AI in the Learning Environment: Examination of Pedagogical, Psychological, and Ethical Implications

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Abstract: This paper provides an overview of how AI tools and capabilities are being integrated in teaching and learning. It also addresses ethical aspects of integrating AI and other advanced technologies in these processes as well as the resulting implications. These issues include algorithmic fairness, privacy and surveillance, intellectual property rights, misinformation and violence, health concerns, and social implications. In addition, how access to such tools will impact the cognitive functions of their users, particularly learners, has become a relevant question. Much more information is now becoming easily accessible to a wider population, making it important to understand and mitigate AI ramifications to human learning, reasoning, and perception, especially for young learners whose brains are still in the early developmental stages. To that end, this paper also reviews the current literature regarding the impact of AI integration in education, focusing on the potential effects this can have on the cognitive abilities and functions of learners. Thus, with AI making its way into the educational realm, from pre-college to advanced studies levels, understanding the resulting pedagogical, psychological, and ethical ramifications can guide thoughtful development and appropriate integration of AI tools in support of the learning environment.

Keywords: AI ethics, Societal impact, Learning, Cognition, Regulation

1. Artificial Intelligence in Education

The speed of technological innovation and acceptance is accelerating. Resulting technological systems are embraced and integrated into the educational processes, with sophisticated AI tools capable of general-purpose language understanding and content generation becoming available to learners of all ages. It is certain that the educational system will fundamentally change as a result, making it necessary to examine, understand, and mitigate the challenges we are certain to face, including how such tools will impact the cognitive functions of their users, specifically learners. It is a fact that AI applications, especially language models, have been adopted quickly and broadly in educational settings, and are commonly used by instructors and learners for their coursework. These tools help educators develop and deliver course content, assess students' knowledge and progress toward their learning goals, and provide targeted feedback and timely support to improve learning outcomes.

While some types of AI systems had already been in use in academic settings, large language models capable of understanding and generating text and other content are allowing to drastically reimagine education. This includes access to things like algorithmic learning systems, predictive analytic tools, automatic assessment, virtual reality, and more. Specifically, promising personalized learning tools, with machine learning algorithms that analyze learners' performance and create customized lessons, aligned with individuals' strengths and weaknesses, are receiving wide acceptance. Virtual Reality devices allowing for better understanding of abstract concepts or practicing complex procedures are increasingly in use. Pedagogies aiming to make learning more efficient while rethinking the important role of the human component in the process are also underway.

The advantages for learners, teachers, and organizations are as indisputable as the drawbacks. In addition, while many have already forecasted that this can also increase motivation and engagement, others warn of risks and consequences, such as diminished capacity for critical thinking, declined memory, reduced attention span, and lack of motivation. Furthermore, there are concerns that it is becoming difficult to ascertain authenticity of intellectual creations, and therefore academic integrity. While some have gone as far as to argue in favor of severely curtailing or forbidding the use of such tools in schools, others see this as an opportunity to guide learners toward ethical and responsible conduct in all matters of academic work. This makes it important to consider the potential ethical and social challenges of these developments as well as the responsibilities that institutions, educators, and students face.

1.1 Generative AI

Probably the most widespread AI tool that has taken over the education system is Generative AI. They are making it possible to create original content in a matter of seconds, for which we would need hours or days to

make, by replicating our own creative processes. The possibilities for this are endless. However, it is important that we ask the question whether we should accept AI as the new "normal" and embrace it as a benefit, or we should be concerned about where it will lead us in the future.

Generative AI models have a long history, going back to the 1960s. They are now used in chatbots to generate human-like responses. Recent advances in machine learning and natural language processing, and the release of new Generative AI systems, have made it possible to bring them into everyday applications. The technology was brought to the public when ChatGPT came out on November 30, 2022. It quickly became a favored platform for creating content for everyone, from students in need of a school essay to employees using it to complete their work.

Generative AI will continue to become increasingly popular and, consequently, the more it develops, the more questions will arise. It is reasonable to ask whether homework assignments will even make sense anymore now that students have discovered AI models; or, how might employers differentiate workers and reward them according to their work contributions given the use of such programs.

