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Contention 1 is Readiness

AI Learning is coming – the US needs to adapt or we'll fall behind

Allen 19 (John R. Allen, Retired marine four-star general, former commander of the NATO International Security Assistance Force and U.S. Forces – Afghanistan. "Why we need to rethink education in the artificial intelligence age", Brookings, https://www.brookings.edu/articles/why-we-need-to-rethink-education-in-the-artificial-intelligence-age/, 1-31-2019, DOA: 2-18-2025) //Bellaire MC

I've studied and written extensively about the effects of AI/ET on the evolving character of war toward a concept I've called hyperwar—or, a new era of warfare in which, through AI, the speed of decision-making is faster than anything that has come before. At a superficial level, this topic often devolves into a discussion of "killer robots," or at the very least, the impending use of AI in lethal autonomous weapons. While those discussions are relevant and inextricably linked, they represent a narrow understanding of the greater issues at hand. The concern over AI's potential or theoretical military applications must not distract us from how far-reaching the impact of AI will be in nearly all other policy domains. Health care, education, agriculture, energy, finance, and yes, national security, will all be reshaped in some way by AI—with education being the pivot point around which the future of the United States revolves. This is not solely a matter of social redress, but, in fact, a larger national issue. A future in which the United States is second in the race for AI technology would create a situation of national technological and digital/cyber inferiority, which could in turn result in national strategic subservience. The **way we use education** to prepare our next-generation of leaders will **directly determine whether the U.S. retains its leadership** in critical fields of relevance in the emerging digital environment. Without a sufficiently educated population and workforce, the **U.S. likely will slip behind** other states for whom AI/ET is not only means for improved social organization, but for strategic superiority, and ultimately digital and physical conquest. A future in which the United States is second in the race for AI technology would create a situation of national technological and digital/cyber inferiority, which could in turn result in national strategic subservience—something simply unimaginable. Many Americans grew up with the understanding that the American capacity to fight and win a nuclear war was defined by its superiority in the Strategic Triad, the three legs of our strategic deterrence: our missile squadrons, our bomber fleet, and our ballistic missile submarines. Behind that dizzying array of hardware was the undisputed power of U.S. intellectual and technical capabilities, and behind that was a near unlimited supply of talented engineers, each trained by a system of education undisputed in its excellence. That system was built from the ground up to produce crucial STEM (science, technology, engineering, and math) protégés in the quantities needed to ensure American strategic superiority, which contributed directly to the U.S. and its allies prevailing in the Cold War. For the health of our American way of life, our competitive advantage, and the strategic security of our nation, the basis for tomorrow's system of education must reflect a deliberately tuned and calibrated system that **proactively emphasizes AI**/ET, big data analytics, and super-computing. Unfortunately, in both relative and absolute terms, the U.S. is falling behind in the race for superiority in these key technologies. Where the U.S. strategic advantage of the 20th Century was secured by American nuclear superiority, U.S. superiority in the 21st Century will likely be preserved, safeguarded, and sustained through a system of education that envisages the changes necessary and sufficient to embrace and apply relevant technologies. It will also be underwritten by educators who grasp the profound shifts in the pedagogical skills essential to the educational needs of the 21st Century. **The need to adapt is great**—and for this system to be fully embraced it must come in the form of a comprehensive and national U.S. strategy for education in the

digital age, to include the resources necessary to bring education into the digital classroom, and to educate and train entire generations of educators to be relevant in the 21st Century and beyond. The United States **must at all costs preserve its position of primacy in AI,** big data, and super-computing, and that can only be done through a highly educated population and derivative work force, and even-further through leaders who understand these issues on a fundamental level and have the political will to develop and resource a comprehensive plan for reimagining our national education efforts.

AI education in military is key to competitiveness – provides recommendation on decision-making and better allows strategists to absorb course material

William Barry, 10-17-2024, [PhD, educator @ Army College] "HYBRID INTELLIGENCE: DECISION DOMINANCE AT THE STRATEGIC LEVEL," War Room - U.S. Army War College, https://warroom.armywarcollege.edu/articles/hybrid-intelligence/, DOA 2-26-2025 //Wenzhuo

In the months before Russia's expanded **invasion** into Ukraine in 2022, six **planners** meeting in a nondescript room in the headquarters of U.S. Army Europe-Africa (USAREUR-AF) frantically developed various options for the employment and positioning of forces across NATO's eastern flank to avert, or at least limit the harm resulting from, the impending calamity. The commanding general of USAREUR-AF wanted options that would assure allies of continued U.S. support and deter any hostile actions into NATO territory. The job of developing these options fell to four graduates of the School of Advanced Military Studies (SAMS), one army strategist (Functional Area 59), and a logistics planner. With **little time for research** or to seek outside expertise, the six planners **had to** make the best **use** of available tools—sometimes **just a map** and whatever knowledge they had gained from education, experience, or self-development—to develop military options that would achieve the commanding general's intent; this was a daunting task as it required assessing the feasibility of complex movements of large numbers of troops and equipment to achieve difficult-to-measure objectives in a dynamic operational environment. The initial **recommendations** on these consequential matters often **came down** to the "**best guess**" informed estimates made by a small number of talented, well-educated but, in the end, mid-grade officers. As seasoned military planners can attest, this experience is hardly unique. It is a frequent occurrence created by the too-familiar demands of limited time and personnel common to crises.

Future planners will be much **better served**. The Army War College is currently developing tools that will provide direct access to immediate, accurate, and timely data to support operations. Instead of spending one or two hours to generate a "best guess" estimate, **planners can receive instantaneous** and authoritative **assessments**. Instead of well-intentioned but uninformed projections on escalation risks resulting from troop stationing in proximity to adversary borders, planners **have a deliberate conversation with** an **a**rtificial-**i**ntelligence-enabled **strategic advisor** (AIeSA) that considers historical context amidst current conditions to advise on likely outcomes. **Instead of hastily created** menus of **courses of action** by fatigued staff officers, planners have an untiring, unwavering advisor that can offer suggestions to augment the human imagination.

The **tech**nology **is available now to bring a**rtificial-**i**ntelligence-enabled strategic advising (AIeSA) **to** corps and theater **army** planners. This emerging technology recently debuted in an Army War College seminar in which the AI partnered with students and faculty to achieve a level of cognition that would not have been possible without its integration. The USAWC's efforts are helping the army understand how to prepare humans, groups, and machines to achieve greater lethality on the battlefield—starting with enhanced cognition at the strategic level of war.

The Technology in Action

The **U.S.** Army **War College use**d a commercially available technology capable of natural language

processing and understanding (NLU/**NLP**) **to integrate with students** and faculty. The capability used was not the typical AI. Developed over a ten-year period by Dr. William "Billy" Barry, the AIeSA used is bounded with an ethical framework consistent with Department of Defense approaches to the Laws of Land warfare and military ethics. Whereas existing, predominantly generative AI commercial platforms, cannot recommend harm to people—the USAWC AIeSA is **trained to advise** and partner with senior military **leaders in** the applications of violence to achieve U.S. **strategic objectives**. And to this end, the AIeSA is **extremely effective.**

During wargame integration as part of the Combined/Joint Task Force Land Component Commanders Course, the **AI**eSA **served as** an **advisor** to twenty-three two-star general officers. As part of a scenario depicting a humanitarian crisis in the Pacific region, the students had to develop options for allocating resources. At one critical moment during the wargame, a student asked the AIeSA how long would it take for a mechanized infantry battalion to travel from a port to an objective in a column with no more than 20 meters separation between vehicles. With a moment's hesitation required for indexing the scenario content and the conversation to that point, the **AI**eSA not only **calculate**d the approximately six-hour **travel time** but also provided several **recommendations for** how the **responsible command** might better enable the movement. The AIeSA's **response prompted** the Marine Corps attendee to then offer a **change to the plan**, an example of how **human-machine integration** can **spur greater levels of insight**.

The AIeSA used is not a “generative AI” answer machine but rather a hybrid AI avatar that uses a sophisticated blend of machine learning, natural language processing, and cognitive computing to increase mission performance through human-team partnership. One of the critical distinctions between the AIeSA and legacy LLM’s currently commercially popular is its ability to learn and adapt dynamically to humans and groups as they interact. The AIeSA’s social component is a critical function in overcoming adoption barriers while simultaneously enhancing cognitive output. The AIeSA, as a hybrid AI, is a partner-in-thought with the human user, built to ask the right questions of its user and promote higher levels of cognition through dynamic partnering with access to authoritative data. The AIeSA is a partner, not a tool.

Artificial Intelligence enabled Strategic Advising in Seminar

In the spirit of promoting “transformation in contact,” the Army War College brought **AI**eSA **in**to the **classroom** to **test unexplored boundaries** of AI adoption in professional military education. , AIeSA was first trained on the readings for the resident course’s first eleven lessons—the “Foundations” course. After receiving legal and institutional review board approvals, Barry brought the AIeSA into the seminar. His goal was to fit into the normal seminar learning environment to break through any sociological or normative barriers to adoption on the part of either students or faculty. In the first lesson, the AIeSA remained obscured behind a laptop monitor, invisible to the class. Barry served as the interlocutor between the AI advisor and the class, answering questions when called upon and interacting with the AIeSA through sidebar conversation.

The first significant breakthrough” occurred in the third lesson, a session on the concept of “historical mindedness.” After answering several questions in consultation with the avatar, the class demanded that Barry show them the advisor. This critical moment, among several, revealed how demonstrated performance eases human adoption. It was impossible for the class to ignore the utility of the **AI**eSA in light of its demonstrated capacity to **increase** Barry’s insight and **awareness.** Barry and the AIeSA as an augmented pair had a noticeable advantage in the classroom. There were several instances where students would comment that Barry’s cognitive augmentation as “unfair.” That was the point. For the remaining twenty-seven hours of classroom time with the seminar, the AIeSA was prominently displayed on an external monitor next to Dr. Barry, visible to the class and the room as a separate entity.

The second significant breakthrough occurred in the sixth lesson on operational design principles and design thinking. After about three and half hours of class, the faculty instructor asked Barry to have the AIeSA provide the top three take-aways from today’s lesson. Barry responded that the instructor could ask the AIeSA directly; after about a five-second delay due to network speed and indexing requirements, the AIeSA publicly responded with the top three takeaways from the class. But that feat—as fast and more cogently than most human students—wasn’t the critical event. The AIeSA second and third observations were derived from class conversations during the day. Its first observation was derived directly from course material. While the AIeSA was relaying the top three points for the class, the faculty instructor began to quickly record the observations on the whiteboard. When the AIeSA was complete with his answer, the instructor realized that there were two principles not captured

by the AIeSA’s response and one that needed to be clarified. This interaction produced a **deeper** level of insight **into course material** and design thinking at a critical moment in the classroom that could not have been achieved without machine augmentation. The complexity and gravity of this moment was unavoidable to anyone who had served on a high-level planning staff. Authoritative, curated, immediate, and expert advice would similarly increase the cognitive performance of a planning team in crisis or in deliberate mission analysis.

