

2024 Premier’s Hicksons Lawyers STEM Scholarship

The Artificial Intelligence Co-Pilot Teacher

Digital Transformation of Education

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# Introduction

Personalised learning has a profound impact on student achievement, as demonstrated by the ‘Two Sigma Problem’ research, which found that students who received one-to-one tutoring improved their achievement levels by two standard deviations compared to those who received conventional group instruction (Bloom, 1984). However, Bloom also identified that it was impractical for thirty students in a traditional classroom to each receive individual tutoring from a single teacher.

Prior to the public release of ChatGPT on November 30, 2022, teachers valued implementing differentiation in the classroom by varying rates of instruction, complexity, and support systems to facilitate deep learning tailored to individual students' needs (Tomlinson, 1999).

The concept of the "Co-Pilot Teacher" represents a groundbreaking shift in educational paradigms, where Artificial Intelligence (AI) becomes integral to teaching and learning processes. The emergence of Generative AI is unprecedented in its capability to generate language responses to human prompts and maintain human conversation. Research indicates that the performance of ChatGPT improved significantly from version 3.5 to 4.0 in terms of accuracy on standardised written examinations (Korkmaz, 2024). AI is now perceived not as a traditional technological tool but as a transformative intelligence, marking a co-intelligence with teachers in classrooms and education globally.

# Focus of Study

This study explores how AI can be used as a Co-Pilot Teacher in the classroom to move beyond merely providing accurate answers for students, to personalised learning and building an AI learning experience that crosses disciplines. The report aims to provide teachers and the school-wide community with findings on using AI in the classroom to make decisions that will lead to quality student learning.

The report examines the potential positive impacts and critical reflections on using AI in learning and teaching for both students and teachers. Emphasis is placed on evaluating AI’s role in developing students’ critical and creative thinking, mathematical fluency, and digital literacy, to equip them for the 21st-century workplace (ACARA, 2024). The report explores how teachers might use AI to foster deep understanding, engagement in a positive classroom environment, and learning that is connected to students' lives and the wider world (Miller, 2019).

The findings in the report are based on emergent practices, which are rapidly expanding, and further research is required to consider the impact of AI on student learning that will lead to best practices (Barlett, 2019). The scope of the report is based on findings from a study tour, attending AI in Education conferences, exploring STEM curriculum training courses, visiting AI-focused museums, interviews with educational leaders and industry experts in Australia and the United States, and referencing articles addressing AI practices in education.

# Significant Learning

There is active engagement among educators in Australia and the United States in using AI in education, with educators agreeing on the potential benefits for students’ learning. This study found that the United States has targeted partnerships with universities to develop AI curriculum resources to assist teachers in primary and secondary schools. These curriculum resources cover ethics and assessment guidelines for using AI and provide practical lesson plans involving projects for students to actively build AI solutions to real-world problems.

This report highlights some of these emergent AI practices that can be implemented in a secondary school classroom. The practices evaluate the positive impacts and critical reflections of implementing AI in the classroom to provide quality student learning, benchmarked to best practices from the Centre for Education Statistics and Evaluation report, recommending explicit instruction, timely feedback, and collaborative student tasks (CESE, 2020).

### Teachers’ role with AI

Upon the public release of ChatGPT, the discourse surrounding AI was initially dominated by concerns about preventing students from cheating on assessments using AI, rather than focusing on how teachers could leverage AI to benefit students’ learning. Teachers were unsure how to implement AI learning tasks for their students and see the potential for AI to develop students’ problem-solving skills (Xiaoyu, 2022). There was a general perception that programmers with technical expertise were best positioned to use AI and reap its benefits.

As familiarity with Generative AI’s language-based functionality grew, the importance of prompt engineering became evident in providing the desired output generated by the AI bot. Teachers are in the best position to work with AI, which requires clear instructions and the capability to provide counter-arguments and responses to probing questions, similar to tasks carried out by teachers in the classroom. Teachers, in their everyday role of providing instructions to students, are well-suited to learn and craft effective prompts, as shown in Figure 1.



Figure 1: Elements of a Good Prompt

## AI-generated metacognitive learning tasks

### Personalised Quizzes

Teachers can significantly reduce their lesson preparation time by using AI tools such as ChatGPT, Co-Pilot or specific apps like My Teacher Aide, Toddle, Quizizz. These tools not only provide answers for students but also create formative assessment tasks in the form of quizzes. AI can generate quiz questions tailored to a student’s achievement level using an engineered prompt, as shown in Figure 2 below. The quiz results can provide students with frequent feedback on their progress, gamifying learning and offering a low-stakes form of formative assessment that engages students without the pressure of grading. Teachers benefit from using quiz data to identify learning gaps and provide remedial support for students (Lu, 2022).

