Environmental Scan Series.7

Artificial Intelligence

Digital technologies like artificial intelligence (AI) have begun to transform traditional teaching and learning practices. From a STEEP perspective, AI influences multiple spheres in the framework, most of all Social, Economic, and Technological. As mentioned in the Trends in Higher Education report, "Technology continues to disrupt traditional models of education" (see Envision Report 1).[1] AI in particular has transitioned from existing only in science fiction to ubiquitous real-world applications, with the potential to augment the learning capacity of students and solve problems inherent to the teaching and learning environment. But progress has shown that despite the potential benefits, AI also has the power to disrupt the education system with its ability to emulate traditional human proficiency on the job.[1] [2] [3] Therefore, it is important that academy leaders understand not only the potential of AI, but also its challenges when developing a strategy for navigating the coming disruptions. This report will discuss the current state of AI and the way in which AI has the potential to disrupt traditional learning, as well as its uses in enriching the learning experience through personalization and the enhancement of the student support environment. Case studies of AI in current practice will be examined to illustrate the myriad potential of the technology.

What is artificial intelligence (AI)?

The term artificial intelligence (AI) is used to refer to a range of technologies that include machine learning, deep learning, neural networks, among others[4]. These technologies aim to simulate human intelligence processes and simplify the models of the human brain.[4] Typically, AI uses vast amounts of data, both structured and unstructured, to uncover hidden patterns to find solutions and make recommendations without human intervention.[5] Some common places where AI is found today include: speech and image recognition software, chatbots, sentiment analysis software and natural language generation.

In the second decade of the 21st Century, the availability of a considerable amount of data, the development of sophisticated machine learning algorithms, and the affordability of computing power have accelerated the development of AI.[5] Today, AI technologies are responsive, decisive, adaptive, and independent.[6]

Historic Moments in AI

1950

Alan Turing published the paper, "Computing Machinery and Intelligence" to suggest the potential of AI.

1969

Backpropagation, the most important algorithm in machine learning was proposed.

1973

The debut of Shakey, the first mobile robot could perceive and reason about its surroundings.

1983

CIFAR set up a research group in AI under the direction of G. Hinton.

1997

IBM's Deep Blue beat world champion Garry Kasparov in chess.

2011

IBM Watson supercomputer won Jeopardy.

2012

Jeff Dean and Andrew Ng trained giant neural network of 16,000 computer processors.

2016

DeepMind's AlphaGo defeated world champion Lee Sedol in the game of Go.

2017

Canadian Government announced a Pan-Canadian AI strategy

Artificial Intelligence

The applications of this burgeoning technology have been embraced across industries from its place in automating complex processes to augmenting human capabilities. AI's function in higher education is allowing institutions to meet the rising demand in learning and support services.[6]

The Canadian AI landscape

Canada has emerged as a leader in artificial intelligence.[7] In the first half of 2017, Canada attracted $162M in AI investment, with the federal government alone earmarking $125 million over the next five years for the Pan-Canadian Artificial Intelligence Strategy.[7] In research and development, Canada now has the world's third-largest concentration of researchers in the field.[7]

A core strength of the Canadian AI sector is the highly collaborative relationship between academics and the private sector, as well as sustained government support over the decades.[8] In 2017, Canada became the first country to release a national AI strategy.[9]

In the future, higher education institutions will play a critical role in the development of AI.[8] The country will rely on universities to increase the number of AI researchers and skilled graduates in Canada, a goal established in the national AI strategy.[8] Another important aspect is to understand the disruption AI may cause – in regards to employment and privacy – in society and to find ways to navigate it.[7] This aspect will require researchers from the humanities and social sciences, areas that many universities can contribute to.[7]

AI and challenges facing higher education

Challenges inherent to the disciplines of teaching and learning include a growing expectation of learners for personalization of service delivery. Also, with the ability of AI to expedite the automation of processes in the workplace it is progressively rendering workers redundant and in many cases obsolete.

Personalization now takes place in almost every service for every individual.[10] Higher education is no different, students are looking for, and in many cases thrive, with personalized adaptive learning.[10] They prefer individualized learning experiences like influence over topics that interest them, the ability to set personal goals, build self-awareness about what they know and do not know, and learn at their own pace.[11] The challenge that teachers face is inadequate time to modify their instructional plans according to the unique characteristics of each student.[11]

Because artificial intelligence can learn faster and obtain better results than humans, it is not logical to keep teaching students to do what can now be automated.[12] This automation will invariably disrupt the economy.[13] Facilitation of new education that values human intelligence is required to counteract this phenomena.[6] But at the same time that technological disruption eliminates jobs, it will create new jobs as well.[13] For instance, new specialist roles like AI researchers, natural language processing experts, data scientists, and information security analysts. These emerging jobs will require unique human skills, including cognitive, social-emotional and interdisciplinary skills.[14]

Higher education institutions need to change what and how to teach in the modern education

Artificial Intelligence

system so that students have the unique human skills and intelligence to thrive in the Industrial 4.0 era.[10] [12]

AI Enhanced learning through personalization: Case studies

AI-based personalized adaptive learning will let teachers shift from the role of instructor to the role of coach, and in-turn help students to better achieve their potential.[11] Early adopters have used AI in different ways to enhance the learning experience. The following cases illustrate practical applications of AI's current use in real institutional settings.

