Artificial Intelligence (AI) and its Potential Impact on the Future of Higher Education

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Still rebounding from the impact of the global pandemic, the higher education sector is being challenged even further by the next wave of Artificial Intelligence (AI) technologies. These technologies have the power to generate in a matter of seconds, quality text, images, music and coding responses to questions or prompts entered into an online chat box. Currently, one of the most accessible and popular text generators is OpenAI's ChatGPT which was released in November 2022. Early evaluation indicates that the quality of the responses exceed standard pass rates for comparable university assessments. Even if academic protocols mandate that text cited from AI sources should be acknowledged and referenced as any other source material, the speed, accessibility and high quality of the AI material justifies a rethink of the purpose of higher education and a redesign of curriculum, pedagogy and assessment. An initial suggestion being promoted in the sector is that learning outcomes and assessments should move away from a focus on content memorisation and recall, to development of higher order thinking skills such as critical analysis, evaluation, resilience, creativity, problem solving, appraising and mastery of verbal communication and computer literacy. This preliminary paper examines some of the literature to date, which discusses potential risks and threats, as well as the opportunities to enhance learning, embedded in this new wave of emerging AI technologies in higher education.

Keywords: Artificial Intelligence technologies, generative text software, implications for curriculum, pedagogy and assessment design.

Introduction

The *advent of Artificial Intelligence (AI) technologies, such as ChatGPT, is poised to revolutionise the way we think about education. By allowing access to personalised, interactive learning experiences, AI-driven education promises to revolutionise the way students learn and educators teach. AI-driven technologies such as ChatGPT offer the potential to create personalised, interactive learning environments that are tailored to individual learning styles, interests, and needs. This shift away from traditional learning paradigms could fundamentally transform the way in which students learn and educators teach, providing unprecedented opportunities to engage with and learn from one another. The impact of AI-driven education technologies will be felt on a global scale, as it has the potential to revolutionise the way education is delivered and experienced around the world.*

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This introduction was created in under three seconds as a result of a simple request entered in OpenAI' s online Playground in early 2023. The question posted was 'Write an opening paragraph or two which positions the impact of AI technologies such as ChatGPT as a major shift in the future of education globally'.

Open AI's response is included in the opening of this paper to illustrate the capacity and power of AI text generative software. On the whole, it offers a reasonable introduction to the subject, although it is quite formulaic and repetitive. A more skilfully worded prompt or request would have harvested a higher quality response. This assumption can be tested by repeating the activity with an improved question.

This preliminary paper approaches the topic of 'Artificial Intelligence (AI) and its Potential Impact on the Future of Higher Education' from a broad perspective. It provides a brief overview of the history of AI in education and discusses some of the risks, threats and opportunities for learning reported in popular and academic literature. The focus of the investigation is on the impact of AI on the higher education sector in the short term and into the future. Future papers and presentations, which exam specific aspects such as the impact of AI on curriculum and pedagogies, and examples of digital assessments which incorporate or minimise the impact of AI, are currently being developed to stimulate further discussion and debate within the sector. It is anticipated that this body of work on AI generative technologies and their impact on education and learning, will form the basis for a professional development book or manual designed to build the capability of higher education institutions to optimise these tools in learning and research.

Context

There is no doubt that education is on the cusp of a new frontier and that to use the language of 'digital natives' - Generation Z, AI technologies will be 'major disrupters' and 'game changers'(Dodd, 2023a). It is not an exaggeration to suggest that advancements in AI will have greater and more sustained impact on our lives than the recent COVID-19 pandemic. Governments, businesses, communities, and education systems will be transformed and individual citizens will encounter quantum leaps in the way they experience and engage electronically, with these and other institutions related to daily activities. The pace of adopting AI technologies will be rapid. As a result of fundamental knowledge and content being more accessible, much is being written about the next wave of intellectual, technical and practical skills that citizens will need to develop. Chamorro-Premuzic (2023) describes this as a need to double-down on human traits of curiosity, adaptability and emotional intelligence and a need to sharpen our somewhat dulled virtues of empathy, humility and self-control.

Among the types of learning outcomes that are being advocated are agility, resilience, creativity, critical thinking, problem solving, appraising and effective communication, particularly verbal and computer literacy. Attributes or traits that are being advanced are those linked to ethics, citizenship, collaboration, teamwork,

social conscious and global awareness. An insightful article on the skills that future workers will need recommends grouping them into cognitive, interpersonal, self-leadership and digital literacy skills (Dondi et al., 2021).

