Intelligence Unleashed:
An Argument for AI in Education
Executive Summary

This paper on artificial intelligence in education (AIEd) has two aims. The first, to explain to a non-specialist, interested, reader what AIEd is: its goals, how it is built, and how it works. The second, to set out the argument for what AIEd can offer teaching and learning, both now and in the future, with an eye towards improving learning and life outcomes for all.

Computer systems that are **artificially intelligent** interact with the world using capabilities (such as speech recognition) and intelligent behaviours (such as using available information to take the most sensible actions toward a stated goal) that we would think of as essentially human.

At the heart of **artificial intelligence in education** is the scientific goal to make knowledge, which is often left implicit, computationally precise and explicit. In other words, in addition to being the engine behind much 'smart' edtech, AIEd is also designed to be a powerful tool to open up what is sometimes called the 'black box of learning,' giving us more fine-grained understandings of how learning actually happens.

Although some might find the concept of AIEd slightly unnerving, the algorithms and models that underpin edtech powered by AIEd form the basis of an essentially human endeavor. Using AIEd, teachers will be able to offer learners educational experiences that are more personalised, flexible, inclusive and engaging. Crucially, **we do not see a future in which AIEd replaces teachers.** What we do see is a future in which the extraordinary expertise of teachers is better leveraged and augmented through the thoughtful deployment of well designed AIEd.

We have available, right now, AIEd tools that could support student learning at a scale previously unimaginable by providing one-on-one tutoring to every student, in every subject. Existing technologies also have the capacity to provide intelligent support to learners working in a group, and to create authentic virtual learning environments where students have the right support, at the right time, to tackle real-life problems and puzzles.

In the near future, we expect that teaching and learning will increasingly be supported by the thoughtful application of AIEd tools. For example, by lifelong learning companions powered by AI that can accompany and support individual learners throughout their studies – in and beyond school – and new forms of assessment that measure learning while it is taking place, shaping the learning experience in real time.

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If we are ultimately successful, we predict that AIEd will help us address some of the most intractable problems in education, including achievement gaps and teacher retention. **AIEd will also help us respond to the most significant social challenge that AI has already brought** – the steady replacement of jobs and occupations with clever algorithms and robots. It is our view that this provides a new innovation imperative in education, which can be expressed simply: as humans live and work alongside increasingly smart machines, our education systems will need to achieve at levels that none have managed to date.

True progress will require the **development of an AIEd infrastructure.** This will not, however, be a single monolithic AIEd system. Instead, it will resemble the marketplace that has developed for smartphone apps: hundreds and then thousands of individual AIEd components, developed in collaboration with educators, conformed to uniform international data standards, and shared with researchers and developers worldwide. These standards will also enable system-level data collation and analysis that will help us to learn much more about learning itself – and how to improve it.

Moving forward, we will need to pay close attention to three powerful forces as we map the future of artificial intelligence in education, namely **pedagogy, technology,** and **system change.**

- Paying attention to the **pedagogy** will mean that the design of new edtech should always start with what we know about learning. It also means that the system for funding this work must be simultaneously opened up and refocused, moving away from isolated pockets of R&D and toward collaborative enterprises that prioritise areas known to make a real difference to teaching and learning.

- Paying attention to the **technology** will mean creating smarter demand for commercial grade AIEd products that work. It also means the development of a robust, component-based AIEd infrastructure, similar to the smartphone app marketplace, where researchers and developers can access standardised components that have been developed in collaboration with educators.

- Paying attention to **system change** will mean involving teachers, students, and parents in co-designing new tools, so that AIEd will appropriately address the inherent "messiness" of real classroom, university, and workplace learning environments. It also means the development of data standards that promote the safe and ethical use of data.

Said succinctly, we need intelligent technologies that embody what we know about great teaching and learning, embodied in enticing consumer grade products, which are then used effectively in real-life settings that combine the best of human and machine.

We do not underestimate the new-thinking, inevitable wrong-turns, and effort required to realise these recommendations. However, if we are to properly unleash the intelligence of AIEd, we must do things differently – via new collaborations, sensible funding, and (always) a keen eye on the pedagogy. The potential prize is too great to act otherwise.