in ways that address the needs of local students
- allocated time and training for teachers to learn how to use GenAI tools (AITSL, 2023a, 2024; Loble & Hawcroft, 2022; OECD, 2023).

Without measures to directly address issues of inequitable access, GenAI tools may end up reinforcing or even exacerbating existing educational inequities. These issues must be addressed in any research aimed at improving learning outcomes and reducing educational inequity.

Strengthening the evidence base for using GenAI in schools

For GenAI to address inequity, we need to know what works, how well, for whom and in what contexts. AERO's initial consultations have identified 5 potential research questions:

1. **Can GenAI tools provide fast and targeted feedback to support students not yet achieving the age-appropriate national benchmarks in writing?**

   NAPLAN data highlights the need to improve students' writing skills. While feedback is key to student learning, it can take time to provide. Many GenAI tools claim to provide effective feedback on writing, but these claims need to be rigorously evaluated within an Australian context.

2. **Can GenAI-powered lesson planning tools help teachers develop lesson materials that support effective teaching?**

   Teachers spend significant time preparing lesson materials, particularly those teaching in under-resourced contexts (Hunter et al., 2022b). While many GenAI-powered lesson planning tools claim to help save teachers' time, none have been thoroughly evaluated within an Australian context. We need to know whether they are producing quality materials that support effective teaching.

3. **Can GenAI-powered tutoring tools accelerate learning for students not yet achieving year-level standards?**

   Little research has been conducted to determine the effectiveness of tutoring tools that can adapt lessons relevant to student progress. We need to know whether these tools work if we are to use them to help students meet year-level standards.

4. **What quality standards do we need for GenAI tools?**

   Schools and systems must make decisions about GenAI tools that will make the best use of limited budgets and staff time. A well-designed process for assessing the effectiveness of GenAI tools would support schools and systems in making informed decisions. It would also encourage the market to produce more educationally effective tools.

5. **What is the state of access and uptake of digital technologies in classrooms and schools?**

   Some schools cannot fully realise the opportunities that GenAI tools offer because of the digital divide. However, we don't know enough about who is affected or to what extent. A mixed methods research project would look at factors that inhibit access to and uptake of digital technologies. This could then inform school and school system decision-making. In the short term, developing a community of practice between under-resourced and highly resourced schools may be useful. This could provide opportunities for sharing experiences, time and expertise.

References

Australian Curriculum, Assessment and Reporting Authority. (2022). *Australian NAPLAN national report for 2022*. https://nap.edu.au/docs/default-source/default-document-library/2022-naplan-national-report.pdf

Australian Education Research Organisation. (2023). *Benchmarking performance*. https://www.edresearch.edu.au/research/research-reports/benchmarking-performance-future-directions-nap

Australian Government Department of Education. (2023). *Australian framework for generative artificial intelligence in schools*. https://www.education.gov.au/schooling/resources/australian-framework-generative-artificial-intelligence-ai-schools

Australian Institute for Teaching and School Leadership. (2024). *Evaluating the evidence for educational technology: Part 2 – Enabling learning.* Spotlight Series. https://www.aitsl.edu.au/research/spotlights/evaluating-the-evidence-for-educational-technology-part-2-enabling-learning

Australian Institute for Teaching and School Leadership. (2023a). *Evaluating the evidence for educational technology: Part 1 – The technologies.* Spotlight Series. https://www.aitsl.edu.au/research/spotlights/evaluating-the-evidence-for-educational-technology-part-1-the-technologies

Australian Institute for Teaching and School Leadership. (2023b). *Australia's teacher workforce today*. Spotlight Series. https://www.aitsl.edu.au/research/spotlights/australia-s-teacher-workforce-today

Gartner. (2023). *Information technology Gartner glossary: Generative AI*. https://www.gartner.com/en/information-technology/glossary/generative-ai

Goss, P., Sonnemann, J., Chisholm, C., & Nelson, L. (2016). *Widening gaps: What NAPLAN tells us about student progress*. Grattan Institute. https://grattan.edu.au/report/widening-gaps/

Hunter, J., Sonnemann, J., & Joiner, R. (2022a). *Making time for great teaching: How better government policy can help*. Grattan Institute. https://grattan.edu.au/report/making-time-for-great-teaching-how-better-government-policy-can-help/

Hunter, J., Haywood, A., & Parkinson, N. (2022b). *Ending the lesson lottery: How to improve curriculum planning in schools*. Grattan Institute. https://grattan.edu.au/report/ending-the-lesson-lottery-how-to-improve-curriculum-planning-in-schools/

Klopfer, E., Reich, J., Abelson, H., & Breazeal, C. (2024). *Generative AI and K-12 education: An MIT perspective*. https://doi.org/10.21428/e4baedd9.81164b06

Lamb, S., Maire, Q., Doecke, E., Macklin, S., Noble, K., & Pilcher, S. (2020). *Impact of learning from home on educational outcomes for disadvantaged children*. Centre for International Research on Education Systems and the Mitchell Institute, Victoria University. https://vuir.vu.edu.au/40386/

Loble, L., & Hawcroft, A. (2022). Shaping AI and Edtech to tackle Australia's learning divide. University of Technology Sydney. https://doi.org/10.57956/kxye-qd93

Organisation for Economic Co-operation and Development. (2023). Opportunities, guidelines and guardrails on effective and equitable use of AI in education. In *OECD digital education outlook 2023: Towards an effective digital education ecosystem*. OECD Publishing. https://doi.org/10.1787/c74f03de-en

Schleicher, A. (2019). *PISA 2018: Insights and interpretations*. Organisation for Economic Co-operation and Development. https://www.oecd.org/pisa/publications/pisa-2018-results.htm

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