Policy Position Statement:
Artificial Intelligence (AI) in Science Education.

Topic	Discussion notes
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Audience of policy position statement	*Media*
	- To inform the general public about the perspective and interests of science educators.
	
	Science educators, including Science Teacher Associations
	- To promote a productive consensus on this issue.
	- To promote best-practice classroom implementation including:
	  - Use in engaging classroom activities and discussion;
	  - Supporting students language expressions;
	  - Supporting teacher research to understand complex ideas;
	  - Opportunities for deeper and richer critical thinking learning activities designed to challenge students' conceptual understanding;
	  - Supporting students to access tasks of higher cognitive levels without the need to first master the underlying skills.

What do we know about the problem/issue?	AI has been used in science education in different forms for at least forty years. However, the COVID-19 pandemic led to a sudden and unexpected increase in the digitalisation of teaching and learning in science, emphasised by a pre-existing need for digital engagement in this subject. These effects, in conjunction with increased access to generative AI tools are the significant background for this topic.
	
	There are four main forms of Artificial Intelligence:
	1. Reactive AI: Simulates a language model through scripted answers to likely inputs. For example, Siri.
	2. Generative/Limited memory AI: Self-generates responses to inputs based on a large database of sample inputs and outputs. For example,
	  a. chatbots like ChatGPT can generate a seemingly complex language model;
	  b. virtual assistants can interact with calendars and spreadsheets;
	  c. self-driving vehicles can follow road rules.
	3. Theory of mind AI: Currently speculative, this will be able to better understand the entities it is interacting with by discerning their needs, emotions, beliefs, and thought processes.
	4. Self aware AI: There is no current model for achieving this level. This will be able to make decisions independent of inputs.
	
	The central challenge of incorporating generative AI in science classrooms is the need to work with the available technology in order to implement deeper learning. In this way, the introduction of this technology resembles the introduction of other research tools such as the internet and word processing programs. The lasting effects of the COVID-19 pandemic make this challenge more complex because of measurable longitudinal decreases in students' capacity for the social and emotional skills needed for independent study and ethical engagement with new technologies.
	
	There is a need to explicitly model and teach the effective and unbiased use of new

	technologies and to recognise the problems of inherent stereotyping. This includes tailored education that provides student learning outcomes in knowledge presentation, knowledge obtaining and knowledge derivation. This requires pedagogical skills that support educator practice in: - Monitoring student input and use - Developing and delivering technology-appropriate learning and assessment tasks - Providing critical feedback - Implementing novel interfaces for human-computer interactions Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., Liu, J. B., Yuan, J., & Li, Y. (2021). *A Review of Artificial Intelligence (AI) in Education from 2010 to 2020.* Fullan, M., Azorin, C., Harris, A., & Jones, M. (2023, August 27). *Artificial intelligence and school leadership: Challenges, opportunities and implications.* Jahic, I., Ebner, M., & Schön, S. (2023). *Harnessing the power of artificial intelligence and ChatGPT in education – a first rapid literature review.* Xu, W., & Ouyang, F. (2022). *The application of AI technologies in STEM education: A systematic review from 2011 to 2021.* OECD (2023), *Artificial Intelligence in Science: Challenges, Opportunities and the Future of Research*, OECD Publishing, Paris, Tangen, J. (2023, June 15). *Academic AI: A Collection of AI Tools and Prompts for Higher Education.* South Australian Government Department for Education. (2023). *Artificial Intelligence in Education*. Retrieved from https://www.education.sa.gov.au/parents-and-families/curriculum-and-learning/ai New South Wales Department of Education. (2023). *AI in Education Consultation Paper. Retrieved from* https://education.nsw.gov.au/content/dam/main-education/about-us/strategies-and-reports/consultation-items/AI_Consultation_Paper.pdf Cominos, C., & Coe, A. (2023). *AI technology in schools: What's happening in the classroom?* Retrieved from https://amp.abc.net.au/article/102563974
What is the problem/issue?	Science educators and students currently have low levels of AI literacy, leading to a workforce that is sometimes poorly-informed about what AI is; the limitations of different types of AI; and methods for safe and ethical use. This limits educators' capacity in the art of delivering a lesson which incorporates AI including: - monitoring student use; - preventing plagiarism; - preventing bias in results; - recognising AI hallucinations and out of date science information; - promoting ethical use of sample input databases; - promoting student engagement and learning; and - designing science investigation. Science educators currently have limited access to AI tools and related technologies. This includes access to proprietary programs and science technologies such as digital data loggers that make use of limited memory output generation to support the analysis of science experiments. Current AI tools have inherent biases, limitations and ethical implications. For example:

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Generative/Limited memory AI makes use of a large database of sample inputs and outputs. When this database has a bias the outputs of the AI will also have biases.
The sample database often accesses the work of authors and artists without their permission or due consideration.
The use of this database can perpetuate misconceptions and pseudoscience. This is true of all research tools but the perception of authority of AI responses can lead to a stronger reinforcement of these ideas than is otherwise possible.

AI tools can undermine currently-popular models of the teaching-assessment cycle. For example:

Chatbots like ChatGPT can make it easier for students to accurately complete science tasks that instruct them to recall or describe concepts
The use of chatbots to answer extended questions can mask student learning deficits in literacy skills that are often assessed as part of science curricula, such as:

Spelling
Sentence formation
Paragraph formation
Inquiry report composition
Text structure e.g. procedures, risk assessments, explanations.

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<tr><td rowspan="3">What could the solutions be and why will they work?</td><td>Solutions</td><td>Rationale for solution</td></tr>
<tr><td>Adequate resources, including AI technologies, should be made available to educational institutions to facilitate hands-on learning experiences for students. This may include access to simulation environments, and data sets that enable students to develop AI models and conduct experiments.

Collaborations between educational institutions and AI research organisations should be fostered to provide students with opportunities to engage in real-world AI projects, enhancing their practical skills and understanding of AI in science.</td><td>Equity and equality for all schools, teachers and students.</td></tr>
<tr><td>Explicitly teach students how to exercise critical thinking and problem-solving skills by integrating discussions and activities that explore the societal and environmental implications of AI applications in science. This will enable students to make informed decisions and contribute responsibly to the field.

Explicitly teach the ethical considerations and responsible use of AI in science education. Students should be educated about the potential biases, limitations, and ethical</td><td>Developing critical thinking and problem solving in order for students to be AI literate.</td></tr>
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	implications associated with AI algorithms and their impact on scientific research and decision-making processes.	
	Provide science educators with exemplar uses of AI that encourage deep cognitive engagement with science concepts while AI is used for unchallenging, yet time consuming work.	Move the focus of teaching, learning and assessment to a level of deeper cognitive complexity.
	Provide professional learning to support science teachers' use of AI in teaching and assessing content and skills, including theory and practical work and their interrelation with the general capabilities.	Supporting teacher capacity and growth.
	Provide professional learning to support laboratory technicians' use of AI in supporting science teacher planning and experimentation. Build a stronger relationship with SETA.	Supporting teacher capacity and growth through collaborative work with lab technicians.