# The Current State of Artificial Intelligence in

# Higher Education

Joe Faith, M.S.

Lecturer of Information Systems

Harding University

Paul R. Carter College of Business Administration

**Abstract**

 In higher education today, we see an ever-increasing burden being placed on faculty to provide top tier instruction to students. This has proven to be difficult, with the current state of the industry in recent years, overall. The potential for Artificial Intelligence (AI) to help the landscape of educational pedagogy is remarkable but, unfortunately, most institutions have yet to realize the full potential of this emerging technology. AI has the potential to bring unrivaled ability to tailor education to students and their respective needs. The possibility for this has already been experimented with, and the results have been very promising. AI needs data to be able to learn how to properly perform its stated function(s). This is always a potential ethical concern, since there is a fear of what happens to the data when it is used to help fuel an algorithm. In terms of Christian-based higher education, this is an incredible opportunity for faculty to take part in shaping one of the foremost emerging technologies. Whether or not people realize it, we are already interfacing with these algorithms on a daily basis. As time progresses, it will be more imperative to understand and utilize these tools to remain competitive in our respective industry.

**Keywords:** Artificial Intelligence, Higher Education, Pedagogy, Tailored Learning Systems

Artificial Intelligence has become quite a "hot topic" in recent years, namely due to the rapid advances we have seen in the technology. The pervasiveness of technologies such as m-commerce, Big Data, wireless computing, and increases in general computing power have led to the ability for AI to explode both in use and popularity (Korteling et al., 2021; see also Laudon & Laudon, 2019). We interface with AI on a daily basis, and most are not aware of this fact. Looking to the future, the intertwining of human and machine is only expected to increase. It should follow, then, that proper education should be based around preparing individuals to work and function well in a society that places so much importance on the use of AI-enabled technology (Bozkurt et al., 2021).

It is undeniable that we live in the age of the Internet, and this has massively affected how we operate in all areas of life ranging from "the economy, social development, science, politics, and education" (Prendes & González, 2019). Education itself has been undergoing a massive change in terms of how it is presented, both in terms of materials and content delivery mechanisms. Education is no longer a fully linear path now, especially for adults and those who are more willing to sleuth for the information that they desire to acquire. When looking towards options like self-guided learning, free to access resources and remote formal education programs, it is clear that education is ripe with opportunity for the personalization and differentiation of learning opportunities for each individual (Prendes & González, 2019). In today's world, it is never too late to start the learning process. As Dr. Diamandis (2018) explains:

> *"In a world of rapidly accelerating technology, understanding how technologies*
>
> *work, what they do, and their potential for benefiting society is, in my humble*

*opinion, critical to a child's future. Technology and coding… are the new 'lingua*

*franca' of tomorrow."*

But the burden to understand this technology does not rest on the student's shoulders alone. Educational facilities have been slow to understand and adopt these new technologies. This fault does not lie solely on these institutions' shoulders, however. Much of the work in AI has been centered around the technical aspects of the technology, while the practical application side of things has tended to be overlooked (Bozkurt et al., 2021).

While this technology has been great in terms of fostering new development and ideas, there is still quite a large gap in knowledge between those who study this field and those who would otherwise be known as passive consumers of the technology. Pair this current scenario with the representations that are shown in Hollywood, and this leaves many individuals confused about what exactly AI is and what it isn't. It is this environment that breeds confusion and, perhaps, distrust about this emerging field of study. It is important, as the discussion around AI in Higher Education (AIEd) starts to unfold, that everyone is clear about what exactly Artificial Intelligence is.