Case 1: Georgia Institute of Technology – Computerized teaching assistant

In 2016, a professor at the Georgia Institute of Technology built an AI teaching assistant (TA) based on IBM's Watson platform. The TA was tasked with handling more than 10,000 forum posts by 300 students enrolled in an online course within a semester.[15] [16] [17] The goal was to let the AI TA handle the simple common questions from students like deadlines, and reserved complex questions about content for the human TA.[17] The question-answering abilities were an invaluable asset to online courses.[17] With more human-like interaction, online learning could become more appealing to students and lead to better educational outcomes.[17]

Case 2: The University of Central Florida (UCF) - Adaptive learning systems

The Center for Distributed Learning at UCF assists faculty members in designing and developing courses using adaptive learning systems.[18] In a personalized adaptive learning course, a portion of the overall online content is delivered via an adaptive learning system.[18] The system will customize the presentation of the content to students based on their individual activities and responses.[18] This way, each student will have a personalized learning path custom to their knowledge, skills, and learning needs.[18]

Case 3: The University of Alberta – Collaboration between learners and an AI tutor

Open Education Practices emphasize collaboration among learners to develop critical skills for the future. However, it is difficult to have collaboration in asynchronous individual online courses, crowded classrooms, or institutions with financial constraint.[19] Now, the capabilities of AI create new possibilities of collaboration between learners and an AI TA.[19]

At the University of Alberta, researchers have studied the collaborations between learners and an artificial intelligence pedagogical agent (PA), during a sub-goal setting activity within an intelligent tutoring system.[20] The study suggested that students did not mind interacting with the AI PA.[20] They were willing to engage in collaboration with the PA when immediate, directional feedback, and an opportunity to try again are provided.[20] Students who had high collaborative interactions with the PA outperformed those who had less collaborative interactions.[20] In short, AI has opened up the possibilities for collaboration in difficult situations like asynchronous individual online courses.

Artificial Intelligence

Case 4: The University of Michigan - Turns an automated grading tool into a learning tool

Automated grading has dramatically improved recently, and is being used with increasing success in essay assessment at the college level.[21] [22] Most often, the primary objective is to ensure AI can mark written assignments to a high standard.[21] However, the University of Michigan has creatively used the assessment capability of AI to improve students' learning skills.

M-Write, the automated grading tool, combines automation with human oversight to lead students through writing assignments.[23] Despite its name, automated grading has never been M-Write's primary objective, although it will generate a predicted score.[23] Rather, it is designed to help students develop conceptual learning and writing skills by providing them personalized feedback.[23] [24] [25] [26]

M-Write will identify areas of a writing piece in which students are struggling.[24] A writing fellow (a senior level student) will verify the ATA score and feedback.[25] Then, ECoach, a personal support platform, will send the personalized feedback and guidance to support and motivate the students.[23] In addition, M-Write will give faculty members personalized feedback to help them understand how students are learning.[23]

By identifying the learning gaps earlier on, both students and faculty members will benefit.25 Students will know what they need to study, and faculty will know what to emphasize in lectures.25

AI and an agile student support environment: Case studies

Artificial intelligence also enables higher education institutions to provide personalized assistance to help students navigate the complexities of campus life. Institutions can also leverage the capabilities of AI to support the strategic goal of increasing student enrollment.

Case 1: Deakin University in Australia – Enhance campus life experience

Today's learners want their experience at university to be smooth and simplified.[27] They want information that is accessible, accurate and immediate.[27] Deakin University implemented IBM Watson cognitive computing technologies.[28] Its function was to replicate a human's ability to answer questions and create a 24/7 online student advisory service.[27] [28] This would enable students to ask questions and receive instant online answers.[27] Within the first 12 months, Watson handled more than 55,000 questions from students.[27] By putting the AI technologies into the hands of today's learners, Deakin has enhanced their campus experience.[27]

Case 2: Leeds Beckett University – Increase student enrollment

The research team at Leeds Beckett University developed a chatbot known as Becky in two months for just 30 pounds and won the Times Higher Leadership and Management Award for digital innovation in 2018.[29]

Background research showed that students using admission services were largely uncomfortable talking to university representatives on the phone.[29] Therefore, the objective of the project was to develop a channel

Artificial Intelligence

that prospective students would be more comfortable with.[29] A chatbot is a computer program that holds natural language conversations, mimics human conversation and reacts to spoken or written prompts. It could take prospective students through the entire application process, including making offers.[29]