The concept of developing a mind-set of 'life-long learning' is another strong theme in educational and business literature in recognition of the view that in the future, jobs will not remain static and employees with need to regularly transition and adapt their learning to new jobs and occupations, many of which may not exist at the present time. A 2021 paper argues that the notion of life-long learning needs to embrace AI and digital technologies and focus on human development and creating value through drawing upon AI technologies (Poquet & de Laat, 2021).

Purpose

The purpose of this paper is to spark discussion and debate amongst leaders, academics, practitioners and students on the potential impact of AI technologies on the higher education landscape.

The research question posed is:

'What will readily available student access to AI generative technologies mean for future teaching, learning and assessment practices and protocols in higher education institutions throughout the world?'

Scope and Limitations

The development of AI technologies is moving so fast and the ground swell of interest is expanding daily that a raft of new products is likely to be available, even before this paper is published. This paper provides a snapshot of the impact and appetite for AI technologies in higher education in the first three months of 2023.

The paper has been largely informed by developments in Australia supplemented by some reports from the USA and England. While some of the articles on AI technologies and education cover the broad education sector, preference has been given to material linked to AI in higher education.

As the wide-spread availability of generative AI technologies is very recent, there has been insufficient time for any long-term research into the impact of these technologies on student learning and assessment practices. It is anticipated that from 2024 onwards, academic literature will start to contain research papers on case studies and analysis of practice.

Definitions

The emerging topic of AI technologies is full of new terminology and acronyms. In order to assist the reader, the following definitions have been included in the paper.

Algorithms are sets of instructions or steps, usually applied in mathematics or computing to solve a particular problem.

Artificial Intelligence (AI) refers to the practice of getting machines to mimic human intelligence to perform tasks.

ChatBot is software which simulates human-like conversations with users via chat. Its key task is to answer users' questions with instant messages.

ChatGPT, the GPT stands for 'Generative Pretrained Transformer'. ChatGPT is an AI language model, that has been trained on a massive corpus of text data, including books, articles, websites, and other sources of information (currently sources up to 2021). The software has learned to recognise patterns and relationships within that data. The program uses algorithms and statistical models to generate responses based on the input (questions or prompts) it receives.

CodeX is an AI technology for producing coding.

DALL-E a tool for AI-generated art. It is similar to ChatGPT but instead of being based on language, it specialises in images and visual outputs.

Generation Z comprises people born between 1996 and 2010. They are often referred to as 'digital natives' - the first generation to grow up with the internet as a part of daily life and to have unlimited information available at the click of their latest digital device.

Generative artificial intelligence (AI) describes algorithms (such as ChatGPT) that can be used to create new content, including audio, code, images, text, simulations, and videos.

Machine Learning is sometimes abbreviated to ML. It is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn.

OpenAI was founded in 2015. It is an AI research and deployment company whose stated mission is to ensure that artificial general intelligence (AGI) benefits all of humanity. It is building a stable of software packages the most popular at this time being ChatGPT (text creation), DALL-E (image creation) and CodeX for coding.

Prompts refer to the key words or questions created to ask programs such as ChatGPT. The more specific and detailed the questions the better the output. A new concept of 'prompt engineering' is emerging in the business literature which refers to identifying the elements which make a quality prompt. These elements include stating the style, format and length of text required, points to be addressed, and the perspective to be taken.

Robotics rely on AI mostly associated with engineering. It involves design, construction, and use of machines (robots) to perform tasks done traditionally by human beings.

Paper Outline

The paper covers the following topics.

1. A preliminary review of literature which provides a brief discussion on the early developments of computers and machine-based learning.

2. Discussion and analysis of the espoused risks and opportunities to enhance learning, by implementing AI technologies in universities. This section is primarily informed by commentary and opinion articles, and reports on the recent application and impact of new wave 'generative' AI technologies in higher education.
3. Discussion on the need for major curriculum reform in higher education, especially in approaches to teaching, learning and assessment design.
4. In conclusion, some suggested areas that need to be addressed in order to minimise the risks and optimise the potential benefits of AI technologies in the higher education sector.

