

- WHITE PAPER -

# Artificial Intelligence and Machine Learning in the Education Sector

- GLOBAL TRENDS AND APPLICATION IN NEW ZEALAND -

11 February 2019

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## Introduction

Artificial Intelligence (AI) is already ubiquitous in our day-to-day lives. From maps that find the optimal route, to Amazon, Netflix and Facebook who curate content and make recommendations tailored specifically to us. Your smartphone even understands voice commands and can perform tasks prompted by you. The technology is pervasive and is increasingly being applied in the education sector.

EDTechXGlobal and IBIS Capital estimated in their 2016 Industry Report<sup>1</sup> that:

- by 2020 the annual global spend on technology in education will reach \$250b (yes billion)
- by 2035 there will be 2.7 billion students worldwide – in order to cope with this demand it is estimated that around **TWO NEW UNIVERSITIES PER DAY** needs to be built over the next 20 years.

Only 2% of global education goods and services are digitised

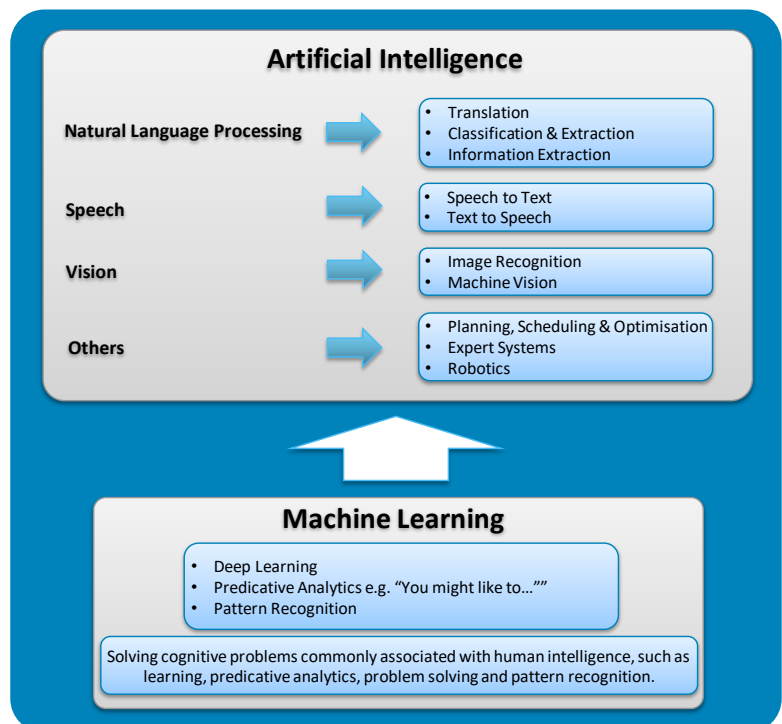
Globally in the education sector, AI is being applied in tools that help develop learner skills, allow self-paced tailored learning, streamline assessment systems, and automate administrative activities. As the technology matures, the hope is that AI can help fill gaps in learning and teaching allowing educational institutions and teachers to do more than ever before. Similarly, the expectation is that educational policy development and decision-making will be greatly enhanced by AI's analytical capability.

Here, in the New Zealand education sector, the opportunities to benefit from AI and Machine Learning (ML) mirror global trends. We already have terabytes of information available to develop better insights to optimise decision-making and refine policy. Due to our relative size we are well-positioned to achieve national impact.

## What is Artificial Intelligence (AI) and Machine Learning (ML)?

A myriad definitions abound concerning these concepts. In simple terms, AI is the umbrella concept for technologies that try to perform tasks or simulate processes we normally associate with human intelligence.

The bedrock of this is Machine Learning (ML) and when multiples of these technologies are used in conjunction, the resulting software or system is said to be 'using AI'.



<sup>1</sup> 2016 Global EdTech Industry Report - [EdTechXEurope.com](http://EdTechXEurope.com) and [PR NewsWire](http://PR NewsWire)

## What is Happening Globally

Various nuances and combinations of AI technologies are being used to deliver specific outcomes in the education sector. Our research shows significant offerings exist to address individual learner success. Equally importantly, opportunities abound for improving the administration, financial management and delivery of educational services at sector level and individual provider.

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*The advances in network speeds, analytics, and security (e.g. BlockChain) present enhanced capabilities in learner record management. Moreover, virtual and augmented reality technologies present amazing experiential learning opportunities.*

*All of these complement and help facilitate AI and ML solutions.*

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### Why is AI in Education on the Rise?

Global population trends suggest that if existing education structures persist, significant infrastructural improvements will be required to meet the higher education demands by 2035.