The chatbot was launched on August 16, 2017.[30] Within one day, it had spoken to 127 prospective students and offered 15 places.[30] A total of 89 students who were made an offer via the chatbot enrolled in September 2017, which represents a 47% conversion of offers to enrolment.[30] This compared to a general conversion rate of 26%. Leeds Beckett's enrolment of students recruited during admission increased by 11% in 2017.[30] The estimated return of investment on Becky would be £2.4m in tuition fees.[30]

Case 3: Georgia State University (GSU) – Reduce summer melt

Georgia State University wanted to reduce summer melt (students who commit to GSU but then fail to matriculate in the fall) by increasing engagement with high school seniors who plan to attend Georgia State the following year.[31] To that end, the university partnered with an ed-tech company AdmitHub to develop a chatbot which would provide on-demand responses to questions from admitted students.[31]

In summer 2016, the chatbot responded to 200,000 messages from 3,100 students.[31] The chatbot accounted for more than 99% of the engagement that Georgia State's incoming class had with the university between being admitted and arriving on campus for orientation.[31] Admissions counselors simply did not have the capacity able to provide the amount of individualized support that the chatbot could.[31] In the end, there was a 22% reduction in summer melt resulting in an additional three million dollars of tuition revenue.[31]

Next in the Series

The next reports in the Envision TRU Environmental Scan series will focus on enrolment trends, Indigenous education, and the cost of education.

Artificial Intelligence

[1] Society for College and University Planning. (2018b). Implications of the external environment: Fall 2018. (Trends for Higher Education).

[2] Education Advisory Board. (2018, May 22). Embrace AI to solve old campus problems in new ways.

[3] Society for College and University Planning. (2019). Implications from the internal environment: Spring 2019. (Trends for Higher Education).

[4] Joint Information Systems Committee. (2019). Horizons report on emerging technologies and education.

[5] Luckin, R. (April 2019). AI and education: The reality and the potential. The Knowledge Illusion.

[6] Klutka, J., Ackerly, N., Magda, A.J. (2018). Artificial intelligence in higher education: Current uses and future applications. Learning House.

[7] Smith, M. (December 2017). How Canada has emerged as a leader in artificial intelligence. University Affairs.

[8] Green Technology Asia Pte Ltd. (2018). The Canadian AI ecosystem: A 2018 profile.

[9] HolonIQ Research. (2019). The global AI strategy landscape.

[10] King, M. (2017). The AI revolution on campus. Educause Review.

[11] Microsoft Education. (May 2018). The class of 2030 and life-ready learning: The technology imperative. A summary report.

[12] Schaffhauser, D. (2019). Employers want 'uniquely human skills'. Campus Technology.

[13] Poloz, S.S. (2018). Technological disruption and opportunity. Bank of Canada.

[14] Luckin, R. (April 2019). AI and education: The reality and the potential. The Knowledge Illusion.

[15] Georgia Institute of Technology. (2016). Meet Jill Watson: Georgia Tech's first ATI teaching assistant.

[16] McKenzie, L. (September 2018). Academics push to expand use of AI in higher ed teaching and learning. Inside Higher Ed.

[17] McFarland, M. (2016, May 11). What happened when a professor built a chatbot to be his teaching assistant. The Washington Post.

[18] University of Central Florida. (n.d.). Personalized learning services. Center for Distributed Learning.

[19] Lingley, S. (August 2018). Robots won't replace teachers – but they could help them. folio, University of Alberta.

[20] Harley, J. M., Taub, M., Azevedo, R., & Bouchet, F. (2018). Let's set up some subgoals: Understanding human-pedagogical agent collaborations and their implications for learning and prompt and feedback compliance. IEEE Transactions on Learning Technologies, 11(1), 54-66.

[21] Hubert.ai (March 2017). AI in education – Automatic essay scoring. Medium.

[22] Contact North. (n.d.). Ten facts about artificial intelligence in teaching and learning.

[23] Straumsheim, C. (2017). More writing through automation. Inside Higher Ed.

[24] Klutka, J., Ackerly, N., Magda, A.J. (2018). Artificial intelligence in higher education: Current uses and future applications. Learning House.

[25] Meltzer, A. (2017, June 4). M-Write expands to include computer analysis in grading student essays. The Michigan Daily.

[26] University of Michigan. (2017). M-Write to include automated text analysis next fall. Gayle Morris Sweetland Center for Writing.

[27] Deakin University. (2015, November 25). IBM Watson helps Deakin drive the digital frontier. Deakin University media release.

Artificial Intelligence

[28] Alam, N. & Kendall, G. (April 2018). Five ways artificial intelligence will shape the future of universities. The Conversation.

[29] Joint Information Systems Committee. (June 2018). Becky the bot chats her way to THELMA glory.

[30] Cardwell, S. (2017, August 17). Becky the chatbot offers her first university place. Leeds Beckett University News.

[31] EAB. (May 2018). Embrace AI to solve old campus problems in new ways.