Generative AI enables individuals and organizations to do things that were not previously possible, both in terms of speed and scale. How it will eventually be exploited is a fundamental point. The public introduction of Generative AI is, in many ways, a first ever test for us, as a human race, as to how we will react to such a wide- and far-reaching innovation. For example, how might students change when they are given an easier path to meeting their responsibilities, whether it is to satisfy a curiosity or something more important; and how some students may completely give in to technology and allow it to do their work, while others use it as an aid to do a better job and be more productive. In fact, the whole notion of work and productivity is being re-written. Take software engineering, as an example, where substantial and sophisticated code can be quickly and readily generated, based on natural language directives, facilitated by the enormous volume of open-source code used by machine language models for their training.

Furthermore, since Generative AI systems make new patterns from countless examples that already exist on the web, the question is who should own the generated content. Since Generative AI products are not based on one source, but on an aggregate number of them, this type of infringement might not be easily noticeable, but it is certainly real and could be discerned. On one side of the debate, there is a notion that intellectual rights belong to the AI model that created the material. Or possibly to an original creator whose work is on the internet, even though it is essentially impossible to make specific attributions. This is because the algorithms are taught to recognize patterns and relationships in large data sets and generate new content. Since the generated material is created using such data, the creators of this work are asking for its copyright. Official US and European laws currently state that AI cannot own the copyright as it is not an author and does not have a legal personality.

1.2 Deepfake Videos

Deepfake Video Technology—videos created using deep learning AI methodology and technology allowing the likeness of individuals in a video to be swapped with any other person's likeness. Deepfakes have already been integrated in education, as a means of visualizing work. While this technology can make some aspects of education more appealing especially to younger learners, perhaps by making a video of a historical figure speaking about an event in the past rather than having a teacher say it, it does also raise some serious concerns.

The reason deepfakes are so convincing, more than a photoshopped picture or an altered audio recording, is that the human brain responds the most to visual communication stimuli compared to other sensory information, a psychological phenomenon known as the Colavita visual dominance effect (Koppen & Spence, 2007), particularly when it involves non-verbal communication such as body movement. Because of this, it is especially hard for us to recognize a real video from a fake. The more we are aware of the fact that videos can be photoshopped, just like images can, the more deliberate we can be in choosing what to believe. This is of utmost importance especially with young learners. In addition, while deepfakes are legal, it is important to understand that some content could be considered to have breached legal codes and is thus liable. Clearly though, whether we talk about public concerns, such as law and order, or personal ones, like reputation and social identity, we are starting to approach an era where protection from technological attacks is becoming a human right.

The best approach to countering any type of deception is through education. The more we know, the less impressionable we become. However, that can bring on another problem, the interference with our ability to acquire knowledge. Knowing that anything can be altered, our brains can doubt every piece of media we see, even the ones that are legitimate, and can lead us to acquire false beliefs. This is known as the epistemic threat

of deepfakes. When this becomes the case, videos will no longer be reliable, especially as trusted evidence, or fair sources of information. This is what makes deepfakes controversial, and diminish its promise for teaching and learning. However, one thing is certain, there is a need for more research into this technology and laws to regulate it.

1.3 Video Gaming

Video games have gained immense popularity in the last decade. As such, significant efforts and resources are being invested to improve the gaming experience. In addition, video games are more accessible than ever. There is no need to go to the arcade room or buy a gaming console anymore. Video games have evolved significantly from their early days. It is fair to say that gaming is here to stay as evidenced by the unprecedented surge in popularity and profitability the industry is enjoying. Also, culturally, gaming is becoming more mainstream. Not only is there a noticeable and rapid increase in the number of people playing games, they are doing it both earlier and later in life.

The introduction of AI into gaming has made it more creative and realistic. Thus, it is also easier than ever for any individual, of any age, to enter the world of gaming and perhaps be exposed to the dangerous side of this world. In fact, AI is enabling the creation of a fully digital universe, the Metaverse, the 3D virtual world, where people interact, socialize, and engage in various activities through virtual environments. These virtual worlds are reshaping societies, economies, and even human identity. That being said, an educational metaverse, where students and teachers interact and learn, is something we will see in the future.