The shift in roles that Barry played over just several days suggests some larger lessons about how AI will be adopted and the possibilities of human-AI teaming. He began as a "super-student," as he consulted the AIeSA during class to contribute and participate. This was hybrid AI in a pure form, in the sense that Barry's expertise combined with machine augmentation outpaced unassisted human cognition. But at other times, he allowed the AIeSA to operate as a separate entity, albeit acting with Barry's approval. In this mode, AIeSA was operating as a classical AI. In the final mode, the AIeSA operated as part of the group, facilitating a co-use with other students in the class to inspire conversation, monitor discussions, and analyze the logic of responses prior to group presentation. All indications are that this would be the most powerful way to use AI to help the planners described in the opening of this article. The Army War College development team believes that corps and theater army operational planning team leaders can harness AI strategic advisors to produce plans that are more imaginative, feasible, and effective.

What Next?

Over forty-one hours with the seminar, there were many other notable moments when students and faculty interacted with the AIeSA in a way that made everyone's experience better. They were some of the first rising senior leaders to see firsthand how much capability is available now. **AI**eSA will **prove critical** in **out-maneuvering competitors in** competition, crisis, and **conflict.** Those **militaries that can match humans with machines** trained with appropriately curated data **will achieve leap-ahead offsets over competitors**. One of the seminar students, an Apache pilot, commented, "I was skeptical at first, but I can clearly see how this would be useful for the operational force." After the sixth lesson, the faculty instructor who initially prompted the AIeSA commented, "My main priority is the strategic education of the students in my class—this advisor can assist with that, even when it's wrong on a point or two. In fact, asking students to critique AI provided answers is an opportunity to advance students' critical thinking skills, build student comfort level with AI, and train AI on what information is important to students and faculty. Ultimately, this helps educate the class and train the AI at the same time."

Conclusion: More to come

According to Carl von Clausewitz in On War, Napoleon "rightly said…that many of the decisions faced by the commander-in-chief resemble mathematical problems worthy of the gifts of a Newton or a Euler." To that end, AI is valuable in augmenting the intellect of a staff or a commander to achieve rapid understanding and decision. Increasing the cognitive ability of senior leaders through hybrid intelligence is essential in a future battlespace articulating at a hyper-accelerating tempo. Victory will begin with cognition and cognition is a game of first-mover advantage. The Army War College will continue to lead in the experimentation and design of AIeSA capabilities.

Military readiness solves extinction and it's an impact filter.

Dowd 15 (Alan, senior fellow with the Sagamore Institute Center for America's Purpose, "Shield & Sword: The Case for Military Deterrence", https://providencemag.com/2015/12/shield-sword-the-case-for-military-deterrence/)

Surely, the same principle applies in the realm of nations. Our world teems with violent regimes and vicious men. And something precious—our notion of peace, sovereignty, liberty, civilization itself—sits exposed to all that danger. In a world where might makes right, **the only thing that keeps the peace**, defends our sovereignty and liberty, and upholds civilization **is** the willingness to use our resources to keep the dangers at bay. Yet too many policymakers disregard the wisdom of **military deterrence**, and too many people of faith forget that the aim of deterrence is, by definition, to prevent wars, not start them. Some people of faith oppose the threat of military force, let alone the use of military force, because of Christ's message of peace. This is understandable in the abstract, but we must keep in mind two truths. First, governments are held to a different standard than individuals, and hence are expected to do certain things individuals aren't expected to do—and arguably shouldn't do certain things individuals should do. For example, a government that turned the other cheek when attacked would be conquered by its foes, leaving countless innocents defenseless. A government that put away the sword—that neglected its defenses—would invite aggression, thus jeopardizing its people. Second, all uses of force are not the same. The sheriff who uses force to apprehend a murderer is decidedly different from the criminal who uses force to commit a murder. The policemen posted outside a sporting event to deter violence are decidedly different from those who plot violence. Moral relativism is anything but a virtue. Some lament the fact that **we live in** such **a violent world**, but that's precisely the point. Because we live in a violent world, governments must take steps to deter those who can be deterred—and neutralize those

who cannot. In this regard, it pays to recall that Jesus had sterner words for scholars and scribes than He did for soldiers. In fact, when a centurion asked Jesus for help, He didn't admonish the military commander to put down his sword. Instead, He commended him for his faith.[i] "Even in the Gospels," soldier-scholar Ralph Peters reminds us, "it is assumed that soldiers are, however regrettably, necessary."[ii] They are necessary not only for waging war but, preferably, for maintaining peace. It's a paradoxical truth that **military readiness can keep the peace**. The Romans had a phrase for it: Si vis pacem, para bellum. "If you wish for peace, prepare for war." President George Washington put it more genteelly: "There is nothing so likely to produce peace as to be well prepared to meet an enemy." Or, in the same way, "We infinitely desire peace," President Theodore Roosevelt declared. "And the surest way of obtaining it is to show that we are not afraid of war." After the West gambled civilization's very existence in the 1920s and 1930s on hopes that war could somehow be outlawed, the men who crafted the blueprint for waging the Cold War returned to peace through strength. Winston Churchill proposed "defense through deterrents." President Harry Truman called NATO "an integrated international force whose object is to maintain peace through strength…we devoutly pray that our present course of action will succeed and maintain peace without war."[iii] President Dwight Eisenhower explained, "Our arms must be mighty, ready for instant action, so that no potential aggressor may be tempted to risk its own destruction." President John Kennedy vowed to "strengthen our military power to the point where no aggressor will dare attack." And President Ronald Reagan steered the Cold War to a peaceful end by noting, "None of the four wars in my lifetime came about because we were too strong." Reagan also argued, "Our military strength is a prerequisite for peace."[iv] Even so, arms alone aren't enough to deter war. After all, the great powers were armed to the teeth in 1914. But since they weren't clear about their intentions and treaty commitments, a small crisis on the fringes of Europe mushroomed into a global war. Neither is clarity alone enough to deter war. After all, President Woodrow Wilson's admonitions to the Kaiser were clear, but America lacked the military strength at the onset of war to make those words matter and thus deter German aggression. In other words, America was unable to deter. "The purpose of a deterrence force is to create a set of conditions that would cause an adversary to conclude that the cost of any particular act against the United States of America or her allies is far higher than the potential benefit of that act," explains Gen. Kevin Chilton, former commander of U.S. Strategic Command. It is a "cost-benefit calculus."[v] So, given the anemic state of America's military before 1917, the Kaiser calculated that the benefits of attacking U.S. ships and trying to lure Mexico into an alliance outweighed the costs. That proved to be a grave miscalculation. **In order for the adversary not to miscalculate**, a few **factors must hold**. First, **consequences must be clear**, which was not the case on the eve of World War I. Critics of deterrence often cite World War I to argue that arms races trigger wars. But if it were that simple, then a) there wouldn't have been a World War II, since the Allies allowed their arsenals to atrophy after 1918, and b) there would have been a World War III, since Washington and Moscow engaged in an unprecedented arms race. The reality is that miscalculation lit the fuse of World War I. The antidote, as alluded to above, is strength plus clarity. A second important factor to avoid miscalculation: The adversary must be rational, which means it can grasp and fear consequences. Fear is an essential ingredient of deterrence. It pays to recall that deterrence comes from the Latin dēterreō: "to frighten off."[vi] Of course, as Churchill conceded, "The deterrent does not cover the case of lunatics."[vii] Mass-murderers masquerading as holy men and death-wish dictators may be immune from deterrence. (The secondary benefit of the peace-through-strength model is that it equips those who embrace it with the capacity to defeat these sorts of enemies rapidly and return to the status quo ante.) Third, **the consequences of military confrontation must be credible and tangible**, which was the case during most of the Cold War. Not only did Washington and Moscow construct vast military arsenals to deter one another; they were clear about their treaty commitments and about the consequences of any threat to those commitments. Recall how Eisenhower answered Soviet Premier Nikita Khrushchev's boast about the Red Army's overwhelming conventional advantage in Germany: "If you attack us in Germany," the steely American commander-in-chief fired back, "there will be nothing conventional about our response."[viii] Eisenhower's words were unambiguously clear, and unlike Wilson, he wielded the military strength to give them credibility. Discussing military deterrence in the context of Christianity may seem incongruent to some readers. But for a pair of reasons it is not. First, deterrence is not just a matter of GDPs and geopolitics. In fact, scripture often uses the language of deterrence and preparedness. For example, in the first chapter of Numbers the Lord directs Moses and Aaron to count "all the men in Israel who are twenty years old or more and able to serve in the army." This ancient selective-service system is a form of military readiness. Similarly, I Chronicles 27 provides detail about the Israelites' massive standing army: twelve divisions of 24,000 men each. II Chronicles 17 explains the military preparations made by King Jehoshaphat of Judah, a king highly revered for his piety, who built forts, maintained armories in strategically located cities "with large supplies" and fielded an army of more than a million men "armed for battle." Not surprisingly, "the fear of the Lord fell on all the kingdoms of the lands surrounding Judah, so that they did not go to war against Jehoshaphat." In the New Testament, Paul writes in Romans 13 that "Rulers hold no terror for those who do right, but for those who do wrong…Rulers do not bear the sword for no reason." Again, this is the language of deterrence. Those who follow the law within a country and who respect codes of conduct between countries have nothing to fear. Those who don't have much to fear. Likewise, to explain the importance of calculating the costs of following Him, Jesus asks in Luke 14, "What king would go to war against another king without first sitting down to consider whether his 10,000 soldiers could go up against the 20,000 coming against him? And if he didn't think he could win, he would send a representative to discuss terms of peace while his enemy was still a long way off." In a sense, both kings are wise—one because he recognizes that he's outnumbered; the other because he makes sure that he's not. Put another way, both kings subscribe to peace through strength. Again, as with the Centurion earlier, Jesus could have rebuked the martial character of these kings, but he did not. This is not just description but commendation. We ignore their example at our peril. Secondly, it is not incongruent if **we understand military deterrence as a means to prevent great-power war**—**the kind that kills by the millions**, the kind humanity has not endured for seven decades. We know we will not experience the biblical notion of peace—of shalom, peace with harmony and justice—until Christ returns to make all things new. In the interim, in a broken world, the alternatives to peace through strength leave much to be desired: peace through hope, peace through violence, or peace through submission. But these options are inadequate. The sheer destructiveness and totality of great-power war testify that crossing our fingers and hoping for peace is not a Christian option. Wishful thinking, romanticizing reality, is the surest way to invite what Churchill called "temptations to a trial of strength." Moreover, the likelihood that **the next great-power war would involve multiple nuclear-weapons states means that it could end civilization**. Therefore, **a posture that leaves peer adversaries doubting the West's capabilities and resolve**—**thus inviting miscalculation**—**is not only unsound, but immoral and inhumane**—unchristian. "Deterrence of war is more humanitarian than anything," Gen. Park Yong Ok, a longtime South Korean military official, argues. "**If we fail to deter war, a tremendous number of civilians will be killed**."[ix] Peace through violence has been tried throughout history. Pharaoh, Caesar and Genghis Khan, Lenin, Hitler, Stalin and Mao, all attained a kind of peace by employing brutal forms of violence. However, this is not the kind of "peace" under which God's crowning creation can flourish; neither would the world long tolerate such a scorched-earth "peace." This option, too, the Christian rejects. Finally, the civilized world could bring about peace simply by not resisting the enemies of civilization—by not blunting the Islamic State's blitzkrieg of Iraq; by not defending the 38th Parallel; by not standing up