... to cope we need to build two universities per day until 2035

The factors driving AI development and implementation in education:

1. AI and ML capabilities have leapt forward in the past few years making innovative solutions more readily available in the market;
2. The students of today will find themselves in an increasingly technological and AI centred world, hence the importance for educational institutions to expose students to these technologies;
3. Growth trends shows the sector will need to reshape and exponentially increase the delivery capabilities and methods for teaching, learning and management of our educational institutions.

### How can AI and ML help?

1. Drive learning effectiveness and personalisation for individual learners.
2. Streamline and optimise administrative tasks for education providers and teachers.

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*To allow teachers the time and freedom to provide understanding and adaptability which are uniquely human capabilities with which machines would struggle.*

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3. Analytics and insights – which have the potential to shape sector decision-making and policy, while being able to evaluate the effectiveness and impact of targeted interventions at speeds not previously seen.

## What's Possible for the Education Sector?

The education sector generates and collects vast amounts of data. Using advanced analytics, insights based on sector wide data can be gained with greater speed, accuracy, and confidence than ever before.

These new insights will inform policy-shaping and decision-making to address specific concerns and increase the effectiveness of targeting specific learner groups' needs, regional needs, and provider behaviours. AI will enable faster, more accurate assessment of policy decisions, whilst new initiatives can be quickly assessed before wider rollout is planned, funded and deployed.

The **MICRO-CREDENTIALS** concept – which is heavily dependent on AI – is gaining significant interest globally. This concept relates to tracking all learning experiences, individual papers, or achievement badges through to full courses and certifications as well as being able to mentor on a personalised level.

Micro-Credentials are badges, nano-credentials and nano-degrees, that recognise the achievement of a defined set of skills and knowledge.

Learning Management Systems (LMS) – which are already prevalent in the sector – are being enhanced with the adoption of micro-credentials. One solution provider<sup>2</sup> is working towards empowering underprivileged communities by aligning a range of learning experience (micro-credentials) to career opportunities.

Similarly, Learner Profiles will be able to be enhanced to form one authoritative history on each learner (transcripts, competencies, accreditations etc). Listen to an [interview with Matt Pittinsky](#)<sup>3</sup> from [Parchment](#)<sup>4</sup> for more on this topic.

## What's Possible for Providers?

There is real potential for AI to create more efficiency and effectiveness for educational institutions. Online and self-service enrolment processes are already assisting students using bots and virtual assistants - thus reducing the face-to-face or call centre support currently used. Deakin University in Australia has leveraged AI in the creation of a smart [campus life assistant](#)<sup>5</sup> and a personal [study assistant](#)<sup>6</sup> for students.

AI is also used within the [Frontline Education](#)<sup>7</sup> system which optimises scheduling of classes and staff (including locums) as well as recruitment and on-boarding of teachers. Additionally, these technologies are used to match candidates with tutors in online mentoring platforms.

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<sup>2</sup> <https://www.lrng.org/about>

<sup>3</sup> <https://www.gettingsmart.com/2018/04/how-better-transcripts-will-improve-college-admissions-employment-and-licensing/>

<sup>4</sup> <https://www.parchment.com/>

<sup>5</sup> <http://www.deakin.edu.au/about-deakin/media-releases/articles/ibm-watson-helps-deakin-drive-the-digital-frontier>

<sup>6</sup> <https://www.deakin.edu.au/about-deakin/media-releases/articles/deakin-genie-digital-student-assistant-wins-major-global-business-award>

<sup>7</sup> <https://www.frontlineeducation.com/>

Micro-schools are virtual schools comprising blended learning environments supporting personalised education and online tutoring.

The concept of **MICRO-SCHOOLS** is taking off in parts of the USA (see [CottageClass](#)<sup>8</sup> and [Acton Academy](#)<sup>9</sup>) and extends to low-cost private schools in Africa and India, indicating a growing interest in full-solution school management platforms (recruitment, student information, attendance, and payments - see [Bridge International](#)<sup>10</sup> as an example).

### What's Possible for Teachers?

Assessments, testing, grading and other administrative tasks are all extremely time-consuming activities for teachers. By utilising the power of AI to automate many of these tasks, more time is opened up for teachers to spend with individual learners. AI could alleviate this task along with identifying gaps in an individual's learning (see [GradeScope](#)<sup>11</sup>).

Other solutions deliver early learning<sup>12</sup>, adaptive learning<sup>13</sup>, track steps in problem solving, competency tracking and management (monitoring individualised progress enables teacher to provide customised review and reinforcement on areas of learner difficulty)<sup>14</sup>.

Research suggests AI will soon be able to assess free-format written responses.