Metaverse offers a glimpse into the possibilities in the converged physical and virtual spaces where digital facsimiles of ourselves, avatars, move freely from one experience to another, taking our identities and assets with us. It is expected that community participation and collaboration will produce innovations and user-generated content for this space. It is not unreasonable to forecast that these exciting developments will only amplify the challenges, particularly ethical ones. While these advancements have made the experience of gaming more realistic and exciting, they are also responsible for some complex dilemmas. It is relevant to mention that the World Health Organization has a classification for a “Gaming disorder”, defined, in part, “as a pattern of gaming behavior characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences.”(Darvesh et al., 2020) However, gaming is also credited for promoting better cognitive performance among its users (Bork, 2012).

2. Emerging Implications and Ethical Ramifications

A major issue with AI is the transparency and accountability of its decision making. Because of the complexity of their design, making AI systems difficult to understand. In addition, there are a host of other matters surrounding the development and deployment of AI tools that require attention. Among the most serious are fairness of predictive algorithms, that is the principle of designing AI algorithms in a way that does not discriminate against individuals or groups. Also, privacy, security, and safety are valid issues given the personal information being collected and stored by corporations, organizations, educational institutions, and governments and how it is used, including the sharing or selling of data as well as the risk for monitoring of individuals that lead to loss of privacy. Furthermore, AI-generated work and impact on intellectual property rights is an issue that is still to be resolved. Misinformation, the potential for violence, addiction, and health problems are also significant concerns. These issues are even more pronounced in education given the different age groups and diverse population potentially impacted.

2.1 Predictive Analytics

Personalized learning is an advantage intended to be a means that enables instructors to tailor unique learning goals based on individual needs. It relies on adaptive algorithms to create content and experiences for learners appropriate to their own profiles and accomplishments based on collected user data. Algorithmic predictions in machine learning use sets of micro- and macro-data to form models that can subsequently be applied to people and objects, and predict outcomes based on previous experience. This type of automated, or semi-automated, decision-making is favored because predictive algorithms are capable of processing much more information, and much faster, than we can and thus impacting matters of significance in domains such as education, but also with potentially wider implications in other domains. For example, the potential of infusing bias into student assessment approaches because human decision-making is being replaced by algorithms of intelligent machines that are subject to biases inherent in the data used to train these algorithms.

The ability to derive insights from multiple data sets and make impactful decisions through algorithms may result in unintended effects on certain individuals and groups that have already shown to be potentially unfair with a risk for racial, gender, or other biases. The predictive algorithms are not thinking, they are making mathematical calculations based on the data that we, humans, provide them and others they collect.

2.2 Algorithmic Fairness

A requirement that AI algorithms are free from bias and do not reinforce existing social discriminations seems reasonable and logical but, at least for now, remains elusive. Decisions commonly and routinely made by humans, which benefit from the innate normative moral sense we possess, despite variation across cultures and communities, are progressively made by computer algorithms that can reach incorrect conclusions. As a result, new problems that have real-life implications are starting to emerge. AI algorithms learn from the data they are trained on, and if that data is prejudiced, the algorithms will unfairly affirm this bias. This requires careful consideration of the data used to train the algorithms, the foundations of the model, and the measures to assess its performance.

In the pre-AI era, humans made simple and complex decisions using available data combined with their instincts, beliefs, and values. Now, algorithms are increasingly taking on some of these decision-making processes because it is believed that they are faster and more accurate in many situations than humans. However, it is important to contemplate these serious matters, considering that AI, as much as it has evolved in the last decade and how much it will still evolve in the future, is still artificial. The fact remains that AI is unable to consider moral judgment in making its calls, and thus can reach incorrect conclusions and generate misguided decisions that create unfair outcomes, such as privileging, or disadvantaging, some people over others.

As technology advances, approaches for mitigating and eliminating these faults can be developed. Even so, the question remains whether a machine can ever be completely accurate, fair, and follow prevailing societal norms considering that AI is, in large measure, based on identifying patterns, and that implicit and explicit stereotypes are essentially a type of pattern by their nature. At the same time, efforts to identify, eliminate, and prevent bias, in all forms, caused by algorithms of personalized learning tools, that are being addressed through audits and checks have yielded acceptable results. Lasting and effective solutions to these problems are possible with social awareness and governmental regulations.