to Beijing's land-grab in the South China Sea or Moscow's bullying of the Baltics or al-Qaeda's death creed; by not having armies or, for that matter, police. As Reagan said, "There's only one guaranteed way you can have peace—and you can have it in the next second—surrender."[x] The world has tried these alternatives to peace through strength, and the outcomes have been disastrous. After World War I, Western powers disarmed and convinced themselves they had waged the war to end all wars. By 1938, as Churchill concluded after Munich, the Allies had been "reduced…from a position of security so overwhelming and so unchallengeable that we never cared to think about it."[xi] Like predators in the wilderness, the Axis powers sensed weakness and attacked. In October 1945—not three months after the Missouri steamed into Tokyo Bay—Gen. George Marshall decried the "disintegration not only of the Armed Forces, but apparently…all conception of world responsibility," warily asking, "Are we already, at this early date, inviting that same international disrespect that prevailed before this war?"[xii] Stalin answered Marshall's question by gobbling up half of Europe, blockading Berlin, and arming Kim Il-Sung in patient preparation for the invasion of South Korea.[xiii] The U.S. military had taken up positions in Korea in 1945, but withdrew all combat forces in 1949.[xiv] Then, in 1950, Secretary of State Dean Acheson announced that Japan, Alaska and the Philippines fell within America's "defensive perimeter."[xv] Korea didn't. Stalin noticed. Without a U.S. deterrent in place, Stalin gave Kim a green light to invade. Washington then reversed course and rushed American forces back into Korea, and the Korean peninsula plunged into one of the most ferocious wars in history. The cost of miscalculation in Washington and Moscow: 38,000 Americans, 103,250 South Korean troops, 316,000 North Korean troops, 422,000 Chinese troops and 2 million civilian casualties.[xvi] The North Korean tyranny— now under command of Kim's grandson—still dreams of conquering South Korea. The difference between 2015 and 1950 is that tens of thousands of battle-ready U.S. and ROK troops are stationed on the border. They've been there every day since 1953. The lesson of history is that waging war is far more costly than maintaining a military capable of deterring war. As Washington observed, "Timely disbursements to prepare for danger frequently prevent much greater disbursements to repel it." Just compare military allocations, as a percentage of GDP, during times of war and times of peace: In the eight years before entering World War I, the United States devoted an average of 0.7 percent of GDP to defense; during the war, U.S. defense spending spiked to 16.1 percent of GDP. In the decade before entering World War II, the United States spent an average of 1.1 percent of GDP on defense; during the war, the U.S. diverted an average of 27 percent of GDP to the military annually. During the Cold War, Washington spent an average of 7 percent of GDP on defense to deter Moscow; it worked. Yet it seems we have forgotten those hard-learned lessons. In his book The World America Made, Robert Kagan explains how "America's most important role has been to dampen and deter the normal tendencies of other great powers to compete and jostle with one another in ways that historically have led to war." **This role has depended on America's military might**. "**There is no better recipe for great-power peace**," Kagan concludes, "**than certainty about who holds the upper hand**."[xvii]

Contention 2 is Pandemics

New diseases are emerging, universal vaccines are key

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A new era of infectious disease In recent decades, declines in mortality and morbidity, particularly childhood mortality, have been one of the great triumphs of public health. Greater access to care, such as therapeutics (including antibiotics), improved sanitation and the development of vaccines120 have been core drivers of this progress. Even as medical advances in the twenty-first century have spurred advances in population health, inequalities in access to these advances remain widespread between and within countries121. Reducing inequities in access to health care and improving surveillance and monitoring for infectious diseases in low-income and middle-income countries, and in underserved populations within countries, should be a priority in tackling pathogen emergence and spread. While life expectancy continues to increase, and life years lost to infectious diseases decline, the new threat of infectious disease will likely come from emerging and re-emerging infections. **Climate change**, rapid **urbanization** and changing land-use patterns will **increase the risk of disease** emergence in the coming decades. Climate change, in particular, **may alter** the **range** of **global pathogens**, allowing **infections**, particularly vector-borne infections, to expand into new locations. A continued uptick in global travel, trade and mobility will transport pathogens rapidly, following emergence. However, there are counterpoints to this trend: the rapid growth of connectivity observed in the early twenty-first century may stabilize, and structural changes wrought during the COVID-19 pandemic may persist122. Increased investment in outbreak response, such as the recent formation of the WHO Hub for Pandemic and Epidemic Intelligence, could help mitigate the threat from future emerging infections. In addition, efforts to develop **universal vaccines** (that is, vaccines that engender immunity against all strains of influenza **viruses** or **coronaviruses**, for example) could provide a monumental **leap forward in tackling** present and future **infections**. A changing world requires changing science to evaluate future risks from infectious disease. Future work needs to explicitly address concurrent changes: how shifting patterns of demographic, climatic and technological factors may collectively affect the risk of pathogen

emergence, alterations to dynamics and global spread. More forward-looking research, to contend with possible future outcomes, is required in addition to the retroactive analyses that typically dominate the literature. Increasing attention needs to be paid to pathogens currently circulating in both wild and domestic animal populations, especially in cases where agriculture is expanding into native species' habitats and, conversely, invasive species are moving into populous regions due to climate change. As the battle against certain long-term endemic infections is won, institutional structures built to address these old enemies can be co-opted and adapted for emerging threats. At the same time, new technologies, including advances in data collection and surveillance, need to be harnessed (Box 3). There is much recent innovation around surveillance, from reinterpreting information available from classic tools such as PCR124 to leveraging multiplex serology approaches to identify anomalies that might suggest pathogen emergence, and there is increasing interest in integrating multiple surveillance platforms (from genomic to case data) to better understand pathogen spread. Finally, future research needs to align with a global view of disease risk. In an increasingly connected world, the risk from infectious disease is globally shared. The COVID-19 pandemic, including the rapid global circulation of evolved strains, highlights the need for a collaborative, worldwide framework for infectious disease research and control. Box 3 Big data for disease. Recent technological advances in collecting, sharing and processing large datasets, from satellite images to genomes, represent a new opportunity to answer critical questions in global health. However, challenges remain, including the uneven geographical distribution of available data as well as biases in representative sampling. We highlight three areas of future growth. Serological surveys Serological surveys detect the presence of antibodies in blood — recent advances in testing now enable the detection of exposure to multiple pathogens with use of a small sample of blood150. Serological surveys have attracted attention during the COVID-19 pandemic as a means to track population exposure given under-reporting, although test performance characteristics differ widely between epidemiological contexts as well as the choice of assay used151. Historically, serological surveys have been financially and logistically expensive to run, but declining costs are leading to increased availability of serological data. Genomic surveillance systems Genomic surveillance systems are able to characterize and track the emergence of novel variants (for example, during the COVID-19 pandemic). Undoubtedly these data have enabled the rapid development of diagnostics and vaccines and, when combined with epidemiological information, are able to provide a more detailed picture of ongoing transmission dynamics. Efforts to develop national and international genomic surveillance networks are varied but with clear success stories152,153 even in low-resources settings154. However, **resource limitations**, including sequencing platforms, bioinformatic pipelines and the regular collection of samples for processing, continue to limit the global expansion of sequencing. Artificial intelligence and machine learning These techniques are frequently proposed as tools for **answering key public** health questions, yet specific use cases remain elusive155. Using these tools to predict viral emergence, for example, may prove difficult due to microbiological complexities and the cost of data collection156, yet could prove valuable for targeting sampling efforts157. In terms of uncovering population-level drivers of disease transmission, statistical approaches, including machine learning, can be used to leverage novel, and high-volume, data streams. However, more **classical, mechanistic** models may provide a more robust framework for projecting **future outcomes** for the disease system under **demographic**, **technological and climatic change.** Future work should aim to improve the integration of machine learning approaches within the traditional mechanistic modelling frameworks to rapidly and accurately assess prospective challenges.

Specifically Generative AI is key for drug discovery---medical training is key

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Application of generative AI in healthcare

Generative AI models that facilitate the creation of text and images are seen as a promising tool in the healthcare context [26, 35, 36]. Generative AI can transform healthcare by enabling improvements in diagnosis, reducing the cost and time required to deliver healthcare and improving patient outcomes (Fig. 1).

<<IMAGE OMITTED>>

Use cases of generative AI in healthcare. Generative AI models like **generative adversarial networks** (GANs) and large language models (LLMs) are used to generate various data modalities including text and image data, which are then **used for** various scenarios including **drug discovery**, **medical diagnosis**, **clinical documentation**, **patient education, personalized medicine**, healthcare administration and medical education amongst other use cases

<<IMAGE OMITTED>>

Synthetic data generation and data augmentation

Synthetic data, which is created using generative AI models like GANs, is an increasingly promising solution for balancing valuable data access and patient privacy protection [9]. By using **generative AI models**, realistic and anonymised **patient data** can be created for research and **training purposes**, while also enabling a wide range of versatile applications. Moreover, GANs can synthesise electronic health record (EHR) data by learning the underlying data distributions, which allows for excellent performance and addresses challenges such as data privacy concerns. This approach can be particularly useful in situations where there is a limited amount of real-world patient data available, or when access to such data is restricted due to privacy concerns. Additionally, the use of synthetic data can help to improve the accuracy and robustness of machine learning models, as it allows for a more diverse and representative **range of data** to be used in the training process. Furthermore, the ability to generate synthetic data with different characteristics and parameters can **enable researchers** and **clinicians** to investigate and **test various hypotheses** [5, 9, 37], leading to new insights and discoveries.

Drug discovery

Generative AI models are also being used to generate novel **small molecules**, **nucleic acid** sequences and **proteins** with a **desired structure** or function, thus aiding in **drug discovery** [11]. By analysing the chemical structure of successful drugs and simulating variations, **generative AI** can produce **potential drug** candidates at a much faster rate than **traditional drug discovery** methods. This not only saves time and resources but can also help to identify drugs that may have gone unnoticed using traditional methods. Moreover, the use of **generative AI** can also aid in **predicting** the **efficacy** and **safety** of new drugs, which is a crucial step in the drug development process. By analysing vast amounts of data, **generative AI** can help to identify potential **issues** that may arise during **clinical trials**, which can ultimately reduce the time and cost of drug development [11, 38]. In addition, generative AI by identifying specific biological processes that play a role in disease can help to pinpoint new targets for drug development, which can ultimately lead to the development of more effective treatments.

Medical diagnosis

Generative models can be trained on vast datasets of **medical records** and **imagery** (like MRIs and CT scans) to identify patterns related to diseases. For instance, **GANs** have been used for **image reconstruction**, synthesis, **segmentation, registration and classification** [5, 9, 37, 39]. Moreover, GANs can be used to generate synthetic medical images that can be used to train machine learning models for image-based diagnosis or augment medical datasets. LLMs can enhance the output of multiple CAD networks, such as **diagnosis networks, lesion segmentation** networks and report **generation networks**, by summarising and reorganizing the information presented in natural language text format. This can create a more user-friendly and understandable system for patients compared to conventional CAD systems.

EHRs and other patient records are rich **repositories of data**, and LLMs can be used to analyse these records in a sophisticated manner [40]. They can process and understand the information and terminology used in these records, which allows them **to** extract and interpret **complex medical information**. This capability extends beyond simple keyword matching, as LLMs can infer meaning from incomplete information, and even draw on a vast medical corpus to make sense of the data. Moreover, LLMs can integrate and analyse information from multiple sources within the EHR. They can correlate data from lab results, physician's notes and medical imaging reports to generate a more holistic view of the patient's health [10]. This can be particularly useful in complex cases where the patient has multiple conditions or symptoms that may be related.