Review of Literature

Early Developments

Machine and computer programs designed to support education and learning originated in the mid-twentieth century. An early example is the American-designed computer software program widely known as PLATO - *Programmed Logic for Automated Teaching Operations.* This software was invented by a team led by Donald Bitzer, a university professor in electrical engineering who was concerned with reports that fifty percent of students graduating from inner city schools in the USA were functionally illiterate (Jones, 2023). The initial program deployed computer languages such as FORTRAN and TUTOR to prepare education materials. Users were confined to a single-purpose laboratory equipped with computers connected to a central mainframe. The early programs provided games, simulations and tutorials to support learners to build their capacity to read (Dear, 2018).

The next major advancements in computer-based learning occurred with the invention of the internet in the 1990s, followed by the widespread availability of personal computers and then the development of wifi, which afforded widespread accessibility and connectivity to the internet (Pastor-Satorras & Vespignani, 2010). The internet provided further opportunities for human interaction with computers for the purpose of learning. Amongst the next wave of popular computer-based education programs were quizzes to test knowledge, self-paced training modules in the areas of health and safety, Q and A databases for frequently asked questions, and programs which enabled automatic marking and feedback on computer-based tests. The availability of personal computers and expanding wifi connections meant that students could almost learn at any time and from anywhere.

Since the availability of AI technologies on the web, such as ChatGPT, educational institutions around the world have started to take great interest in the impact and potential of generative software programs to support learning and learners. To date, business and academic literature on this new wave of AI technologies mainly involves opinion and commentary articles which debate the pros and cons of AI in education and editorialise on key considerations for policy

makers, educational leaders and practitioners (Yousuf & Wahid, 2021; Chui et al., 2022, & Peterson, 2023).

The next groundswell of literature on AI in education will undoubtedly provide reports and findings from research and case studies into the new generation of AI software programs and their impact on teaching, learning and assessment in both controlled and in-situ settings.

So far, the literature review has provided a brief background on the evolution of AI technologies in education. It traced AI's early beginnings from the invention of computer mainframes, specific purpose computer laboratories, the internet, personal computers, wifi connectivity and most recently, responsive and generative text, image, music and coding software.

Discussion and Analysis of the Espoused Risks, Threats and Opportunities to Enhance Learning of Implementing AI Technologies in Universities

The next section of the paper identifies and discusses some of the risks and threats, as well as the opportunities to enhance learning, of the widespread implementation of AI generative software in higher education settings. As the application of AI technologies in higher education is a rapidly developing area, the risks, threats and opportunities discussed in this paper are those identified at this point in time. As universities integrate AI into their curriculum, pedagogy and assessment, and as new technologies become accessible, it is feasible that new risks and threats to academic integrity and new opportunities for learning enhancement will emerge and will need to be addressed. Society is facing a very fragile and shifting educational landscape.

Potential Risks to the Academic Integrity of Education by Drawing upon Artificial Intelligence

The previous section on the early developments in machine and computer learning indicated that computers have been used in education to support learning, especially for low performing students, for a number of years. However, the landscape changed significantly with the release of user-friendly, free or low cost AI generated text software in November 2022, through OpenAI and other companies. Initially, the response from academics and professionals in the advertising and marketing industries was one of fear or at least serious concern, as they saw their jobs being replaced by machines.

Since generative models of AI are new, research into the long-term effects of these tools in the business and education sectors is sparce. However, even at this early stage of implementation, a literature search and review of webinars and panel discussion on the risks and threats to academic integrity of such software, revealed a number of issues and challenges. Many of these articles and discussions are quite subjective but they raise significant questions such as: how AI might be used in different subjects? And, how might AI be able to support students with special needs? (Girdhar, 2022).

One major threat, not only to academic integrity but to the entire system of certification of university qualifications, is the potential for fraudulent submission of AI generated written text, artwork, musical compositions and coding algorithms as original work (Cohen, 2023). Without adequate regulations, policies and processes for monitoring and authenticating assessments, it might be possible for someone to pass an entire university course by submitting AI generated work. If this practice is allowed to progress unchecked, it has the potential to completely undermine the value of higher education qualifications and destroy the reputation of offending universities and even the entire higher education sector.