There are two main types of AI systems, both centered around the level of "knowledge" that the system takes into consideration when operating in its environment. ANI, otherwise known as Artificial Narrow Intelligence, is the main type of AI that we see in use today. This AI is very efficient in a very specific application, such as performing thousands of computations very quickly. This is something that may not be computationally difficult for a human to do, but we could not perform it with the speed (and possibly accuracy) that a machine trained to do it

could. This brings up an interesting idea to understand in the debate surrounding Artificial

Intelligence: Moravec's paradox. Moravec's paradox is the idea that "it is comparatively easy to

make computers exhibit adult level performance on intelligence tests or playing checkers, and

difficult or impossible to give them the skills of a one-year-old when it comes to perception and

mobility" (Moravec, 1988).

So, how do we determine what constitutes intelligence and difficulty of a task? Well, it is

important to make the distinction that measuring the intelligence of an artificial system should

be different from the metrics used for humans, since we are comparing a non living entity to a

living one. Since it would potentially be limiting to tie intelligence of a nonorganic lifeform to

how a human would perform in a similar task, a popular definition for intelligence has been

thrown around to be "the capacity to realize complex goals" (Korteling et al., 2021). In other

words, intelligence is more how we analyze information and is not so dependent on what the

vessel that does the computation is composed of. In terms of difficulty, it will usually depend on

the computational load of the situation, as well as the number of calculations and different

domains of knowledge that need to be accessed or cross-referenced (Korteling et al., 2021).

Circling back to Moravec's paradox, he observed that concrete reasoning skills were very low in

terms of computational resources for a machine; it was the abstract concepts that caused

machines to stumble (Moravec, 1988). Executing through the abstract issues and situations of

day-to-day life has been what researchers have hoped that AGI, or Artificial General

Intelligence, would be able to achieve.

The main idea of AGI is to create a system that would exhibit human-like intelligence;

that is, the ability to reason effectively and efficiently in a wide array of situations (Laudon &

Laudon, 2021). The goal of AGI is to achieve a system with "non-biological capacities to autonomously and efficiently achieve complex goals in a wide range of environments" (Korteling et al., 2021). The idea of this machine powered general intelligence hinges on the idea of being comparable to the intelligence demonstrated by humans. There are a few important points to consider when analyzing this (Korteling et al., 2021):

- *Human beings are probably not as smart, as a species, as we would have ourselves believe; is human-like really the goal we should strive to meet with AGI?*

- *There are different levels of intelligence out there and some of them are feasibly higher than what humans possess. Achieving this state of general intelligence for a machine may look different than how it expresses itself in humans.*

- *Artificial General Intelligence is not necessarily a "one-size-fits-all" type of solution. In many cases, using several ANI systems tied together has shown great promise without some of the main drawbacks, mainly that being power consumption, of one AGI system.*

Many fear that the adoption of AI is a proxy for the end of "normal" work for humans, the current research does not point to this in any realistic respect. The best conclusion from this current point in time is that AI should be developed to help humans in their day-to-day activities, mainly playing the role of support and leveraging some of its abilities (such as faster processing or automation of manual tasks) to help humans make better, more informed decisions. It is unfair to suppose that, in today's fast-paced business environment, humans can keep up with all of the potential facets of an organization and its related data due to the

velocity and volume with which it comes at them. Perhaps AI can be used to help support and strengthen the places where we would classically be weak in, allowing humans to have a more holistic approach to business decision making (Korteling et al., 2021.)

So, how is the research looking in terms of AI adoption across society? Well, the use of AI has been on the rise since its inception, gaining a lot of momentum in the 1970's with the advent of Expert Systems, or AI applications that codified a certain domain of knowledge (Laudon & Laudon, 2021). From there we began to get other uses of AI through technologies like machine learning, whereby the machine learns a task and optimizes how to achieve a desired outcome through the use of analyzing patterns and identifying trends. Expanding on this idea through the 2000s was deep learning, which is more an attempt to simulate how the human brain functions through the use of neurons, or processing units, to help analyze data that is high-dimensional in nature, essentially trying to lead to a system that could learn many different, distinct skills and function more in a broad, fluid manner (Bozkurt, et al., 2021).