2.3 Privacy and Surveillance

As AI continues to pervade many aspects of our personal and professional lives, it becomes easier and quicker to gather, store, analyze, and share information in ways that intrude on privacy. This brings up a number of concerns with its use in education. Starting with privacy and surveillance, AI devices that track students' location, attention, and behavior capture and store sensitive data. Determining data ownership and control can be complex, especially when data is collected by third-parties. Observing students using technology for seemingly legitimate reasons, such as identifying those who may be inattentive or distracted during class, can limit creativity, or freedom, and amounts to surveillance. This authoritarian approach to data gathering also raises the question of profiling, violating privacy rights, and may lead to potential exploitation. There is also a rising trend in using AI facial recognition tools for predictive profiling by tracking and monitoring, sometimes excessively, the actions and movements of students resulting in incidents of bias and discrimination.

Nearly all processes students engage in on a routine basis requires the disclosure of some personal data such as name, address, phone number, date of birth, and gender. Complex processes require the collection of much more sensitive forms of personal data points that require a greater level of protection such as social security number, racial or ethnic background, and biometric or genetic information. Much more intrusive data requests can be made depending on the nature of the action triggering it. This is becoming increasingly pronounced in our schools.

The risk of individual harm, especially troubling for minors, are examples of the potential consequences stemming from unauthorized data breaches. Making this more unsettling is the fact that it is not clear who owns the data collected from surveillance systems, how securely it is stored, and with whom it is shared, let alone whether appropriate consent was obtained to collect the data in the first place. It can be further argued that it is difficult to safeguard impacted individuals, whose images and activities are being captured, often unaware, by cameras becoming omnipresent in classrooms, a technological intrusion that is not transparent.

There are other, more serious, data privacy questions regarding digital surveillance, which are necessitated by the need to protect schools and their occupants, including students, teachers, staff, and visitors. That is the use

of the technology to identify individuals without their informed consent or knowledge especially by identifying and analyzing biometric traits of the face, voice, gait, and other features of a given image. There are legitimate algorithmic concerns in such situations. Relying on machine learning in the public safety sphere amounts to predictive profiling, which essentially requires the AI to anticipate that crimes will occur, who might the offenders be, and who might the victims of these potential crimes be. Although not purposeful, given the questions of algorithmic fairness and bias in training data, implications to individuals and groups may disproportionately affect certain sectors of society more than others.

2.4 Intellectual Property Rights

There are many moral questions, beyond plagiarism and copyright, and it is crucial that we are able to define the limit to which an action is ethical or not, especially considering what the future of AI still holds. Ever since Generative AI gained popularity, the development of software detecting AI-generated material has begun. From a pragmatics perspective, it is less important to know whether or not the material can be detected as generated by AI. The question should be which of our actions are likely to be unethical and violate certain norms, not just in education, but also in everyday lives.

The issue of potential academic misconduct is the simplest to address. As it has always been with such matters, instructors' philosophy and preferences have created a range of reactions, from a very vigilant approach to stamping out the use of AI-generated content, on one hand, to a more tolerant approach of accepting such generated material, on the other. It seems reasonable, for a writing exercise, that generated content can be used as a starting point to inform one's work, brainstorm ideas, and prepare notes, just as can be done with textbooks, library resources, and web materials; of course, with appropriate citations and attributions. Obviously, there should be no tolerance for plagiarism regardless of how it occurs.

An ethical concern also arises whether authors of intellectual work used by Generative AI are being disadvantaged. Normally, if a person's work is used in any form, the owner, author or artist, would have to be referenced or otherwise compensated, thus receiving credit for their original creation. However, Generative AI does not do any of these things, raising ethical flags among writers, scientists, artists, and other content creators.

2.5 Misinformation, Violence, Health Concerns, and Social Implications

Digital harassment, hate speech, and fake news are becoming more prevalent across societal domains including education. AI is now an unwitting enabler that carries a big risk of spreading misinformation or using the generated material for misconduct. Such behavior is already a major concern in schools as it is easily effected through AI in the form of threatening messages and abusive language, disclosing unauthorized private information or images, and disseminating erroneous information and spreading rumors, creating false profiles or assuming social media identities of others, and making fake videos or AI-generated content that is difficult to distinguish from real ones. Deepfakes, for example, especially those of sexual nature, have been harmful to the reputation and well-being of students subjected to such behavior. The use of video gaming as a pedagogical tool has added to this complication and their integration in education requires careful planning. Virtual worlds like the Metaverse are anticipated to undergo further growth, offering even more immersive experiences. The Metaverse, in particular, has the capacity to profoundly impact the education domain and, as it continues to evolve, could reshape how we interact, learn, and engage with technology in ways we have yet to fully comprehend.