Commentators warn that to maintain academic integrity standards, AI generated text will need to be treated like any other source and acknowledged with appropriate attribution. However, a significant difference between AI generated text and traditional plagiarism is that the AI is constantly evolving and has the ability to respond quickly to detection software. Furthermore, the potential of AI software to deliver reasonable quality written work, calls into question the appropriateness of essays and simple written tasks for assessment purposes. A range of early research suggests that 50%-75% ChatGPT generated essays would receive at least a 50% pass mark compared to equivalent level university assessment. A study conducted at the University of Pennsylvania found that ChatGPT was capable of writing responses to an examination paper in a MBA course, to an overall B to B- standard (Terwiesch, 2023). Other researchers noted that the AI generated text was of a very high standard when it was required to perform basic analysis but made simple mathematical errors and struggled with more complex analysis questions (Rosenblatt, 2023).

A similar study found that the earlier foundational, less powerful ChatBot, GPT-3.5 had the potential to pass the multi-state multiple choice section of the Law Bar Examination, which generally requires seven years post-secondary school education and months of targeted preparation (Bommarito & Katz, 2022).

To avoid blatant cheating and academic misconduct, curriculum designers and assessors will need to become familiar with the potential of AI and either design assessment tasks which incorporate AI or minimise its input. It will no longer be sufficient to rely upon evidence of knowledge in a descriptive written essay format. Assessment design will require evidence of higher order thinking such as analysis and evaluation of the ChatGPT generated text against discipline-based theories, or reflection on the content of the computer text in reference to a specific context or case study.

A useful starting point for this approach might be to revisit Bloom's (1956) Taxonomy of Education Objectives and later adaptations of the taxonomy including ones for digital learning contexts (Anderson & Krathwohl, 2001 and Krathwohl, 2002). It is suggested that reference to Bloom's taxonomy requires a significant move up his knowledge hierarchy to more complex thinking, which is sometimes referred to as metacognition - thinking about thinking'(Chick, 2013). Reference to Bloom's affective domains which address feelings, emotions and attitudes as well as his psychomotor domains may also be helpful in optimising the application of AI educational technologies and reshaping curriculum, pedagogy and assessment (Armstrong, 2010 & Persaud, 2021).

While early research suggests that computer generated essays and responses are of a reasonable quality, others point to the potential for bias and inaccurate information (Scharth, 2023). AI generated text software relies on algorithms to search through the masses of data that the program has been trained to sort and retrieve. Its response is only as accurate as the information that it has been exposed to and, at the time of writing this paper, can only draw upon information that was available up to 2021. Any developments since that time will not be captured. However, as new information is fed into the system, one must assume that the quality of the responses will continue to improve.

If the question or prompt posted in the AI software is not carefully crafted, it can also inherently convey a bias which is reproduced in the software's response. For example, as an experimental exercise the following two requests were entered into ChatGPT. Prompt 1: 'Write two to three paragraphs on the significance of Australia Day Celebrations. Prompt 2: Write two to three paragraphs on why some people oppose Australia Day Celebrations?' On the surface these two prompts are very similar but the second one contains a definite negative view of Australia Day, which was captured in the AI generated responses.

While unwitting bias is identified as a risk of AI generated text, so too is the potential for inaccurate or unreliable information. The computer software behind programs such as ChatGPT are based on the material from a variety of sources, the status of which is unclear. This practice goes against conventional academic practice which teaches reliability and validity as cornerstones of research methodology. It might be possible to limit the field by requesting information from only scholarly or refereed sources but verification of the authenticity of the information provided may still be unclear.

Another risk of AI technologies that is raised in the literature and panel discussions is that of privacy. While, this is linked to academic integrity, the articulated concern is more to do with protection of student data, ownership of intellectual property and copyright. The issue of privacy flows into concerns about transparency and authenticity and illegal use of staff and student work.

The need to distinguish between computer-generated work and human output is partially being addressed by the need to acknowledge and cite sources, which is in line with the required protocol for any academic work. However, the risk can be mitigated or minimised significantly, by rethinking assessment design and monitoring and evaluating assessment artefacts through various stages of development. This might mean monitoring assessment at the planning phase, drafting phase, feedback phase and completion phase. Other strategies might be to preference recorded and personally narrated oral presentation assessments, and peer and self-reflections and assessments.