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| You are a quiz creator of highly diagnostic quizzes. You will make good low-stakes tests and diagnostics. You will then ask me two questions. Read what is on the pdf attachment and ask me about the high school student year level for the quiz. Once you have my answer, you will construct several multiple-choice questions to quiz the audience on that topic. The questions should be highly relevant and go beyond just facts. Multiple choice questions should include plausible, competitive alternate responses and should not include an "all of the above option". At the end of the quiz, you will provide an answer key and explain the right answer. |

Figure 2: Example of ChatGPT 4 engineering prompt to design a class quiz at different achieving levels

### Interactive Worksheets

Traditionally, teachers tailored tasks to the student’s achievement level by creating worksheets or using simulations programmed by education specialists. AI can now create worksheets and simulations for teachers. These visual simulations can be incorporated into real-world projects for students to solve problems connected to their lives (Merriam, 2017). Teachers can devote more time to facilitating class discussions on project work, developing students’ conceptual understanding. Students can also adjust the simulation settings to match their learning needs.

## AI problem-solving projects

The use of AI can serve as a metacognitive teaching strategy to enhance new learning experiences for students, fostering critical thinking and creativity (Hattie, 2009). The following section exemplifies new learning opportunities involving AI projects that students can embark on in the classroom.

### Conversations with a ChatBot

Sydney University has initiated a pilot program for second-year occupational therapy students, where they implement therapy plans through personalised conversations with a ChatBot named 'Mrs. S.' This ChatBot, designed with an engineering prompt, acts as a subject matter expert, allowing students to practice interacting with a patient's teacher. The pilot results indicated significant student engagement, as the AI facilitated connections to real-world scenarios. Students applied critical thinking to formulate questions for the ChatBot and received immediate feedback in a two-way dialogue. Furthermore, the ChatBot can pose questions to students about their prior knowledge, provide responses using specific vocabulary, grade their dialogue against a rubric, and give teachers feedback on students needing additional support (Maher, 2023).

A similar methodology can be applied by using a Subject Matter Expert (SME) in the form of a 'Data Scientist ChatBot,' designed with an engineering prompt, to interact with Year 9 and 10 students (as shown in Figure 3). This setup enables students to explore data analysis within the context of a professional role, as outlined in the new Stage 5 Computing Technology syllabus. Teachers can ensure responsible AI usage by guiding students to validate the accuracy of the ChatBot’s output.

Figure 3 demonstrates key aspects of the pedagogical prompt to personalise learning and stimulate student thinking. The prompts encourage students to formulate their own questions and respond at their own pace, fostering critical thinking. The prompts are tailored to students' prior knowledge, supporting Vygotsky’s Zone of Proximal Development evidence-based practice, which underscores the importance of scaffolding. The AI ChatBot is instructed to communicate supportively and encouragingly, promoting critical and creative thinking by prompting students to articulate their thought processes. Additionally, the ChatBot is designed to detect if a student is struggling and provide appropriate scaffolding, which is particularly beneficial for lower-achieving level students.

Deploying SME ChatBots across various Key Learning Areas (KLAs) can introduce industry expertise into the classroom, aiding students in making real-world connections. The learning experience can be further enhanced with AI in Virtual Reality (VR) technology, allowing students to interact with an animated SME ChatBot. VR enhances experiential learning, provides spatial learning, and boosts motivation and engagement among diverse student learners.

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| You are a Data Scientist who helps students understand concepts by explaining ideas and asking students questions. Start by introducing yourself to the student as their Subject Matter Expert who is happy to help them with any questions. Only ask one question at a time. 1. Ask them what they would like to learn about. Wait for the response. Then ask them about their learning level: Are you a high school student, a college student or a professional? Wait for their response. Then ask them what they know already about the topic they have chosen. Wait for a response.
2. Given this information, help students understand the topic by providing explanations, examples, analogies. These should be tailored to students learning level and prior knowledge or what they already know about the topic.
3. You should guide students in an open-ended way. Give students explanations, examples, and analogies about the concept to help them understand. Do not provide immediate answers or solutions to problems but help students generate their own answers by asking leading questions.
4. Ask students to explain their thinking. If the student is struggling or gets the answer wrong, try asking them to do part of the task or remind the student of their goal and give them a hint. If students improve, then praise them and show excitement.
5. If the student struggles, then be encouraging and give them some ideas to think about. When pushing students for information, try to end your responses with a question so that students have to keep generating ideas.

Once a student shows an appropriate level of understanding given their learning level, ask them to explain the concept in their own words; this is the best way to show you know something, or ask them for examples. When a student demonstrates that they know the concept you can move the conversation to a close and tell them you’re here to help if they have further questions. |

Figure 3: Example of an engineering prompt to set up a Subject Matter Expert ChatBot

### Build your own Bot

The University of Florida has piloted ‘The Shark AI Project’ for elementary school students to build a Bot to classify shark teeth. Using the Google Teachable Machine app, students take images of shark teeth to train a Bot. This project teaches students the basics of facial recognition, engages them in real-world problem-solving, and develops their digital literacy by inputting data and validating the Bot’s output (Crawford, 2021).