In terms of many different industries, we have been witnessing how they have been transformed. Certain industries however, like education, have been slower to adapt to the digitization and changes brought forth by emerging technologies such as Artificial Intelligence. Research around AI is very technical due to the nature of the work, much of it involving computer programming, and as such, this is one of the reasons why integration of AIEd has been slower than other industries (Hurley, 2019, as cited in Bozkurt et al., 2021). The main issues found with integrating Artificial Intelligence into educational institutions was the "lack of critical reflection challenges and risks of AIEd, the weak connection to theoretical pedagogical perspectives, and the need for further exploration of ethical and educational approaches in the

application of AIEd in higher education" (Zawacki-Richter et al., 2019). These limitations are not

fatal, however, and should provide hope that there is a real need for higher education

institutions to take on the challenge of utilizing the "tools of tomorrow". If these technologies

are becoming a part of the common "toolkit" of life and business in the future, educators

should play a pivotal role in helping to ensure that they are researched and used in their

industry responsibly. Perhaps the industry could even be a role model in the coming years, if

handled properly. According to the EDUCAUSE Horizon Report, "AI's ability to personalize

experiences, reduce workloads, and assist with analysis of large and complex data sets

recommends it to educational applications… AI in the American education sector is expected to

exceed a market value of $85 million by 2022, with a compound annual growth rate of nearly

48%, and the trend is similar globally. This rapid growth in adoption sees institutions of higher

education partnering with industry to create AI-driven solutions for the purposes of reducing

college costs and allowing students to personalize their learning experiences to best meet their

needs" (Alexander et al., 2019).

Obviously, the market and the demand are there for Artificial Intelligence to keep

"taking the world by storm". The main question is how is what is seen in other industries being

applied to education? There is a strong belief that fostering the use of AI-enabled solutions

across higher education campuses can help to spur on the next generation of learners. In our

current environment, we are dealing with more issues than any other time in our history, when

taking in the full scope of economic, social, and political issues that create a maelstrom over

college campuses. The need for a tool that can help to unite and better bridge the gap between

learners and teachers is something that needs to be highly considered. Already, AI has been

being adopted more and more by higher education institutions, namely in different core functions of the business such as "learning management systems, proctoring, grading/assessment, student information systems, office productivity, library services, admissions, disability support, and mobile apps" (Pelletier et al., 2021). One of the best things about AI is its ability to help automate and raise the standard for certain processes that could be subject to human error, such as data entry or issues when transferring information from one source to another (Laudon & Laudon, 2021).

While many aspects are certainly noteworthy about how AI is helping and can revolutionize higher education, one of the most interesting, and perhaps needed, avenues that has been pursued is how education is delivered and learning occurs with students today. The vast majority of students in today's universities have grown up in a digital world, at least in some small capacity. This means that traditional models of teaching may not be best suited to the audience that is coming to learn the information. With the advent of the Internet Age and the rising usage of cloud computing, the ability to teach a greater number of subjects to ever growing audiences has never been better than what we see today. Through using AI, we have reached a point where the computing power is able to scale teaching, as a platform, while having the cognitive backing to help support and evaluate personalized student learning outcomes (Goel & Joyner, 2017). One of the most common ways we see AI being utilized in higher education today is through the use of so-called "intelligent tutoring systems".

Intelligent tutoring systems are an attempt to help modernize teaching methods to be more applicable to the audiences of today. These systems make use of "nanotutors" which are individually created systems that have a deep understanding of a particular question or aspect

of a subject, such as a chapter in a textbook. While these tutors can be quite time-consuming to create in the moment, the benefits that can be reaped from them for each unique student to utilize their services is invaluable. By utilizing this technology, you get the benefit of having automatic feedback for students while they are learning. This can be great for problems that are iterative in nature, allowing them to get feedback at individual steps, which allows students to achieve a deeper understanding of the subject they are studying. If they happen to miss a question, the nanotutor will point out what parts of their response(s) is incorrect and how they can reach the desired outcome (in this case, the correct answer). The main concern that people have is if the students appreciate this new technology in their learning environments. Do they prefer traditional methods of assignment receival and feedback mechanisms? This is showing to not necessarily be the case. In a study carried out by the Georgia Tech Online Master of Science in Computer Science program, they found that "about 80 percent of students agree that the interactive exercises improve their understanding of the material, and about 75 percent of students agree that nanotutors also help enhance their understanding of the material" (Goel & Joyner, 2017).