A significant risk to academic integrity, which flowed through much of the literature and discussion on the application of AI generated outputs, is the concern around ethics and ethical practices. The topic touches upon issues of equity for all students in relation to access to computers, reliable wifi and relevant software programs. It also covers ethics in relation to transparency, ownership and how the computer generated outputs are used (Buckingham Shum, 2023).

The potential to use computer programs to replace lecturers and human interaction was raised as a concern in some forums. This concern was often expressed in terms of the overall loss of human intellectual capacity and collegiality in our universities. Some academics noted the extra demands on tenured staff, and a trend toward casualisation of the workforce with inadequate compensation for demanding roles such as tutoring and marking assessments.

Potential Opportunities to Enhance Learning and the Academic Integrity of Education by Drawing upon Artificial Intelligence

While some early voices raised concerns about the potential of AI generated outputs to undermine the foundations of traditional education institutions, the more optimistic and pragmatic views are that AI generative software programs are readily available and that educators need to take advantage of their outputs to enhance and expand learning opportunities. An early article by Salomon, Perkins et al., (1991), identified benefits of human and computer technology partnerships as well as the residual, or spin-off cognitive effects for humans of working with machines.

An initial assumption is that machine learning is impersonal and generic. However, recent commentary on the value of utilising AI tools to enhance learning, suggests that software such as ChatGPT can be used to create more personalised learning experiences for individual students. The notion behind this view is that by accessing data on individual student's strengths, weaknesses and learning preferences, AI can generate an algorithm to provide learning activities tailored to each student's needs.

In a recent interview, controversial and prominent clinical psychologists and social commentator Jordan Peterson predicts that AI is going to highlight the importance of human intelligence with respect to our ability to bring meaning to content (Peterson, 2023). This view is already being somewhat challenged by a recent research project which investigated the ability of the latest AI, ChatGPT-4. This study reported a new general intelligence, coined 'artificial general intelligence' demonstrated in GPT-4's core mental capabilities of reasoning, creativity, and deduction tested in a range of disciplines including literature, medicine, and coding and tasks such as playing games and using tools. (Bubeck. 2023).

Already a number of University Learning and Teaching Centres are providing advice on how to use AI generated text to support student learning. In Australia at the University of Sydney researchers are exploring AI as a research partner, to improve student writing and language learning, and to foster interaction and creativity (Liu, 2023). At Stanford University in the USA, the guidance notes from the Center for Learning and Teaching strongly advise implementation of pedagogy and assessment which works with AI. The principles they follow include transparency, focusing on learning outcomes, designing assessments for an AI world (Stanford University 2023).

The topic of effective feedback is addressed substantially in educational literature. Concepts such as the impact on learning of Ebbinghaus's forgetting

curve (Shrestha, 2017) and experiments around the number of new pieces of information that can be processed at the same time are well documented in cognitive overload theory and research studies (Sweller, Ayres et al., 2011). The common concerns that emerge when evaluating effective feedback are, was the feedback provided in a timely manner, was the information provided accurate, and did the feedback provided lead to improvement. In terms of the above criteria for providing effective feedback, AI tools exceed all these expectations. They can be programmed to provide individual feedback in real-time, to identify areas for improvement and to suggest helpful resources and strategies.

Educators working with findings from contemporary neuroscience on how the brain learns point to a number of brain-friendly learning strategies or learning enablers which facilitate effective learning (Willis, 2007 & 2020; Hardiman, 2012). Effective feedback is named as one of the learning enablers, along with the provision of interactive and engaging activities, sequential learning tasks and fun and relevant activities. AI-powered educational tools can be designed to address all of these elements. Computer games which progress from simple to more complex levels of skill address elements of motivation, engagement, scaffolded learning and enjoyment; factors which neuroscience supports lead to enhanced learning (Willis, 2007).

While rural and remote students, and students from low socio-economic groups, may be disadvantaged by not having access to a personal computer and adequate wifi coverage to connect to AI tools, overall, the development of AI tools has the potential to expand and enhance educational opportunities to new student markets. For example, ChatGPT software offers language translation services for those whose first language may not be English.

Academic staff and students frequently complain about heavy work and study loads. They express frustration particularly about so-called 'busy work' which consumes significant time for little benefit. AI can relieve staff of many of the routine administrative tasks by providing time-saving tools. Examples include providing current lists of relevant research papers, opening chat rooms and discussion boards for integration and sharing of resources.