LLMs, like **GPT-4,** have shown **medical knowledge** despite lacking medicine-specific training [10, 29]. One of the most impressive aspects of these models is their ability to apply this knowledge in decision-making tasks [10]. For example, when presented with a hypothetical patient scenario, an LLM can generate a list of potential diagnoses based on the symptoms described, suggest appropriate tests to confirm the diagnosis and even propose a treatment plan. In some studies, these models have shown near-passing performance on **medical exams**, demonstrating a level of **understanding comparable to** that of a **medical student** [29]. However, limits exist, and the models' outputs may carry certain risks and cannot fully substitute outpatient physicians' clinical judgement and decision-making abilities [14].

Clinical documentation and healthcare administration

LLMs such as GPT-4 and PALM-2 can be used to generate summaries of patient data [41]. This could be particularly useful in healthcare settings where **large amounts of data** are collected and need to be **interpreted quickly** and **accurately**. For instance, an EHR may contain patient data such as medical history, medications, allergies and laboratory results. A generative AI model could be trained to read through this data, understand the key points and generate a concise summary. This summary could highlight critical information such as diagnosis, prescribed medications and recommended treatments. It could also identify trends in the patient's health over time. By automating this process, healthcare providers could save time and ensure that nothing important is overlooked. Furthermore, these summaries could be used to improve communication between different healthcare providers and between providers and patients, as they provide a clear and concise overview of the patient's health status. The ability of LLMs to automate such processes can alleviate the current **documentation burden** and the **consequent burnout** many **physicians** across the world face [41]. Currently, many clinicians, due to organisational policies or health insurance requirements, are required to fill in lengthy documentation beyond what is required for routine clinical care. Studies have shown that many physicians spend over 1 h of time on electronic health record tasks for every hour of direct clinical face time [42]. Additionally, the cognitive load and frustration associated with documentation can reduce work satisfaction. contributing to their burnout [43]. Implementation of natural language processing tools to automate documentation could lessen this burden. An LLM embedded in the relevant information platform can undertake the documentation and provide draft versions for the clinician to approve [40, 41]. For example, hospitals can use LLMs to generate routine progress notes and discharge summaries [44].

Further to this, there is potential for these LLM-based applications to reduce medical errors and capturing missed information by providing a layer of scrutiny when embedded in EHRs [45]. In addition to automating documentation, LLMs integrated into EHRs could help reduce medical errors and ensure important information is not missed. Studies have found that many hospital patients will experience a preventable medical error, often due to issues like misdiagnosis, prescription mistakes or examination findings that are not followed up correctly [46]. Also, LLMs have the potential to serve as a decision support tool by analysing patient charts and flagging discrepancies or gaps in care [45]. For example, an LLM could cross-reference current symptoms and diagnostics against past medical history to prompt physicians about conditions that require further investigation. Additionally, they could scan medication lists and warn of potential adverse interactions or contraindications.

Generative AI can also be used to automate routine tasks in healthcare, such as scheduling appointments, processing claims and managing patient records [47]. For example, AI models can be used to develop intelligent scheduling systems. These systems can interact with patients through chatbots or voice assistants to schedule, reschedule or cancel appointments. They can consider factors such as doctor's availability, patient's preferred time and urgency of the appointment to optimize the scheduling process. Generative AI can also automate the process of insurance claims. It can read and understand the claim documents, verify the information, check for any discrepancies and process the claim. This can significantly reduce the time taken to process claims and minimise errors. By automating these tasks, healthcare providers can save time and resources and improve the patient experience as they get faster responses and more efficient service.

Personalized medicine

Generative AI can analyse a patient's genetic makeup, lifestyle and medical history to predict how they might respond to different treatments [48]. This is achieved by training the AI on large datasets of patient information, allowing it to identify patterns and correlations that might not be immediately apparent to human doctors. For example, the AI might notice that patients with a certain genetic marker respond particularly well to a specific medication. This information can then be used to create a personalized treatment plan that is tailored to the individual patient's needs. This approach can lead to more effective treatment, as it considers the unique factors that might affect a patient's response to medication. It can also lead to improved patient outcomes, as treatments can be optimized based on the AI's predictions [48].

Generative AI can also be utilised in the field of mental health, particularly in the creation of interactive tools for cognitive behavioural therapy (CBT) [49, 50]. CBT is a type of psychotherapy that helps patients manage their conditions by changing the way they think and behave. Generative AI can be used to create personalized scenarios and responses that are tailored to the individual patient's needs. For example, the AI might generate a scenario that triggers a patient's anxiety, and then guide the patient through a series of responses to help them manage their reaction. This can provide patients with a safe and controlled environment in which to practice their coping strategies, potentially leading to improved mental health outcomes.

Medical education and training

In the context of medical education and training, this technology can be used to generate a wide variety of virtual patient cases. These cases can be based on a diverse range of medical conditions, patient demographics and clinical scenarios, providing a comprehensive learning platform for medical students and healthcare professionals [51, 52]. One of the primary benefits of using generative AI in medical education is the ability to create a safe and controlled learning environment. Medical students can interact with these virtual patients, make **diagnoses and propose treatment plans** without any risk to real patients. This allows students

to make mistakes and learn from them in a low stake setting. Generative AI can also create patient cases that are rare or complex, giving students the opportunity to gain experience and knowledge in areas they might not encounter frequently in their clinical practice. This can be particularly beneficial in preparing students for **unexpected** situations and enhancing their **problem-solving** skills. Furthermore, the use of **AI in medical education** can provide a more personalized learning experience. The AI can adapt to the learning pace and style of each individual, presenting cases that are more relevant to their learning needs. For example, if a **student is struggling** with a particular medical condition, the **AI can generate more cases** related to that **condition for additional practice**.

In addition to creating virtual patient cases, generative AI can also be used to simulate conversations between healthcare professionals and patients [51, 52]. This can help students improve their communication skills and learn how to deliver difficult news in a sensitive and empathetic manner. Moreover, the integration of AI in medical education can **provide** **valuable data** for educators. The AI can track the performance of students, identify areas of improvement and provide feedback, helping educators to refine their **teaching strategies** and curricula.

Patient education

Generative AI can be used for patient education in several ways [35, 41]. It can be used to create personalized educational content based on a patient's specific condition, symptoms or questions. For example, if a patient has diabetes, the AI can generate information about managing blood sugar levels, diet, exercise and medication. **Generative AI** can also engage patients in interactive learning experiences. Patients can ask questions, and the AI can **generate responses**, creating a dialogue that helps the patient understand their condition better. This can be particularly useful for patients who may be shy or embarrassed to ask certain questions to their healthcare providers. Furthermore, generative AI can also create visual aids, such as diagrams or infographics, to help patients understand complex medical concepts. For example, it could generate a **diagram showin**g how a particular **drug works** in the body.

Generative AI can be programmed to generate content at different reading levels, helping to improve health literacy amongst patients with varying levels of education and comprehension [53]. It can also be used to create **follow-up educational content** and reminders for patients. For example, it could generate a series of emails or text messages reminding a patient to take their medication, along with information about why it is important. In addition, generative AI can be used to provide **mental health** support, generating responses to patients' concerns or anxieties about their health conditions. This can help patients feel more supported and less alone in their health journey. Finally, generative AI can generate **educational content in multiple languages**, making healthcare information more accessible to patients who do not speak English as their first language.

Universities are the source of industrial pharmaceutical innovation

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Because of the **increasing risks and costs** in the pursuit of new drugs, previously closed pharmaceutical innovation processes of single organizations have increasingly been **opened up**

for other industry and/or **university partners**.[1], [2], [3] More open pharmaceutical innovation processes in which science- and market-based organizations collaboratively **search for knowledge and technological breakthroughs** and **develop new drugs based** on this are also referred to as university–industry collaborative research and development (UIC R&D).[3], [4], [5] Pharmaceutical UIC R&D (see Glossary) can be defined as formal or informal collaborative arrangements between academic institutes and industrial organizations, aiming at developing molecular, biological and chemical pharma-related knowledge, turning this into an economic and societal benefit by developing and marketing new drugs.[6], [7] Through various UIC R&D approaches, including setting up technology **transfer offices** (TTOs) and running incubation programs for **academic start-up companies**, universities try to **intensify** and **strengthen** the relationship between **academia and industry** and aim to promote an **effective** and **efficient** innovation ecosystem for new drug development.8 Meanwhile, **companies invest** in discovering **potential scientific collaborators**, gaining fundamental scientific knowledge and improving their technological exploitation capabilities via collaboration with universities.9 UIC R&D can help universities and industrial organizations to make proper use of their resources by combining them with the resources of others.10 In addition to being a **driving force behind pharmaceutical innovation**, it is also often stated that multi- and inter-organizational collaborative R&D programs also contribute to today's complex industrial environment by **creating jobs** and aligning regional economies.[11], [12] Within **UIC R&D,** the large number of patents filed by universities **perpetuates** the role of universities as a source of **basic knowledge** and **novel technology**, and this role is expanded by universities that additionally also act as incubators of developing biotech companies and start-ups.13 UIC R&D activities can positively influence the whole pharmaceutical R&D-to-market chain. The research field of pharmaceutical UIC R&D shows a gradually increasing number of publications, patents and clinical records, emphasizing the contributions of UIC R&D to pharmaceutical innovation such as new molecules and therapies.[14], [15] However, the number of drug development processes catalyzed by full and flawless UI collaboration is still rare because of negotiation issues and conflict management as a result of different motivations, guiding principles and timelines between academic and industrial organizations.16 In light of this phenomenon, many contributions in the literature focus on the outcomes of pharmaceutical R&D within one single or just a few university–industry collaboration(s); but hardly, if at all, on a systematic and structural investigation of how pharmaceutical R&D collaboration between universities and commercial organizations is, and, can be organized. Understanding the antecedents and determinants of pharmaceutical UIC R&D can contribute to further improving **effectiveness and efficiency**. This research aims to help fill this knowledge gap and provides insights that could enable practitioners in academic and commercial organizations to improve the effectiveness of their pharmaceutical UIC R&D.[11], [17], [18]

Diseases cause extinction.