Similarly, a project can be developed for students to build an ‘Indigenous Dhurga to Australian English Translator Bot’ to explore Indigenous culture across disciplines. Through this hands-on approach, students learn how to train a Bot using the Poe app, develop digital literacy skills through the understanding of data organisation, input of data into the Bot, use of prompt engineering, and validation of the Bot's output. The project can integrate Indigenous culture into the classroom, enhancing multidisciplinary learning in the NSW syllabus.

The Design School at Stanford University challenges students to think of potential real-world problems they can solve, such as “How can AI be used to help tackle sustainability and climate change?” These learning experiences can digitally transform the classroom, encouraging students to work collaboratively on solving real-world issues.

## AI learning assistants

Personalised learning implies that each student has their own tutor, providing scaffolding at their level, individualised feedback, differentiated tasks, and new learning opportunities for engagement. The following introduces the potential impacts of AI learning assistants on students' key competencies in secondary schooling.

### Writing

AI writing assistants can help students brainstorm ideas, draft tasks, model sentence examples, and provide prompt feedback on grammar and spelling. These assistants can guide students in structuring essays, organising ideas, creating outlines, and building logical arguments. Writing assistants, such as Wordtune and Grammarly, can extend students’ thinking by generating counterarguments.

### Numeracy

AI numeracy assistants, such as Mathspace and Khanmigo, explain each step of the mathematical solution process to individual students. These AIs encourage students to attempt the next step rather than providing the solution immediately, employing a Socratic approach. Teachers can assign adaptive tasks to each student’s achievement level, and the AI provides feedback on student progress. AI-generated text responses develop students’ fluency, although they currently lack the capability to generate explanatory images crucial for conceptual understanding in mathematics.

### Research

AI research assistants, like Elicit, support teachers and students in searching for research papers, summarising main findings, tailoring content to individual needs, and providing counterarguments to develop critical thinking. Elicit is accessible to all students, allowing them to adjust difficulty levels and present information in various formats. The positive impacts include brainstorming ideas, critical thinking, and reducing research time by quickly providing a list of relevant sources.

### Feedback

AI tools, such as ChatGPT and Co-Pilot, offer the potential to improve feedback in education, providing frequent and detailed feedback tailored to each student. AI can automate the grading of certain assignments, reducing teachers' administrative load and allowing more time for teaching. AI feedback can be instant and detailed, helping students understand their mistakes and how to improve.

AI tools can analyse students’ work submissions to a marking rubric and suggest improvements, adjust assessment difficulty in real-time, and keep students engaged and motivated in their learning within their zone of proximal development (ZPD). However, teachers remain essential for modelling critical thinking and assessing students holistically, as AI cannot fully replicate the nuanced observations made by teachers in the classroom.

### Reading

AI reading assistants, such as Explain Paper, can summarise complex texts, translate content, analyse texts for themes, sentiments, and patterns, and generate comprehension questions. These tools help students grasp main points, understand material, and effectively test their comprehension. AI reading assistants are particularly beneficial for visually impaired students or those with conditions such as dyslexia.

### Speech

In language learning classes, AI speech assistants, like Whisper, can help students practise speaking skills, transcribe speech for correction, and create written records of discussions. These tools make education more accessible for students with disabilities or from a non-English speaking background and provide real-time transcriptions of class notes.

# Conclusion

The AI Co-Pilot Teacher has the potential to be accessible to all students, offering tailored scaffolding and feedback aligned with their achievement levels, thereby promoting equity in education (Loble & Hawcroft, 2022). Teachers are well-positioned to lead the integration of AI in classrooms by acquiring skills in prompt engineering, enabling them to instruct the AI Co-Pilot Teacher in generating quality learning tasks.

AI has the potential to not only complete traditional administrative tasks, such as creating lesson plans and assessment questions; but digitally transforming education. This includes reimagining students' roles in building AI Bots to solve real-world problems, frequent formative assessments for students to receive feedback on their learning progress, and offering AI learning assistants to support students’ literacy and numeracy skills. AI projects can enhance students' learning experiences by developing critical and creative thinking, as well as mathematical and digital literacy skills essential for the 21st-century workplace. Further research is recommended to implement AI as an integrated system across the entire school, accessing student learning data to fully realise AI's impact.

My objective is to collaborate with my school and the broader educational community to demonstrate how AI learning assistants can support students in writing, reading, numeracy, research, and feedback. We are currently in the emergent practice paradigm of integrating AI into classroom learning tasks. It is hoped that these emerging practices will evolve into best practices that enhance student learning. There is an opportunity to incorporate AI response validation into learning task rubrics and teach students digital literacy skills to validate AI-generated responses.

Students should be empowered to control the digital technology solutions they create. Encouraging students to use AI will equip them to become builders and creators of AI rather than passive consumers. AI has the capacity to integrate across various curricular areas, however, ongoing discussions are needed to explore creative ways to utilise SME ChatBots in different KLAs.

It is crucial to use AI in pedagogically appropriate ways, not merely for providing answers. There is an opportunity to think big. Using AI, teachers can develop metacognitive learning tasks to emphasise students' digital literacy, critical and creative thinking skills, and to prepare them for the challenges and opportunities of the 21st century workplace.

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