These tutoring systems also have wonderful benefits for the institutions that employ them, as well. Being able to better understand what topic(s) the students are struggling with can allow educators to better tailor the classroom experiences to help fill in the gaps where students could use some more attention. Having more accurate means of tracking student progress and learning, both as an individual and as a group, allow the teachers and institutions to better prepare the students for entering the workforce as more competent employees (Grivokostopoulou et al., 2017). One of the main reasons that instructors struggle with this is

due to the difficulty and time required to give the best possible feedback to students. This leads many teachers to struggle with balancing time in the classroom, in terms of how much to allocate towards assignments and instruction time. This is a common sacrifice that can harm the overall value of the course. Some professors may decide to lower the number of questions that they assign their classes which, in many cases, can be seen as a reduction in the number of learning opportunities for the pupils. Finally, teachers who decide to offer a high number of learning opportunities, may end up falling behind in providing grades and feedback to their students. This can be especially harmful for the students if the material is strongly linked together (i.e., it builds on itself throughout the duration of the course). This can lead the teacher to perhaps not be as objective in their grading criteria in all instances. Using an AI-enabled tutoring system can help to provide timely feedback that is, if vetted properly, just as (if not more so) accurate than the human grader (Goel & Joyner, 2017; Grivokostopoulou et al., 2017).

These tutoring systems can become even more powerful, however, if they start to adopt even more technologies from under the AI "umbrella". For even smarter tutoring, building AI-enabled tutoring that utilize machine learning (ML) and natural language processing (NLP) allowed for "automated, data-driven personalized hints and explanations, Wikipedia-based explanations, and mathematical hints. Feedback generated this way takes the individual needs of students into account, does not require expert intervention or hand-crafted rules, and is easily scalable and transferable across domains... personalized feedback leads to substantially improved student learning gains and improved subjective feedback evaluation in practice" (Kochmar et al., 2020). Being able to utilize the plethora of data available in today's

environment, paired with the unbelievable power of AI and its associated technologies, allow

for a multifaceted approach to learning and knowledge retention that, instead of abusing,

utilizes the tools we have at our disposal to teach to the modern student. Using AI in this

manner allows institutions to create generic models for helping to tutor students, while offering

the flexibility to assist students in a more personalized way, whether it be during assignment

work or through intelligent feedback after the task has been submitted (Perikos et al., 2017).

Make no mistake about it, though, the technologies surrounding the use of AI, even in

something as specific as intelligent tutoring agents have to encompass many technologies

under the "umbrella" of AI. NLP is incredibly powerful, namely due to how it revolutionizes the

interactions that humans can have with certain systems. Classically, a human would need to

interact with a computer in a very manual, most likely text-based environment. The device in

question will have a limited number of answers to possible queries, constrained namely by the

program that fuels it. By introducing a new element, NLP, which can function as a conduit for

interaction, either text-based or using spoken language. Hopefully, the system in question can

handle both. The complexities involved with AI and the typical number of different technologies

needed for a tutoring system (intelligent agent, NLP, ML, etc.) can cause there to be quite a

hefty technological component and is a large reason why progress in AI is not widespread

across most institutions (T. Baird, personal communication, April 18, 2022). It has been shown

that "the combined use of NLP and ITS technologies in the simulation of virtual patients might

promote students' learning by making the student-software interaction more similar to a real-

life scenario" (Furlan et al., 2021).