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*Adaptive learning management systems will let students progress at their own pace and get personalised recommendations. Teachers will know where to focus their revision attention or which students to challenge with more advanced content.*

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As AI provides more and more of the content presentation role both online and in the classroom, the role of teachers is thought to be moving towards being a learning motivator, to achieve higher levels of mastery, and being a facilitator of individualised understanding.

### What's Possible for Learners?

In addition to improvements for early learning and adaptive learning, solutions also abound for course material summation<sup>15</sup>, language learning, writing assistance and translating. Solutions offering test preparation use ML to assess topic mastery and focus preparation on reinforcing weaker areas, for each individual learner (see [Quizlet](#), [Kaplan](#), [Magoosh](#) and [Toppr](#))<sup>16</sup>.

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<sup>8</sup> <https://cottageclass.com/>

<sup>9</sup> <https://www.actonacademy.org/>

<sup>10</sup> <http://www.bridgeinternationalacademies.com/>

<sup>11</sup> <https://www.gradescope.com/>

<sup>12</sup> <http://kidaptive.com/> & <https://www.playosmo.com/en/>

<sup>13</sup> <https://www.curriculumassociates.com/Products/i-Ready>

<sup>14</sup> <https://www.panoramaed.com/>

<sup>15</sup> <http://contenttechnologiesinc.com/>

<sup>16</sup> <https://quizlet.com/>, <https://www.kaptest.com/>, <https://magoosh.com/> and <https://www.toppr.com/>

Moreover, augmented reality (AR) and virtual reality (VR) assisted by AI and ML, can create experiential learning opportunities to explore study topics ([see this article for more](#)<sup>17</sup>). Assistive technology for special needs students is able to learn and adapt to individual needs (e.g., using language detection and learning the individual's speech patterns or including a "picture dictionary"). Soon, assistive technology could use past learning to predict areas of difficulty when a learner is faced with new content.

As AI continues to develop, a major test of its potential will be whether it can replace human judgment in individualised, complex ways. At Georgia State University<sup>18</sup> they developed a system to assist high school students in their transition to university, helping them to navigate the many twists and turns along the way. Knowing that the transition from school to university is laced with challenges, such as: submitting high school transcripts, obtaining immunizations, securing student loans, and paying tuition fees, Georgia State utilised AI to provide a support programme. They realised that failure to effectively support students — particularly those from low-income backgrounds — could mean they drop out before they start. Moreover providing generic outreach to all students would provide all students with the assistance they need to enrol in the most efficient and effective manner.

In the long term combining mentoring solutions, adaptive learning platforms and learning profiles with a personal learning assistant will create the possibility to have a personal life-long learning companion. It will know your strengths, weaknesses and learning behaviours as well as all the competencies you have achieved to date.

## Where to from here

Individualised curricula and customised learning plans based on the exact and specific needs of the learner is where some in the industry are already steering.

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*There is consensus that:  
**Teachers are not replaceable***

*Instead they will be empowered to improve the outcomes for their learners and will also see their manual and menial work reduce through the use of AI.*

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There are many challenges facing the education sector including, online delivery, personalisation of content, the curation of content, maintaining pedagogy principles, institutional administration, individual assessment, proctoring, as well as accreditation management.

At the moment there is a significant number of solution providers who target better outcomes for individual learners and teacher administrative activities. For the sector, significant opportunity is found in the analytics capability that AI offers to help drive policy development and refinement.

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<sup>17</sup> <https://www.gettingsmart.com/2018/05/innovation-creating-and-learning-in-ar-vr/>

<sup>18</sup> <https://hbr.org/2018/01/how-georgia-state-university-used-an-algorithm-to-help-students-navigate-the-road-to-college>

The education sector needs to be the driving force in directing activity towards a sustainable ecosystem.

Today learners are growing up a world increasingly impacted by technology and AI, our education sector must prepare, adapt and support its learners and institution to exploit this future. The New Zealand education sector must start to future-proof its policies, processes and systems for all learners of all ages.

The role of the teacher will focus highly on coaching and developing their learners through an enhanced understanding of what the learner needs next, in real-time.

## Opportunities for New Zealand

There is a need for a consolidated and co-ordinated approach to identify NZ-appropriate technologies and implement these across the sector. New Zealand has the opportunity to take a holistic approach to finding and implementing the best solutions.

- New Zealand needs to stay current with international trends. Our size, position and agility enable the potential to take a world leading position on AI in education.
- With sector-wide collaboration and national coordination we are in a position to implement ground-breaking solutions.
- Due to New Zealand's relatively centralised structure, we are well placed to evaluate these on a small scale and then implement the successes at a national level. Our experience could help shape AI in the education space globally. Most importantly, we can prepare education in New Zealand for the future.

New Zealand's size and centralised education structure is a strength in preparing for the future.

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*Think Big – Start Small – Grow Fast*

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