The American Psychological Association indicates that a high percent of video games currently on the market contain some form of violence, while acknowledging that there is not a direct connection between playing these games and being violent. However, a psycho-social theory known as the General Aggression Model suggests that exposure to violence through video games creates cognitive scripts of aggression in the human brain.

Additionally, AI-powered games collect and analyze vast amounts of player data to create personalized experiences and optimize in-game features. However, this comprehensive data collection presents an ethical challenge regarding data privacy–how is this information used, stored, and shared. Similarly, there are social concerns arising from the prevalence of gender stereotyping in games. For example, only a small percent of video games feature a female protagonist. When female characters are included, they often are sexualized, characterized by revealing clothing and exaggerated body proportions. Finally, there are concerns that some video games can be used maliciously, for example to normalize deception or promote suicidal ideation. Naturally, the aim should be to foster positive and inclusive communities, and resist the temptation to propagate biases, toxicity, harassment, stereotypes, or discriminatory behavior.

3. Impact of AI in Education on Cognition

Interest in how technology impacts human cognition is growing with the rise of AI tools capable of language understanding and generation. Reliance on AI tools, instead of thinking processes raises concerns on how AI will affect cognitive development, especially in children and youth. There already have been some psychological phenomena documented when it comes to the relationship between the brain and digitization. Specifically, the tendency of not committing valuable information to our memory because we know that it is easily accessible online, known as "Digital Amnesia" (Sparrow et al., 2011). Understanding how this technology affects our cognitive ability and mitigating ramifications to human learning and reasoning is crucial for pedagogical purposes.

Although theoretical models to explain potential impacts and consequences have been proposed, only a limited number of experimental studies have been conducted so far, due to the recency of AI (making it impossible to observe longitudinal effects or notice neurological changes) and methodological challenges regarding validity and reliability of measurement tools. Therefore, most current experimental literature in this area relies on questionnaires, self-reported measures, and pre- and post-test designs in groups with or without engagement with AI tools. For instance, investigating the influence of Generative AI on critical thinking skills in a sample of 107 graduate students (Essien et al. 2024) found that students who were allowed to use ChatGPT improved basic cognitive abilities compared to those who were not allowed, but there was no significant effect on higher-level skills like creativity. This suggests that while ChatGPT can assist with fundamental cognitive skills, its effect on higher-level functions remains limited.

Similarly, another study on 637 students found that AI improved students' efficacy and engagement, but had no significant effect on critical thinking skills (Jia & Tu, 2024). This increase in self-efficacy may be due to the psychological boost students receive from feeling more capable of handling academic challenges. Conversely, a comprehensive two-phase study from 2021 focused on the relationship between inputs, such as the time invested, and outputs, such as learning, knowledge transfer, and skill adoption, when students use or do not use digital technology in their education The results found that the use of digital technology in higher education has no positive impact on students' efficacy and the cognitive outputs, and that students are actually more efficient in their higher education goals when they do not use digital technology (Lacka et al., 2021).

The cognitive process behind overreliance on AI during decision-making has also been investigated (Bucinca et al., 2021). It was hypothesized that people rarely engage in critical and analytical thinking when deciding to trust the information given by AI. The experiment was conducted on 199 people divided into three groups, each engaging with one of the three cognitive forcing designs, and compared it to a control group. The results showed that cognitive forcing significantly decreases overreliance on AI. The importance of this study lies in the fact that overreliance is one of the main causes of critical thinking decline when engaging with AI, which poses a significant danger to students. It also represents a valuable way to determine if a student simply plagiarized the content generated by ChatGPT or only used it as a tool and analytically thought through the information that was generated.

3.1 Attention and Motivation

The most commonly investigated cognitive function impacted by technology is attention, likely due to the constant stream of stimuli we encounter (e.g., common notifications, working in multiple tabs, seconds-long videos on social media, etc.). As the intensity of these stimuli increases, the level on which we interact with them decreases, a behavioral pattern called "media multitasking".