It is overwhelmingly clear that AI has great potential and has shown great effectiveness in higher education already at this point. However, it is important to note that, like most emerging technologies, society will push the edge of what is possible with tech and leave the ethical component behind. This can be a major problem for an industry that is becoming more digitally connected (Nye, 2016). There are multiple dimensions of AI that need to be considered in order to effectively deploy it in education, such as "fairness, accountability, transparency, bias, autonomy, agency, and inclusion" (Holmes et al., 2021). One of the biggest leaps of logic to make in this case is the jump from the idea of including ethical processes in AI versus creating a system that performs tasks in an ethical manner. While it could be easy to let these ethical concerns fade into the background, there is simply too much at play here to ignore. Unfortunately, AIEd is lagging behind other fields of AI usage in terms of thinking about ethical applications. Sadly "no framework has been devised, no guidelines have been agreed, no policies have been developed, and no regulations have been enacted to address the specific ethical issues raised by the use of AI in education" (Holmes et al., 2019).

In education, as with many other fields, there are many questions to be answered surrounding the use of AI. Whenever you are dealing with an algorithm, you want to be certain that you understand how it is coming to the decisions or answers that it is arriving at. As far as student learning outcomes, assignment tutoring, and college entry decisions, some institutions are finding that they cannot fully explain how some decisions were reached. If algorithms are to be used in higher education, the students, professors, and even parents need to be able to fully understand the parameters and tests that went into deciding the final outcome (Mouta et al., 2019). While there are plenty of questions surrounding major decisions, there also needs to be

discussions about the ethics of teaching and how an AI system fits into the relationship between the teacher and the student. Though the ethics of AI could be a discussion that could go on for quite some time, the main components that need to be considered are "the ethics of teacher expectations, of resource allocations (including teacher expertise), of gender and ethnic biases, of behaviour and discipline, of the accuracy and validity of assessments, of what constitutes useful knowledge, of teacher roles, of power relations between teachers and their students, and of particular approaches to pedagogy (teaching and learning, such as instructionism and constructivism)" (Holmes et al., 2021).

If the field of AIEd can take these factors into account, the beginnings of a scaffolding for how AI should be implemented in a safe and ethical way can begin to be formed. It must include individuals from all parties involved, however: teachers, students, and developers if the "whole picture" is ever to be acquired (Bozkurt et al., 2021). While ethics has been a hot topic of debate, both among industry experts and media outlets, there is surprisingly little concrete research on the topic. This area of study "generally lacks benchmarks that can be used to measure or assess the relationship between broader societal discussions about technology development and the development of the technology itself." (Zhang et al., 2021). This is not a question of understanding the abstract issues with technology, but not being able to realize concrete metrics, or KPIs (Key Performance Indicators), which can help companies have something to meet or strive towards.

According to the 2021 AI Index report, "technical advances have started to outpace the benchmarks to test for them" (Zhang et al., 2021). While there has been plenty of progress over the past couple of years in different areas of AI, there has not been much cross pollination of

ideas between disciplines which has, in effect, created silos between disparate groups. This is a

real issue, when the expertise of individuals who could provide great feedback for certain

human-focused applications of AI are not consulted, which could lead to improper

implementation of Artificial Intelligence. This is a great concern for how AIEd could play out, if

pedagogy and real-world use cases are not discussed between developers and professors

(Holmes et al., 2021).

Many may argue that the need for AI is superfluous at best, and downright harmful at

worst. While, as can be seen from the literature, there is a definite downside to the improper

use of AI such as introducing bias in the algorithm or stifling of human-based connection

(Mouta et al., 2019; Ntoutsi et al., 2020). While these issues are not unique to the situation of