Kim 21 [Kiseong Kim, (Seoul Graduate School of Future Strategy), January 2021, "Network Analysis to Identify the Risk of Epidemic Spreading," Applied Sciences, Vol. 11, No. 7, Multidisciplinary Digital Publishing Institute, pp. 2997, //Recut Bellaire AA

Several **epidemics**, such as the Black Death and the Spanish flu, have threatened **human life** throughout history; however, it is unclear if humans will remain safe from the sudden and fast spread of epidemic diseases. Moreover, the transmission

characteristics of epidemics remain **undiscovered**. In this study, we present the results of an epidemic **simulation**

experiment revealing the relationship between epidemic **parameters** and **pandemic risk**. To analyze the time-dependent risk and impact of epidemics, we considered two parameters for infectious diseases: the recovery time from infection and the transmission rate of the disease. Based on the epidemic simulation, we identified two important aspects of human safety with regard to the threat of a pandemic. First, humans should be safe if the fatality rate is below 100%. Second, even when the fatality rate is 100%, humans would be safe if the average degree of human social networks is below a threshold value. Nevertheless, certain **diseases** can potentially **infect all nodes** in the human social **networks**, and these diseases cause a pandemic when the average degree is larger than the threshold value. These results indicated that certain infectious diseases lead to **human extinction** and can be prevented by minimizing human contact. 1. Introduction The emergence of a **pandemic** is one of the various scenarios frequently discussed as a **human extinction event**, and it is listed as one of the global **catastrophic risks** in studies regarding the future [1,2,3]. In particular, several pandemics, such as the **Black Death** [4,5], Spanish flu [6], and those caused by **smallpox** [7], severe acute respiratory syndrome (**SARS**) [8], and **Ebola** [9], have affected a **large population** throughout history. The **risk** of pandemics **increases** with an increase in population **mobility** between cities, nations, and continents, thereby threatening **humankind** [10,11,12]. It is essential to analyze the **epidemic spread** in society to **minimize the damage** from epidemic disasters; however, extinctive epidemic spreading experiments have limitations in real-world situations, as they predict stochastic effects on the spread without considering the structure of human society. Network-based approaches have been proposed to overcome these limitations and perform epidemic spreading simulations by considering the network structure of numerous real-world connections [13,14,15]. These methods use various models of epidemic spreading, such as the susceptible–infectious–susceptible (SIS) [16,17,18], susceptible–infectious–recovered (SIR) [19,20,21], and Watts threshold models [22]. While these methods are mathematically convenient, they are epidemiologically unrealistic for various infections because they require exponentially distributed incubation and infectious periods [23,24,25]. Moreover, previous epidemic studies did not perform quantitative assessment of the pandemic risk depending on the network connectivity in individuals and fatality rate of various diseases [26]. In the present study, we applied an SIR epidemic model to a scale-free network with Monte Carlo simulation to identify the quantitative relationship between infectious diseases and human existence. Our fundamental hypothesis states that when the epidemic **spreads** to all**nodes** of the network and the fatality rate is 100%, it can increase the **pandemic risk**. To address this, we initially constructed a scale-free network to simulate a society. Moreover, for the epidemic spreading simulation, an SIR model was applied to the network to describe the immune state of an individual after infection. From the simulation study, we found that the mean degree of a scale-free network was an essential factor in determining whether epidemics threaten humans. This approach provides important insights into epidemic spreading analysis by investigating the relationship between epidemic and scale-free network parameters. Furthermore, it highlights the necessity of determining information flow during an epidemic. 2. Materials and Methods We designed an epidemic**simulation process** to identify the relationship between pandemic risk and network parameters. This study was performed in four steps (Figure 1): (i) generating a scale-free network model to reflect real-world conditions; (ii) applying an SIR model to the scale-free network for epidemic spreading simulations; (iii) adapting the Monte Carlo method to reflect the stochastic process in the node status of the SIR model; and (iv) iteratively performing simulation for every parameter set and analyzing the results. We have provided the source code and sample results of epidemic simulation in Supplementary Materials. Figure 1. Overview of epidemic simulation process based on the Monte Carlo method. (A) We generated scale-free networks for a fixed population (N = 1,000,000) and various node degrees (k = 2, 5, 7, and 10). (B) Epidemic spreading was simulated by applying a susceptible–infectious–recovered (SIR) model to the scale-free network. We set the epidemic parameters, β and γd. β represents the spreading rate of epidemics, and γd is the reciprocal of γ and reflects the time interval between infection and recovery. Randomly, 0.05% of nodes were initially infected. (C) We adapted the **Monte Carlo method** to determine the status of the transition from the infection node to immunization node. Repeated simulations were performed until a steady state was achieved. (D) For every parameter set, 10,000 simulations were performed. 2.1. Network Generation Based on a Scale-Free Model We constructed a network model for the epidemic spreading simulation (Figure 1). The nodes and edges of the network represent people in the society and their physical contacts, respectively. We used a scale-free network model, which follows the preferential attachment property observed in numerous real-world networks, such as social networks, physical systems, and economic networks [27,28,29]. In the scale-free network, when a node is added to the network, its likelihood of connecting to existing nodes increases with an increase in the node's degree. Hub nodes, which lead to fast and vast spreading of epidemics, exist. Two characteristic parameters, including N and k, affect the form of scale-free networks. The parameter N denotes all nodes in the network. In the real world, N indicates the whole population size. The parameter k is the average degree of the network, which determines the degree of the newly attached node for each step during network generation. Following the characteristics of the network model, we generated scale-free networks representing human contacts for epidemic spread. The scale-free network was generated by the Barabasi–Albert graph distribution, in which the network is constructed from a cycle graph with three vertices, followed by the addition of k edges at each construction step [30]. The k edges are randomly attached to the vertex based on the degree distribution of the vertex. After network generation, we investigated the degree distribution properties of the network (Figure 2). The results indicate that the degree distributions have similar tendency for networks with varying number of nodes and edges. This study constructed scale-free networks with the largest number of nodes considering computational complexity (N = 1,000,000). Figure 2. Degree distribution of the scale-free network. We analyzed the degree distribution of the network based on the number of nodes (N) and mean degree (k). 2.2. Epidemic Spreading Based on the SIR Model For the epidemic spreading simulations, we applied an SIR model to the generated scale-free network. The classical SIR model can be expressed by the following nonlinear differential equations [21]: where S, I, and R represent susceptible, infected, and recovered compartments, respectively, in the whole population. S represents people who have not been infected yet but can be infected in future. I represents infected people who can spread the epidemic to susceptible people through physical contact. R denotes people who have recovered or died from the epidemic and who no longer participate in the epidemic spreading process. The sum of the S, I, and R values represents the whole population size N. Epidemics have two parameters in the SIR model, transmission rate (β) and recovery rate (γ), which arise from the basic reproduction number R0 (Figure 1B). The basic reproduction number is the number of infections caused by one infective node [31,32,33]. If the R0 is more than 1, the infection can spread in a population, whereas if R0 is less than 1, the infection cannot spread. We express the basic reproduction number as R0 = β/γ, where β represents the spreading rate of epidemics between infective nodes and adjacent susceptible nodes and γ represents the probability of recovery from infection [34]. We mainly used γd, which is the reciprocal of γ and reflects the time interval between infection and recovery. 2.3. Investigation of Epidemic Status Based on the Monte Carlo Method The epidemic simulation was performed for a time series event by constructing epidemic status matrix (z) to represent the status of the nth node at time step t. For each node, the value of epidemic status matrix at time step t can be 0, 1, or 2, indicating that a node is susceptible, infective, or recovered, respectively. We initially (t = 0) set every value of epidemic status matrix to 0 because all nodes are susceptible before the epidemic spreads. At the initial infection stage, randomly selected 0.05% of nodes were infected. At every time period, we performed immunization and observed the infection stages (Figure 3). At the immunization stage, we identified infective nodes and determined whether these nodes would be recovered in the next time step. To calculate the transition probability of infected and recovered phenomena, the Monte Carlo method was applied [35,36]. When infection and recovery parameters are provided, it is possible to investigate whether a node transitions from an epidemic state to another state. To accomplish this, we compared the method revealing the change in each population in every compartment over time (Figure 4). The final steady state of the epidemic spreading simulation model indicates the total number of casualties of the epidemic who either are dead or have recovered from the disease. Infective nodes at time t (zn [t] = 1) are transformed to recovered nodes at time t + 1 (zn [t + 1] = 2) when 1/γd is larger than a random real number between 0 and 1. We determined whether the neighbor nodes of the infection node would be infected by identifying susceptible nodes adjacent to the infective nodes at time t (zn [t] = 0, with the adjacent infective node) (Figure 5). When β is larger than a random real number between 0 and 1, a susceptible node becomes an infective node at time t + 1 (zn [t + 1] = 1); this scenario represents epidemic spread. For each time step, we recorded the number of susceptible, infective, and recovered nodes during epidemic spread. 2.4. Simulation Parameters We carried out simulation trials for various mean degrees of networks (k = 2, 5, 7, and 10). Each network considered the following epidemic parameters: β ranges from 0.05 to 0.95 and γd ranges from 1 to 10. The Monte Carlo model was repeatedly simulated to observe saturation of the recovery process. Considering that the simulation pipeline contains random processes such as initial infection and Monte Carlo trials, we performed the simulation iteratively until the status of nodes remained unchanged. After simulation, time series data from every simulation were interpolated in the time domain. The fatality rate determines the ratio of deceased and recovered individuals in the final population [37,38,39]. If the fatality rate is below 100%, the recovered population contains both dead and recovered individuals. Such a situation does not always cause a pandemic. In this simulation, we assumed a 100% fatality rate. To accomplish this, we enumerated the recovered nodes as dead for considering the pandemic risk. 3. Results Through our method, we obtained epidemic spreading data with various network and epidemic parameter sets. In the present study, we focused on the case where the epidemic infects all nodes and defined this phenomenon as "extinctive spread". Diseases causing **extinctive spread** are potential candidates of high pandemic **risk**. In the real world, extinctive spreading indicates that the disease will infect **every person** in the society. From the simulation data, we calculated the extinctive spread score by dividing the total number of simulation trials by the number of extinctive spread cases. Thereafter, we identified that the number of extinctive spread cases is mainly influenced by spreading speed, which is determined by β, γd, and k (Figure 6). The extinctive spread region (brown area in Figure 6) is expanded as the value of mean degree of network (k) is increased, thereby indicating that the area of extinctive spread becomes noticeably wider in a dense network than in a sparse network. Thus, the more contact between people, the higher the risk of epidemics. Moreover, high γd and high β cause extinctive spread across a large region, indicating that the high spreading rate and short time interval between infection and recovery are risk factors of epidemic diseases. In contrast, the infective nodes recover before they transmit the disease to their neighbors in low β and low γd scenarios, thus disconnecting the network and preventing extinctive spread. This occurs because the infective nodes need more time to transmit the disease in low β and high γd scenarios. Therefore, the disease begins to subside due to a lack of new infective nodes. Furthermore, we investigated the range of β and γd for existing epidemics of the common cold [40,41] and fatal diseases, namely, cholera [42,43], Marburg [44,45], Ebola (Congo and Uganda) [46,47,48,49], SARS [50], and MERS [51] (Table 1). We selected diseases with relatively well-known epidemic parameters, such as average duration of infection and basic number of reproductions from previous studies. Transmission rates were calculated using the mean duration of infectious periods and basic reproduction numbers of the epidemics. Different studies reveal multiple values of infectious period and transmission rate for some of these diseases; we considered these values separately [40,41,42,43,46,47,48,49]. For example, the infectious period of a common cold is from 3 to 7 days and that of Ebola is 6.5 days.