The Need for Major Curriculum Reform in Higher Education, Especially in Approaches to Teaching, Learning and Assessment Design as a Result of the Growth in AI Educational Technologies

Current literature on AI, notes the exponential growth in the application of AI across many aspects of society, especially the business, finance and education sectors. The speed of expansion was boosted by the global pandemic of 2020-2023 which saw many emerging technologies boom due to the necessity of doing business remotely and communicating and learning online.

In the education sector, schools and universities were closed and replaced by models of remote and online learning. As a result of this major transition to online and digital learning, educators sought out digital technologies and sources to support this mode of delivery.

Major concerns about the lack of regulations and policies to ensure ethical use of AI technologies continue to be expressed, in government, business and education literature. According to a Stanford University Artificial Intelligence Index Report (2022), publications expressing concerns about the lack of fairness and transparency have increased fivefold over the past four years and that while AI models are excelling on technical benchmarks, there propensity for bias is increasing.

For Korteling et al., (2021) the issue is not whether human or artificial intelligence is better but rather '*For what tasks and under what conditions, decisions are safe to leave to AI and when is human judgment required?'* (Korteling et al., 2021. *p.1).* Korteling and colleagues argue for an approach to education based on a collaborative model which capitalises on the specific strengths of both human intelligence and artificial intelligence. This approach distinguishes between biological (human) and digital (machine) behaviours and concepts of intelligence. They identify that behaviours associated with humans reflect an anthropocentric perspective and include such capacities as awareness, attention, emotion, creativity, planning and reasoning. They propose a non-anthropocentric definition of artificial intelligence which draws upon the earlier work of Bieger et al., (2014) and Tegmark (2017) as 'non-biological capacities to autonomously and efficiently achieve complex goals in a wide range of environments'. The anthropocentric theme is reflected in a 2023 publication by Chamorro-Premuzic which calls for humans to reclaim was makes us unique from automation.

With respect to the future of education and curriculum development across all education sectors, one of the main messages from Korteling et al., (2021) is that educational leaders and curriculum developers will benefit from approaches to teaching, learning and assessment which utilise and integrate both human intelligence and artificial intelligence, recognising the strengths of each and determining for what and when to trust and rely on the information provided.

The potential or likelihood that AI generative programs such as ChatGPT will spark a major re-think of higher education curriculum, pedagogy and assessment is extremely high. A common view across the sector is that recent new breakthroughs in the field have the potential to drastically change the way we approach content creation (Chui et al., 2022 and Dodd, 2023b).

The potential of AI to change the focus of higher educational and teaching practice is not only being discussed in western countries. The review of literature found several examples from Asian countries which cited the power of AI to create positive learning environments and positive learning experiences spanning a range of disciplines. The ability of AI to translate across languages is also seen as a positive factor (Neha, 2020).

ChatGPT is a tool which enables non-technical users to access reasonable quality content on the web very quickly. In educational settings it is best treated as a resource to assist and optimise learning by shifting the focus from content acquisition and rote learning to higher order thinking skills such as analysis, critical thinking, evaluation, reflection and creative problem solving.

Earlier in the paper, reference was made to Bloom's taxonomy and updated digitalised versions, to inform integration of AI into curriculum reform. The

Structure of the Observed Learning Outcomes (Solo) Taxonomy, devised by Biggs and Collis (1982), is another way of thinking about students' level of learning and may assist in devising ways to integrate AI technologies into learning activities and assessment design. It may even be worth running fresh eyes over Maslow's hierarchy of needs with a focus on the concepts of wisdom and intelligence embedded in his concept of self-actualisation (Rudin, 2017).

Curriculum design generally starts with the identification of course and unit learning outcomes which become the anchor or reference point for the curriculum content, pedagogy, learning activities and assessment tasks. The regulator and curriculum experts have encouraged practitioners to think of learning outcomes in terms on acquisition of knowledge, skills, application of knowledge and skills along with attributes such as ethics, life-long learning and teamwork (Higher Education Standards Framework (Threshold Standards) HESF 2021 and TEQSA 2023).