While early researchers suggested that multitaskers would excel in attentional task-switching (because they "practice") results actually showed the opposite, and analysis suggested that those who engage in frequent and extensive media multitasking show worse attention abilities because they are too susceptible to irrelevant environmental stimuli and distractions (Ophir et al., 2009). These results were also supported by MRI imaging of the brain observed while subjects performed attentional tasks (Moisala et al., 2016). Similar findings were also reported (Adiguzel et al., 2023) on productivity, engagement, and learning outcomes that may improve as a result of AI's integration, but also suggested that the ethical and practical risks need to be accounted for. The same conclusions were also reached by other researchers (Baido-Anu & Anash, 2023; Firat, 2023).

Another relevant cognitive process is motivation. Specifically referencing motivation in the context of learning, an obvious assumption may be that the presence of AI decreases motivation because learners no longer "have to" complete certain common tasks, such as essays, reflections, analyses, or even writing programming language code because these can be instantaneously generated by ChatGPT. However, this does not appear to be the case

as already research studies agree that the integration of AI in coursework and academic environments greatly increases learner motivation (Ali et al., 2023; Yildiz, 2023).

3.2 Language Processing and Memory

Language processing is an important cognitive function, most rapidly developing within the first couple of years of life. From a neuroscientific perspective, extensive media use is related to decreased brain white matter pathways responsible for reading and language (Hutton et al., 2020), as well as decreased brain connectivity between areas responsible for word recognition, language and cognitive control, and executive brain functioning (Horowitz-Kraus & Hutton, 2018). This was similarly established in other research showing that children with a higher amount of screen time demonstrated significantly poorer language development (Horowitz-Kraus & Hutton, 2018; Duch et al., 2013). However, it is worth noting that children, as more impressionable beings and their brain still being in the development phase, are more prone to these negative effects than adults.

Another cognitive function impacted by technology is memory. Researchers have investigated a commonly asked question, whether easy access to countless information on the internet will affect our semantic memory (i.e., memorizing facts). Their work has demonstrated that our ability to immediately access information online causes the tendency not to remember the information we read because we know it is easily accessible, a phenomenon known as “Digital Amnesia” or “The Google Effect” (Sparrow et al., 2011).

These and other similar important studies were conducted during a time when the internet was becoming more accessible. However, none of these studies reflected the recent proliferation of AI that we are currently subjected to. Hence, the impact of new technology, specifically AI, is presumed to have changed what we have known in this recent period. For example, Sparrow’s findings reflected changes in semantic memory, which only refers to memorizing facts, while other aspects of memory were not affected. However, now we not only have access to information online, but to language models, such as ChatGPT, that can easily write an essay within seconds, or present us with step-by-step instructions for something that we would once have had to figure out by ourselves or by researching multiple information sources. It is, thus, reasonable to postulate that as technology advances, including AI, the same and other aspects of our cognition are bound to be affected in the future as well.

4. Concluding Remarks

Very few aspects of our lives and our society are likely to remain unaffected by AI. Already organizations and governments are working together to maximize benefit for society as it is understood that the future of computing, specifically AI, and correspondingly ethics will be shaped by continued technological advancements, social and cultural acceptances, and regulatory frameworks.

The groundwork for this has already been laid in education. Even though the rate of technology adoption in nearly every aspect of our lives had been on the increase, our access and comfort level in teaching and learning received a boost as a result of the recent pandemic when our physical self suddenly needed to become also virtual. Educational institutions rushed to invest in and integrate as much technology as was feasible to continue their work in a virtual environment. Learners and their instructors managed their digital spaces so well that this type of virtual and independent learning has now become mainstream alongside the traditional classroom mode. Ever since, there has been a debate on how technology will continue to change education. This debate has only intensified now with an ongoing AI movement that will significantly facilitate and give further credence to these developments.

The increased reliance on AI could lead to devaluation of teaching expertise, which can impact training as well as the growth and development of future workforce. Thus, the actual practice of education, although already impacted by automation, must remain human-centric, particularly the activities that deal directly with students. AI will have the important role of augmenting the skills and the work of teachers, ranging from making more efficient lectures and activities, to providing timely feedback and support. It will be important to ensure that AI systems remain subordinate to human command. However, realizing that AI will only continue to develop, attempting to forestall it is simply not possible. Whether we like it or not, AI is going to become an everyday part of our lives, and now is the time to learn to adapt to it.

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