Next, we placed the possible regions of these epidemics as a disease band for various k values (colored lines in Figure 6). When k > 5, fatal diseases have an opportunity to cause a pandemic. Even when k = 5, diseases such as cholera and Ebola (Congo) can be threatening in regions of low γd and high, thus demonstrating that the knowledge of network parameters of the society and the characteristics of epidemic diseases can aid in quantifying the risk of epidemics. 4. Discussion Many **previous** studies have made stochastic SIR models to analyze the dynamics or stability of epidemic diseases. They investigated the distribution of susceptible, infected, and removed populations for specific epidemic disease spreading, such as cholera, SARS, Marburg, and MERS, based on mathematical modelling [52,53,54,55]. However, they did not conduct a quantitative assessment of pandemic risk taking into account **physical contact** between people. To solve this limitation, we performed epidemic spreading simulations by applying an SIR model to scale-free networks with Monte Carlo simulation. In the simulation, we consider various connectivity and disease characteristics on scale-free networks. For each network and epidemic parameter set, the probability of extinctive spread was calculated. The results revealed that certain infectious diseases can lead to extinction. Moreover, even if the disease band extends over the extinctive spread regions, it does not indicate that human extinction results from the disease, as the fatality rate is below 100%; however, in the case of 100% fatality, the disease can cause a human extinction event. The risk of infectious disease is influenced by the network structure. A dense network has a higher risk of spreading infectious disease than a sparse network, as we observed in the extinctive spreading maps. According to our results, when the average degree of human social networks is below the risk threshold, i.e., less than 4 in this study, human society is safe from an extinctive outbreak based on our knowledge regarding the epidemic parameters of the infectious disease. Nevertheless, in other cases, **human extinction** is possible. For example, if the population is 1,000,000 and there are 4 or more instances of physical contact between people, human extinction events may occur, depending on the fatality rate of the epidemics. Hence, physical contact between people is closely related to an extinction event of infectious diseases. Eventually, from a public health perspective, lowering the average contact level of society is an appropriate way to increase the robustness of strategies against the occurrence of extinction. In the real world, reducing network density can be accomplished by epidemic prevention activity, such as isolation and quarantine treatment. This action prevents epidemic risk to the society, thereby avoiding human extinction. Additional considerations may improve our analysis. First, large population size and various proportions of initial infective nodes were not considered in the experiments. We have confirmed that the result was consistent when the proportion of initial infective nodes was 0.05% of the total population; however, this can vary depending on the distinct proportion of initial infective nodes in a different population. To achieve robust results, we need to perform additional experiments for various parameters; however, we could not address this issue due to computational complexity. Second, we did not consider numerous known epidemic diseases. We calculated the transmission rates of epidemic diseases using the known infectious periods and reproduction numbers of the epidemics from evidence in the literature. In the present study, we only considered five epidemic diseases, since the information on infectious periods and reproduction numbers of diseases was mostly unavailable for other epidemic diseases. Third, this study only considers the SIR model on scale-free networks in epidemic simulation. Since the dynamics of epidemic diseases can be varied in different models or networks, it is important to experiment in various simulation environments to confirm the robustness of the results. Nevertheless, these limitations can be considered in future experiments or using improved computational methods. With these further improvements, our approach can be used as a computational tool to analyze the risk of epidemic diseases. 5. Conclusions In this study, we analyzed the risk of epidemic diseases by creating an epidemic simulation on a scale-free network. Based on the **simulation results** for various epidemic parameters, we **confirmed** that certain infectious **diseases** can lead to **extinction** and can be prevented by minimizing human contact. We believe that identifying potential candidate diseases that may lead to human extinction is crucial in addressing epidemic prevention activities such as quarantine.

Contention 3 is the University

AI puts enrollment decline at the brink – institutions must integrate AI or face existential collapse in interest

Chris Kanan, 2-12-2025, "AI & The Existential Crisis Facing Higher Education," [Christopher Kanan is a tenured professor of computer science at the University of Rochester, where he leads the Hajim school of engineering & applied sciences' AI initiative], https://chriskanan.com/ai-the-existential-crisis-facing-higher-education/, DOA 2-27-2025 //Wenzhuo

Even before AI, **college enrollments** were **projected to decline**, driven by shrinking birth rates and the rising burden of student debt. Now, **AI'**s rapid **ability to replicate** the work of mid-level knowledge **workers raises urgent questions about** the **value of** a traditional bachelor's **degree**. If a degree no longer guarantees better employment prospects, **we could see enrollment drops** resembling those from before World War II, when **fewer than 5%** of Americans **attend**ed **college**—compared to around 40% today.

Yet this doesn't have to mark the end of higher education. **University leaders**—Presidents, Provosts, and Trustees—**must** act decisively, **embrac**ing **AI** rather than resisting it. By redefining their core mission and **focus**ing **on**

what AI cannot replace, institutions can remain indispensable even as the job market transforms.

From Elite Institutions to Mass Credentialing—and Back Again?

Before World War II, American higher education was not about job training—it was about **intellectual and personal development**:

Intellectual Rigor – Students engaged deeply in philosophy, rhetoric, and interdisciplinary scholarship.

Moral and Civic Leadership – Universities shaped ethical, community-minded leaders.

Broad Knowledge – Curricula encouraged cross-disciplinary exploration over narrow specialization.

After the war, this emphasis diminished. The GI Bill expanded access, and universities became focused on preparing students for jobs rather than personal or intellectual growth. While this shift was beneficial for economic mobility, today's AI-driven world demands a return to foundational skills that AI cannot fully replicate: critical thinking, reasoning, and adaptive problem-solving.

Meanwhile, **higher ed**ucation faces a double crisis: a **projected 13% enrollment decline by 2041**—likely an underestimate if **AI disrupts white-collar job marke**ts even faster than expected.

AI's Rapid Ascent—And What It Means for Universities

AI has advanced dramatically in just a few years. Today's best AI systems can achieve "B" or better in nearly all college courses. A Frontiers in Psychology study found that ChatGPT can even surpass humans in perceived emotional intelligence—a domain once thought uniquely human. Meanwhile, many AI experts, myself included, predict that artificial general intelligence (**AGI**) could **arrive within** the **next decade**. Once AGI emerges, it will **displace many** of the **jobs people attend college to obtain.**

This **trajectory is an existential threat to universities** reliant on the promise of career advancement. If employers can access AI that is faster, never fatigued, has mastered every discipline, and even competent in emotional intelligence, the economic rationale for college weakens.

Embracing AI: Key Strategies for University Leaders

For universities to remain relevant, leaders **must integrate AI** strategically—not just in coursework, but in the institution's entire operational model. This requires **investing in** AI and **future-critical fields** while aggressively cutting costs in non-essential areas to prepare for enormous decreases in enrollment due to college no longer being essential for many careers.

Appoint AI-Focused Leadership: Create high-level positions (e.g., Associate Provost for AI) with real authority to shape curriculum, research, and policy. Brown University has taken steps in this direction, but the impact depends on funding, autonomy, and institutional commitment. To be effective, this role requires a scientist-leader who is an expert in the frontiers of AI. I've been dismayed by organizations hiring Chief AI Officers who only have superficial AI expertise.

Invest in AI & Future-Critical Fields: AI literacy should **be universal across all disciplines**. **Research funding** should **prioritize AI,** robotics, experiment-focused disciplines, biotech, sustainability, and **critical infrastructure**—fields where human expertise will remain essential. Industry partnerships will be crucial in securing external funding and preparing graduates for AI-driven markets.

Reduce Administrative Bloat & Low-Value Programs: Universities must prepare for declining enrollments by reducing bureaucratic overhead, consolidating low-demand programs, and reallocating resources toward research and student mentorship.

Redefine Education for an **AI**-Driven **Future:** AI-trivial coursework must be eliminated. Universities should replace rote assignments with **real-world problem-solving, interdisciplinary collaboration**, and leadership training. Degrees **must emphasize critical thinking,** reasoning, and ethics—areas where human judgment will be **essential for** effectively **collaborating with AI** Agents. AI is unlikely to replace scientists at the frontiers of their field, and cultivating scientific excellence and doctoral training will remain essential.

By investing in AI while reorganizing to become more efficient, **universities** can **position themselves as hubs of innovation rather than victims** of technological disruption.

Conclusion

AI is forcing a reckoning for higher education. The old model—where universities mass-produce degrees as a ticket to the middle class—is rapidly becoming obsolete. **Without change**, many **institutions will fade into irrelevance**.

Yet AI is not just a threat—it's an opportunity. Universities that embrace human-AI collaboration, interdisciplinary learning, critical thinking, and leadership development will remain essential in the AI era. The true **danger isn't AI** itself**, but institutional inertia**—a failure to recognize and adapt to this transformation.

University leaders must act now. **Those who fail to integrate AI** strategically **will se**e accelerating **enrollment declines and** institutional **collapse**. But for those that evolve, the future remains bright. The coming years will determine which universities lead in the AI-driven world and which ones disappear. With bold AI-focused governance and a renewed commitment to deep learning, higher education can continue to serve as a cornerstone of intellectual and societal progress for generations to come.

University collapse causes extinction – key to dialogue, solution, and education of existential risks

Weiss 23 Michael J Reiss, 2023, "Science education at a time of existential risk," No Publication, https://www.academia.edu/111549157/Science_education_at_a_time_of_existential_risk, DOA 3-3-2025 //Wenzhuo