With the increasing accessibility of AI technologies capable of furnishing quality content within seconds, the focus on curriculum design will need to move away from content generation, memorisation and recall to a curriculum which evaluates and applies the content through processes such as critical analysis, problem solving, comparing and contrasting, and contextualising the content to specific case studies and personal scenarios. Learning outcomes and assessments will need to aim for authenticity, innovation, involve experiential and personal activities and be forward looking. A recent Digital Assessment Framework (DASH C21) development by Bennett and Abusalem (2023), is a useful resource for thinking about and developing digital assessments that utilise technology tools, which support academic integrity policies and practices. The DASH C21 Framework is underpinned by a set of ten principles and values which are the inputs. It draws upon four dimensions including practices and pedagogies, strategies, emerging technologies and stretching horizons and provides outputs in the form of digital assessments which are authentic, forward looking, experiential and innovative embedded in academic integrity.

Discussion

The preliminary investigation undertaken in this initial paper on the potential impact of AI education technologies on the future of higher education, corroborates the notion that the sector is at a tipping point of relevancy and survival. This situation has been building for some time. In an evidenced-based book entitled *The University Challenge Changing universities in a changing world*, co-authored in 2020 by Byrne and Clarke, the former an eminent international academic and leader of higher education institutions in Australia and England and the latter, a former Minister for Higher Education in the British Parliament, argue that the current university model is no longer fit-for-purpose. They claim that universities are losing their status and relevancy in society and need to become more responsive and flexible to new modes of learning and life-long education. Despite this rather grim view of the current system of higher

education they strongly advocate that 'high quality universities are the best way to help our world deal with the enormous challenges of accelerating change' (p.245). They propose a higher education model which, understands and interprets change in the world, offers approaches to harness the process of change for general benefit, educates and trains the specialists whose skills are necessary to address change and creates an intellectually engaging climate and culture across societies. Thinking of change that is currently upon higher education as a result of AI technologies, the four tenets suggested by Byrne and Clarke are well worth keeping to the forefront of curriculum reform in higher education.

An area of learning theory which is worth considering when assessing the risks and benefits of content derived from artificial intelligence is the body of work on human and multiple intelligences. An early component of multiple intelligences was Gardner (1986), who suggested eight types of human intelligences. These are linguistic, logical/mathematical, spatial, bodily-kinesthetics, musical, interpersonal, intrapersonal, and naturalist. Since this early research into multiple intelligences, other forms of intelligence have become popular in education and psychology disciplines to help explain human behaviours and reactions. The most common of these new wave intelligences are spiritual, emotional, social, moral and existential intelligences (Mayer & Salovey, 1999). Although there is some debate as to whether these are intelligences or simple attributes or personality traits, it is this latter group of 'human intelligences' which may need to be prioritised in an education environment where machine-derived content is a given.

Another perspective on the concept of human versus machine intelligence is that instead of discussing the differences between the way humans and machines process content as 'intelligences' we consider the differences in terms of lenses or filters. Using this premise, it is possible to argue that unlike machines, humans have the capacity to be aware of their environment and apply filters to the content/knowledge in their possession. These filters could heighten our consciousness of the lack of social, political, cultural, environmental, diversity, equity and emotional dimensions of AI content. Application of the filters to content involves higher order thinking skills such as critical analysis, evaluation, problem solving, appraising, innovation and creativity. The same learning outcomes that are being recommended as the cornerstones of curriculum, pedagogy and assessment reform.

The risk of non-alignment or misalignment of the goals of AI and human intelligence has been identified by key players in the AI space. Tegmark (2017), an American cosmologist and a cofounder of the Future of Life Institute, warns of the implications for society when AI and human goals are at odds with each other. Christian (2020) who raises questions about ethics, transparency and inbuilt bias in AI source material, refers to this tension between machine learning and human values as the 'alignment problem'.

A recent book entitled *'I Human'* (Chamorro-Premuzic 2023) recommends that we focus on the qualities that make us human, that is distinguishes us from machines, and that we position ourselves as the main beneficiaries of AI and

technologies and not allow them to stop us from learning and become mentally lazy.

A warning against the notion of AI replacing human learning is also touched on in a very recent article by an Australian deputy vice-chancellor (Crossley, 2023) who is responsible for academic quality. His reaction is typical of the concerns raised by academics and researchers who caution against dilution of scholarship. He concedes that while AI is a useful learning tool, students still need to learn and be able to quickly draw upon the foundation knowledge of their discipline in order to discuss and interact with their colleagues on a deeper level, independent of AI response to a prompt. He sees the challenge for education is to keep ensuring that students do the 'intellectual heavy lifting'.