Artificial Intelligence, they can perhaps be made to be more acutely damaging than they

otherwise would be. This is mainly due to the lack of a real "human element" being present in

the way the decisions are made by the algorithm in question. When dealing with AI, it can feel

like there is, potentially, no course of action should you question the output that was

determined. Bias is something that is, unfortunately, present in society in general. Therefore, it

is impossible to make an algorithm that can fully account for this. While there is definitely work

that can be done to make the algorithms better at detecting anomalies in the data, there are

some other aspects of creating these algorithms that need to be considered. Ideas surrounding

how data is collected (or generated) and any sort of institutionalized bias need to be considered

when working towards one of these algorithms. If there are issues at the root, it is difficult to

believe that the fruit borne will not have the same issues (Ntoutsi et al., 2020). There is also

something to be said about who is creating the software that powers these AI machines. While

it is difficult to do everything yourself, there are several news stories that should come to mind from the past few years that highlight some of the issues with trusting "Big Tech" firms with your private data. Regarding Higher Education, this is an industry that needs to be extra aware of the potential pitfalls of someone getting access to the private data held within the "digital walls" of the facility. The fear is that, by adopting AIEd "many sets of tasks that are currently placed at the core of teaching practice in higher education will be replaced by AI software based on complex algorithms designed by programmers that can transmit their own biases or agendas in operating systems. An ongoing critique and inquiry in proposed solutions stay critical to guarantee that universities remain institutions able to maintain civilization, promote, and develop knowledge and wisdom" (Popenici & Kerr, 2017).

So where does this leave the industry, overall? It would not be fair to take an all-positive or an all-negative approach to analyzing AI. The technology, undoubtedly, has incredible potential. Like most tools that have great potential, this can swing in either a positive or a negative direction. It, like all other tools, will be up to the wielder of it to determine how its power will be utilized. The need for a clear understanding of the ethics surrounding AI is critical and it is blatantly obvious that more talks and committees are needed to help "police" and set guidelines for industries using Artificial Intelligence in practice. Some of the leading minds in the field, such as Demis Hassabis of Deep Mind (creators of the infamous AlphaGo algorithm), have stated on record that they would like to be a part of such an effort, citing the need for more experts to get involved in the ethical implications of this emerging technology (DeepMind, 2020). Currently, the area of ethical frameworks for Artificial Intelligence is not yet formed; it is still embryonic, so to speak. These systems are being developed, validated, and put out into

production use, without much thought behind a set-in-stone ethical framework, which is leading for there to be confusion around best practices for developing these systems, not to mention how they should be tested, trained, and utilized in real life. There is a real opportunity present here to be a part of a "next wave" in technology. In all industries ethics is important, but two of the most important ones that need to be especially verified are education and healthcare, two industries which deal heavily in personally identifiable information (PII). As of now, Western thinking dominates the AI space, which is something that needs to be figured out; do people want AI algorithms that can be flexible enough to work for all cultures or do they need to be tailored to their specific environment? This is a critical question that needs to be answered. Also, as of now there is a severe lack in terms of practical applications of ethics to these systems. Most ethical frameworks are still in the abstract, or conceptual, phase (Hickok, 2021).

There is a huge opportunity here for Christians to be involved in these conversations and we should be, where possible. This technology threatens the idea of many of what it conceptually means to be human, as we see the lines between silicon-based and carbon-based lifeforms blurring. So, how should Christians approach this technology? Craig Bartholomew, a Christian theologian, has a great way of framing this question (Bartholomew, 2017; as cited in Schuurman, 2019):

> *"We should start with ontology —this is our Father's world, and we are creatures made in his image— and then move on to epistemology —as his creatures, how do we go about knowing this world truly?"*

There is great concern about how much power humans should exert, should they start to play the "role" of God, which could lead humanity to try to do things perhaps beyond our scope as stewards of this planet. Looking forward, it will be important to understand the fundamental aspects that make humans human, and to be sure that those respects are not diminished. AI can be applied in a way to help the flourishing of society; it just needs to be supported by a sound moral framework to help it function and work alongside humans (Schuurman, 2019). Therefore, Christians are needed in this field of study. Talks about more complex applications of AI are already happening. It would be a shame if Christians were not involved in these discussions as much as possible since the alternative could be quite frightening.

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