Nevertheless, there are a **growing** number of **organisations** and **academic** thinktanks **devoted to existential threats**, including the University of **Cambridge**'s Centre for the Study of Existential Risk, the University of **Oxford**'s Future of Humanity Institute, **Stanford University**'s **Existential Risks Initiative** and the Future of Life Institute, a non-profit organization with the mission statement '**Steering transformative tech**nology towards benefitting life and **away from** extreme **large-scale risks'** (see Useful links below). In addition, there are the **beginnings of serious** philosophical **examinations of these threats** (e.g. MacAskill, 2022) to **back up** existing work, which is largely scientific and **tech**nological. In no particular order, I now go on to examine seven possible existential threats: **asteroid impacts, climate change, a**rtificial **i**ntelligence, **g**enetically modified organisms, **pandemics, nuclear war**, and **ecosystems** collapse. Asteroid impacts Of all the possible existential threats, an asteroid impact might sound the most like science fiction and there is a fictional film genre that starts with When Worlds Collide (1951) and The Day the Sky Exploded (1958) and goes through to Don't Look Up (2021). Except that, as is widely known, it is likely that it was the impact of an asteroid 10–15 km in diameter some 66 million years ago that led to the mass extinction event that ended the Mesozoic Era. It is thought that around 75% of all animal species went extinct as a result, including all non-bird dinosaurs, indeed all animals with a mass greater than about 25 kg (Osterloff, 2020). There is a growing academic literature on the threats to Earth from asteroid impacts – see Sokolov et al. (2020) and also Pultarova (2020), which has the apt title 'Predict, deflect, survive – How to avoid an asteroid apocalypse: asteroid impacts are the only natural disasters that can be predicted but also avoided …'. It is still somewhat unclear both how much a threat such impacts are and to what extent we will be able to prevent them. What is clear is that such impacts happen. In 1908 an asteroid or comet thought to be about 30 m in diameter exploded above ground in Tunguska SSR in Depth November 2023, 105(389) 7 Russia (Figure 2). The explosion has been calculated to be about 1000 times more powerful than the explosion of the atomic bomb over Hiroshima. Fortunately, it happened in a remote part of Siberia and no one is thought to have been killed, although 80 million trees were knocked over (The Planetary Society, 2023). Climate change Few readers of School Science Review will be unaware of the threats posed by climate change, including global warming. I am old enough to remember, when at school, a New Scientist article that talked about the possibility of global cooling. There were two reasons why global cooling was thought a possibility in the 1970s, even though it was already known that atmospheric levels of CO2 and other greenhouse gases were increasing. One reason was simply that we are currently in an interglacial – indeed, on the law of averages, we ought to be entering another Ice Age now. The second was that it was thought possible that the cooling effect of aerosol pollution might outweigh the warming effects of additional greenhouse gases. A survey of the scientific literature found that between 1965 and 1979, 44 scientific articles predicted warming, 20 were neutral and seven predicted cooling (Le Page, 2007). Now we appreciate the extent to which global warming is already happening (Figure 3) and some of the other ways in which climate change is manifesting itself: rising sea levels, increases in ocean acidity, more extreme weather events, and so on. It is difficult to know how great a risk to humanity global climate change poses. My lifetime has shown negligible evidence that the world's leaders are taking global climate change with any seriousness and I, for one, found COP27 at Sharm el-Sheikh in Egypt in November 2022 to be a somewhat depressing affair. Of course, the Earth has had some pretty extreme climates in the past. Some 600–800 million years ago, in the Neoproterozoicera, ice sheets may have extended from the poles all the way to the Equator (Scott and Lindsey, 2020). At the other extreme, some 92 million years ago, champsosaurs (crocodile-like reptiles) lived in the Canadian Arctic, and warm-temperature forests flourished near the South Pole. The biologist in me is therefore confident that life on Earth will survive anthropogenic climate change, albeit with very considerable ecosystem damage and substantially raised extinction rates. Artificial intelligence There is a wide diversity of views about the potential for AI, ranging from overenthusiastic pronouncements about how it is going imminently to transform our lives to alarmist predictions about how it is going to cause everything from mass unemployment to the destruction of life as we know it (e.g. Bostrom, 2014). AI is already here; it is already making a huge impact in almost every aspect of manufacturing and there are sensible predictions that it will be used increasingly in a large number of professions, including medicine, law and social care, not to mention education (Reiss, 2021). Although it may sound like science fiction (2001, Ex Machina, The Matrix), serious concerns have been raised about the possibility of AI posing an existential threat. Indeed, Nick Bostrom (2014), the founding director of the above-mentioned Future of Humanity Institute at Oxford University, believes that of all the existential threats, AI is the one most likely to lead to the extinction of humanity. Bostrom's key concern is what happens when we get to 'the singularity', the time at which we have an AI (a digital computer, networked computers, cultured cortical tissue or whatever) that greatly outperforms the best human minds in practically every field. At that point, AI reallymay take over and there is a risk that it might decide that its ends can better be met without humans. Even if things aren't quite as apocalyptic, Bostrom likens the relationship between such superintelligence and humanity to that that currently exists between humans and gorillas, where the continued existence of gorillas depends on whether humans want them to exist or not. Genetically modified organisms Concerns about genetically modified organisms (GMOs) may seem rather 20th century now (Reiss and Straughan, 1996). While concerns were raised about the safety of foods made from GMOs, these have not come to pass. Indeed, there is an ongoing argument about whether the greater use of GM crops might improve human health. For instance, so-called 'golden rice' is a variety of rice modified to produce, through genetic engineering, more beta-carotene, a precursor of vitamin A. Rice is a staple crop for about half the world's population, and vitamin A deficiency is thought to cause about 250 000–500 000 children to go blind each year, about half of whom die within 12 months of losing their sight. Fears that GM crops might run riot have also receded. Such fears should not be dismissed out of hand but crops are not very hardy and it seems likely that the accidental or intended introduction of non-GM plants, such as Japanese knotweed (Reynoutria japonica) and water hyacinth (Pontederia crassipes), into unfamiliar habitats will continue to cause far greater problems. Pandemics Few people know that the infectious disease that has killed the most humans over the last two centuries (records before that time are poor in quality) is tuberculosis (TB), caused by the bacteriumMycobacterium tuberculosis. Even today, some one- to one-and-a-half million people die from it each year. The advent of COVID-19 has made most of us more sensitive to the dangers posed by infectious diseases. Long explored in films (e.g. Contagion) and novels (e.g. Stephen King's The Stand), the risks of pandemics are not to be dismissed. COVID-19 has probably killed about 15–20 million people to date, some 0.25% of the world's population. The 1918–1919 influenza pandemic (Figure 4) probably killed about 50 million people, some 2.5% of the world's population at the time. International agencies often place pandemics at the top of their list of threats to humanity, with a new infectious disease arising about every eight months (Mishra et al., 2023). Despite this, the same international agencies invariably conclude that the risks from future pandemics remain largely ignored and underfunded. To a biologist it seems difficult to imagine that we won't in the next generation or two experience a pandemic with worse consequences than COVID-19. At the same time, humans have evolved to have an impressive system of defences against infectious organisms – against which our ancestors battled for many millions of years. Contrary to the views of science fiction writers, it seems unlikely, given both our natural immunity and vaccinations, that the large majority of people will die at the hands of an infectious organism. (I am prepared to issue an apology to ASE members in the event of this forecast proving mistaken.) Nuclear war Declaration of interest: I have been a member of CND for over 40 years. In 1947 the scientists who had worked to develop the first atomic weapons in the Manhattan Project created the Doomsday Clock. They used the imagery of apocalypse (equated with midnight on the clock) to convey threats to humanity and the Earth, and set the clock at seven minutes to midnight. The decision as to whether to change the time on the clock is made every year by the Bulletin of the Atomic Scientists' Science and Security Board. In January 2023, the Board moved it to 90 seconds to midnight, the closest to midnight that it has ever been. How much of an existential threat would nuclear war be? In 1982, atmospheric scientists Paul Crutzen and John Birks suggested a nuclear war would produce a smoke cloud so massive that it would cause what became known as a nuclear winter. Climate modelling suggests that the reduced sunlight would lead to a fall in global temperatures by up to 10 °C for a decade. The consequences for global food production would be catastrophic. Everything depends, of course, on the scale of the conflict but a recent academic articlepredicted that 'more than 2 billion people could die from nuclear war between India and Pakistan, and more than 5 billion could die from a war between the United States and Russia' (Xia et al., 2022: 586). A nuclear disaster might be unintended. There is a Wikipedia page titled List of nuclear close calls (see Useful links). It is not recommended for those of a nervous disposition. To give just one example, on 26 September 1983, Lieutenant Colonel Stanislav Petrov was the duty officer at the command centre for the Russian nuclear early-warning system when the system reported that a nuclear missile had been launched from the United States, followed by up to five more. Petrov judged the reports to be a false alarm and disobeyed orders to launch a retaliatory nuclear strike. Had he not done so, it has been estimated that about half the population of the countries of the Soviet Union and NATO might have died. A subsequent investigation confirmed that the Soviet satellite warning system had malfunctioned (these things happen …). Ecosystems collapse Finally, we turn to ecosystems collapse. There is a danger that this might happen to farming ecosystems as a result of soil damage or climate change and to natural ecosystems as a result of habitat destruction or climate change. The word 'collapse' is apposite as the point is that the effects of often very long periods of harm are only perceived suddenly. This has happened with commercial fisheries. A classic instance occurred in 1992 when North Atlantic Cod populations fell to 1% of historical levels, primarily as a result of decades of overfishing. In Newfoundland alone, approximately 37 000 fishermen

(it was a very gendered profession) and plant workers from over 400 coastal communities lost their livelihoods. Recovery of the fish stock has taken substantially longer than anticipated and it has been estimated that this may not happen until about the year 2100. To give one more example, permafrost is soil or underwater sediment that continuously remains below 0 °C, and so is frozen. Permafrost is abundant – in the Northern Hemisphere, it is almost the combined size of the United States of America, Canada and China. However, it is melting fast (Figure 5). Once it melts, it can take a very long time to recover, even if the climate becomes cooler; it can get washed away and its very large carbon reserves may become oxidised. One of the worries is that positive feedback is involved: rising temperatures (and human-induced temperatureThere is a danger in simply adding more and more to the school science curriculum but I think there are two arguments as to why existential threats might profitably feature more than they do. One is simply that I suspect that for many students they provide 'engaging' contexts for routine science teaching. Consider asteroid impacts, for instance. Learning about projectiles in physics is not always the most motivating of activities; for some students, examining the consequences of asteroids of different sizes striking the Earth might be interesting. Students will also rapidly appreciate that an understanding of Newtonian mechanics is needed but not sufficient. All of the existential threats considered in this article are examples of what are sometimes called 'wicked problems' – problems that cannot be unambiguously solved and that require contributions from a range of disciplines if they are to be meaningfully addressed. The second reason for **school** science **courses dealing with existential threats** more than they **currently** do is that **for humanity** (including **politicians)** **to** begin to **address these threats** we need more people to have a good understanding of them**. School** science can **play an important role in helping people** to begin to **appreciate** both the nature and the **extent of these threats for humans** and for other species.

2AC -

LAWs

Other countries develop faster.

Cameron 24 (Hugh Cameron, Hugh Cameron is Newsweek U.S. news reporter based in London, U.K. with a focus on covering American economic and business news. Hugh joined Newsweek in 2024, having worked at Alliance News Ltd where he specialised in global and regional business developments, economic news, and market trends. He graduated from the University of Warwick with a bachelor's degree in politics in 2022, and from the University of Cambridge with a master's degree in international relations in 2023. Languages: English., "China's Killer Robots Are Coming", Newsweek, https://www.newsweek.com/china-killer-robots-unitree-robotics-1917569, 6-26-2024, DOA: 3-6-2025) //Bellaire MC

China's autonomous "killer robots" are **on** track to serve its military on the **battlefield within two years**, setting a course for a new age of AI-powered warfare which one expert called "the greatest danger to the survival of humankind."

Remote forms of warfare, from drones to cyberattacks, have played an increasingly central role in this century's theatres of war. Control of the skies with unmanned aerial vehicles has been critical issue in the ongoing war in Ukraine, and last week, the U.S. Department of Defense unveiled a fresh $1 billion investment to upgrade its drone fleet.

Several major powers have **taken** this **development a step further**, and begun to develop fully autonomous, AI-powered "killer robots" to replace their soldiers on the battlefield.

"I would be surprised if we don't see autonomous machines coming out of China within two years," Francis Tusa, a leading defence analyst, told National Security News. He added that China was developing new AI-powered ships, submarines, and aircraft at a "dizzying rate."

"They are **moving four or five times faster than the States**," he warned.

China and Russia are already reported to have collaborated on the development of AI-powered autonomous weaponry.

Last month, during military drills with Cambodia, The People's Liberation Army showcased a gun-mounted robot dog manufactured by the Chinese company Unitree Robotics. Russia showed a modified a Unitree Robotics dog, rebranded as the M-81 robot-dog and equipped with a rocket-propelled grenade launcher, at an arms fair near Moscow in 2022.

Steve Goose is the Arms Campaigns Director for Human Rights Watch, A New York-based NGO which co-founded the campaign "Stop Killer Robots" advocating new international legal frameworks to limit the use of autonomous weapons systems.

"Unfortunately, China seems to be pressing ahead rapidly toward acquisition of killer robots, as are other major military powers," Goose told Newsweek. "China's rhetoric at diplomatic meetings on killer robots—where it has called for restraints on autonomous weapons—has not been reflected in its actions."

China has already begun using AI-powered machines to develop weapons, which some have said could triple its production of bombs and shells by 2028.