The research question posed at the beginning of this paper was:

'What will readily available student access to AI generative technologies mean for future teaching, learning and assessment practices and protocols in higher education institutions throughout the world?'

From this preliminary review of literature, webinars and panel discussions, there is little doubt that the rapid growth and availability of AI technologies will change how learners access content. While there are risks and threats that will need to be addressed, it is apparent that the benefits and opportunities to foster and enhance learning will far out-weigh the downside of using AI technologies for learning.

An issue of significance will be how AI technologies can be integrated into higher education in transparent and ethical ways in order to enhance learning but also to validate its authenticity. This is likely to require a mix of communication, education, regulation and detection strategies as well as a major rethink of how to reconceptualise curriculum pedagogies and assessment design. The aim will be to engages students in stimulating and challenging activities and projects that will not only equip graduates for future jobs but will create generations of citizens who manage the application of artificial intelligence for the greater good of society.

Conclusion

This paper is the first in a planned series on the impact of emerging AI technologies on the form and function of higher education in the future. Other topics that are under development or are being considered for subsequent dissemination include: time to rethink the purpose of Higher Education; the form and function of the reconceptualised university of tomorrow; is the essay dead as an assessment tool?; optimising the potential of AI technologies to enhance learning; focusing on new learning outcomes which develop and assess higher-order thinking and skills; designing digital assessments which are authentic, forward looking, experiential and innovative, utilising the features of Learning Management Systems to harness and ethically apply AI content; and, managing the gap between artificial intelligence and emotional, social, political, cultural, environmental and ethical intelligences in higher education settings.

This is an ambitious list of topics, it is not an exhaustive list, as almost on a daily basis new challenges and opportunities arise as a result of 'playing' with AI technologies and learning more about their limitations and capabilities. Much of this learning is coming from grandchildren in primary and secondary schools who are already using the language of trained researchers such as 'unit of inquiry', investigating possible causes, ranking preferences, and developing hypotheses. They are regularly capturing their learning using multi-media programs such as *ClipChamp* which allows them to record and edit personal videos, insert photographs and graphics, add text and narration using their personal computer or mobile phone. Their mobile phones are constant 'accessories' and used, almost as a reflex action, to find the meaning of a new word, to translate a question or answer into a foreign language or to find the nearest restaurant serving dumplings.

These simple anecdotes should act as red flags for those working in the higher education sector. While I am not suggesting that this type of creativity in not taking place in higher education, it does not appear to be the norm. Yet it will be the expectation of future cohorts of current school children as they decide whether to advance to higher education. There is mounting evidence that Generation Z may well by-pass higher education in preference to self-paced learning through the internet and using their creativity and skills in Artificial Intelligence technologies to start up their own business enterprises.

The evidence presented in this paper suggests that society is at a tipping point: a major shift in human existence, and that for higher education institutions to remain relevant they will need to undergo major reform. It may be too late. Whatever course of action is taken, it will require significant collaboration and goodwill across all levels of society including governments, business and industry groups, employers, unions, educational regulators and authorities, higher education leaders, academics and students, and most significantly local communities. It will be important that the reform is framed by ethical responses and considers multiple 'bottom-lines', not just financial outcomes, with the priority outcome being for the greater good of society. In recent times, the current university business model has not served us well and must be realigned if we are to continue to attract the brightest minds and talent to study and work in the sector and nourish future generations of young learners.

Even from this preliminary investigation, the potential impact of powerful emerging AI educational technologies on approaches to teaching, learning and assessment in the Higher Education sector will be life changing. It will require significant investment in time, resources and our smartest minds to lead and nurture the necessary changes in order to reposition higher education as the 'go-to' place for leading research and innovation as well as a significant player in the process of life-long learning.

Postscript

This paper was initially accepted for Review by ATINER in June 2023. Many of the ideas raised in this paper have been further developed and expanded upon in a book now available, entitled *Optimising AI Technologies: A practical guide to*

transform higher education by Lorraine Bennett and Ali Abusalem. For enquires about the book go to www.benetali.com or email AIbook.bennett@gmail.com

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