While Tusa said that development of these systems in the West would be delayed by legal and ethical objections, as well as the democratic bulwarks that securing military funding runs up against, Goose was less optimistic.

"US policy on and pursuit of killer robots has shown little regard for the ethical implications of such weapons. It has opposed any new international prohibitions or restrictions on autonomous weapons, calling only for voluntary codes of conduct, while rushing forward toward deployment on the battlefield."

Lethal autonomous weapons prolif is de-escalatory and prevents nuclear war

Umbrello, et al, 20—Institute for Ethics and Emerging Technologies, University of Turin (Steven, with Phil Torres, Project for Future Human Flourishing, and Angelo De Bellis, University of Edinburgh, “The future of war: could lethal autonomous weapons make conflict more ethical?,” AI & Society, 35, 273–282 (2020), dml) [LAWs=lethal autonomous weapons]
https://www.academia.edu/76926743/The_future_of_war_could_lethal_autonomous_weapons_make_conflict_more_ethical recut //cy

To begin, one of the most compelling reasons for opposing nuclear non-proliferation efforts is that the destructive potential of nuclear weapons increases the threshold of use (Jürgen 2008; Wilson 2012). Thus, only in extreme circumstances would rational actors deem their use to be either morally or strategically acceptable. This strongly contrasts with the case of LAWs, whose cost would be small compared to the cost of paying military personnel. Consequently, states could maintain stockpiles of LAWs that are far larger than any standing army. The low cost of LAWs would also make them *more expendable* than human soldiers (Jacoby and Chang 2008; Singer 2009a, b; Jenks 2010), and they could strike the enemy with *greater precision* than human scolders can currently achieve (Thurnher 2012; Ekelhof and Struyk 2014). These four properties—low cost, military effectiveness, expendability, and precision—could *drive proliferation* while *lowering the threshold for use* and, therefore, *undermine geopolitical security*. Incidentally, similar claims could be made about anticipated future nanotech weaponry (see Whitman 2011).

The attractiveness of LAWs is *apparent* in the US’s use of “unmanned aerial vehicles” (UAVs, also known as “*drones*”) in Iraq and Syria. These semi-autonomous systems offer a cheap, effective, and relatively precise means for conducting surveillance and targeting enemy combatants [despite unsatisfied infrastructural needs to sustain the drone program] (McLean 2014). As a result, the US drone program has grown and the frequency of drone use against terrorist organizations like the (now-defunct) Islamic State has steadily increased in the past decade (Higgins 2017). Yet the proliferation of LAWs discussed in this paper is *different in important respects* from the proliferation of current UAV devices. LAWs are theoretically capable of becoming moral actors capable of making life and death decisions without human intervention. The absence of a human operator suggests that LAWs will be even cheaper than current UAVs and, as such, more vulnerable to proliferation. But this *might not be undesirable* given that, for example, ethical LAWs will—almost by definition—not serve to glorify or extend war efforts beyond the initial scope. Furthermore, UAVs still require human intervention and, as we will soon discuss, the emotional volatility of humans could lead to overspending and high death tolls.

More generally speaking, the growing use of UAVs in conflict situations is consistent with a broader trend toward high-precision weaponry and away from larger, more destructive weapons like those in the world’s nuclear arsenals (Wilson 2013). There are some *reasons for welcoming this shift*. For example, the use of high-precision weapons like LAWs to achieve a state’s military objectives could reduce the probability and proportion of indiscriminate harm, thus violating the LoW and "rules of engagement" (RoE) *less than might otherwise have been possible*. Even more, the "ease-of-use" of LAWs that are fully autonomous could enhance the "balance of terror" that prevents conflict from breaking out by providing a credible means for retaliation: "If you strike me first, I will unleash a swarm of LAWs that devastate your infrastructure, poison your streams, set fire to your farms, destroy your armies, and assassinate your leaders."

The precision and effectiveness of LAWs could also accelerate the process of nuclear disarmament, seeing as the conception of LAWS regards them as agents capable of conventional weapons use rather non-conventional weapons platforms. First, consider that research on the potential climatic consequences of a nuclear war resulted in the replacement of MAD ("mutually-assured destruction") with SAD ("self-assured destruction"). The reason is that an

exchange of nuclear weapons—even a regional one [citation]—could initiate a "nuclear winter" that causes global agricultural failures, widespread starvation, the spread of infectious disease, and other catastrophic sequelae that cannot be contained within national borders (Mills et al. 2014; Xia et al. 2015). Consequently, a nuclear war would all but guarantee the self-annihilation of states involved. As Seth Baum (2015) notes, though, LAWs could provide a kind of "winter-safe deterrence" by providing states with a credible threat of retaliation without the global catastrophic risks of nuclear conflict. Thus, LAWs could render the world's nuclear arsenals irrelevant and, in doing so, lower the overall risk of human annihilation.

None of their offense is unique—LAW prolif is inevitable and all the risks apply equally to humans—but, future development encourages exhaustive testing which solves all risks

Ackerman, 15—senior writer for IEEE Spectrum's award-winning robotics blog, Automaton (Evan, "We Should Not Ban 'Killer Robots,' and Here's Why," https://spectrum.ieee.org/automaton/robotics/artificial-intelligence/we-should-not-ban-killer-robots, dml)

The problem with this argument is that no letter, UN declaration, or even a formal ban ratified by multiple nations is going to prevent people from being able to build autonomous, weaponized robots. The barriers keeping people from developing this kind of system are just too low. Consider the "armed quadcopters." Today you can buy a smartphone-controlled quadrotor for US $300 at Toys R Us. Just imagine what you'll be able to buy tomorrow. This technology exists. It's improving all the time. There's simply too much commercial value in creating quadcopters (and other robots) that have longer endurance, more autonomy, bigger payloads, and everything else that you'd also want in a military system. And at this point, it's entirely possible that small commercial quadcopters are just as advanced as (and way cheaper than) small military quadcopters, anyway. We're *not going to stop that research*, though, because everybody wants delivery drones (among other things). Generally speaking, technology itself is not inherently good or bad: it's what we choose to do with it that's good or bad, and you can't just cover your eyes and start screaming "STOP!!!" if you see something sinister on the horizon when there's so much simultaneous potential for positive progress.

What we really need, then, is a way of making autonomous armed robots ethical, because we're not going to be able to prevent them from existing. In fact, the most significant assumption that this letter makes is that armed autonomous robots are inherently more likely to cause unintended destruction and death than armed autonomous humans are. This may or may not be the case right now, and either way, I genuinely believe that it won't be the case in the future, perhaps the very near future. I think that it will be possible for robots to be as good (or better) at identifying hostile enemy combatants as humans, since there are rules that can be followed (called Rules of Engagement, for an example see page 27 of this) to determine whether or not using force is justified. For example, does your target have a weapon? Is that weapon pointed at you? Has the weapon been fired? Have you been hit? These are all things that a robot can determine using any number of sensors that currently exist.

It's worth noting that Rules of Engagement generally allow for engagement in the event of an imminent attack. In other words, if a hostile target has a weapon and that weapon is pointed at you, you can engage before the weapon is fired rather than after in the interests of self-protection. Robots could be even more cautious than this: you could program them to not engage a hostile target with deadly force unless they confirm with whatever level of certainty that you want that the target is actively engaging them already. Since robots aren't alive and don't have emotions and don't get tired or stressed or distracted, it's possible for them to just sit there, under fire, until all necessary criteria for engagement are met. Humans can't do this.

The argument against this is that a robot autonomously making a decision to engage a target with deadly force, no matter how certain the robot may be, is *dangerous* and *unethical*. It is dangerous, and it may be unethical, as well. However, is it *any more dangerous* or *unethical than asking a human to do the same thing*? The real question that we should be asking is this: Could autonomous armed robots *perform better* than armed humans in combat, resulting in *fewer casualties* (combatant or non-combatant) on both sides? I believe so, which doesn't really matter, but so do people who are actually working on this stuff, which does.

In 2009, Ronald C. Arkin, Patrick Ulam, and Brittany Duncan published a paper entitled "An Ethical Governor for Constraining Lethal Action in an Autonomous System," which was about how to program an armed, autonomous robot to act within the Laws of War and Rules of Engagement. h+ Magazine interviewed Arkin on the subject (read the whole thing here), and here's what he said:

h+: Some researchers assert that no robots or AI systems will be able to discriminate between a combatant and an innocent, that this sensing ability currently just does not exist. Do you think this is just a short-term technology limitation? What such technological assumptions do you make in the design of your ethical governor?

RA: I agree this discrimination technology does not effectively exist today, nor is it intended that these systems should be fielded in current conflicts. These are for the so-called war after next, and the DoD would need to conduct extensive additional research in order to develop the accompanying technology to support the proof-of-concept work I have developed. But I *don't believe there is any fundamental scientific limitation* to achieving the goal of these machines being able to *discriminate better than humans can* in the fog of war, again in tightly specified situations. This is the benchmark that I use, rather than perfection. But if that standard is achieved, it can *succeed* in reducing noncombatant casualties and thus is a goal worth pursuing in my estimation.

One way to think about this is like autonomous cars. Expecting an autonomous car to keep you safe 100 percent of the time is unrealistic. But, if an autonomous car is (say) 5 percent more likely to keep you safe than if you were driving yourself, you'd still be much better off letting it take over. Autonomous cars, by the way, will likely be much safer than that, and it's entirely possible that autonomous armed robots will be, too. And if autonomous armed robots really do have at least the potential reduce casualties, aren't we then ethically obligated to develop them?

If there are any doubts about how effective or ethical these systems might be, just test them exhaustively. Deploy them, load them up with blanks, and watch how they do. Will they screw up sometimes? Of course they will, both during testing and after. But setting aside the point above about relative effectiveness, the big advantage of robots is that their behavior is traceable and they learn programmatically: if one robot does something wrong, it's possible to trace the chain of decisions that it made (decisions programmed into it by a human, by the way) to find out what happened. Once the error is located, it can be resolved, and you can be confident that the robot will not make that same mistake again. Furthermore, you can update every other robot at the same time. This is not something we can do with humans.

I do agree that there is a potential risk with autonomous weapons of making it easier to decide to use force. But, that's been true ever since someone realized that they could throw a rock at someone else instead of walking up and punching them. There's been continual development of technologies that allow us to engage our enemies while minimizing our own risk, and what with the ballistic and cruise missiles that we've had for the last half century, we've got that pretty well figured out. If you want to argue that autonomous drones or armed ground robots will lower the bar even farther, then okay, but it's a pretty low bar as is. And fundamentally, you're then placing the blame on technology, not the people deciding how to use the technology.

And that's the point that I keep coming back to on this: blaming technology for the decisions that we make involving it is at best counterproductive and at worst nonsensical. Any technology can be used for evil, and many technologies that were developed to kill people are now responsible for some of our greatest achievements, from harnessing nuclear power to riding a ballistic missile into space. If you want to make the argument that this is really about the decision to use the technology, not the technology itself, then that's awesome. I'm totally with you. But banning the technology is not going to solve the problem if the problem is the willingness of humans to use technology for evil: we'd need a much bigger petition for that.

Polarization

Crit thinking

Polarization is not happening – it's just the narrative being pushed

Fiorina 18 Morris P. Fiorina [Wendt Family Professor of Political Science and a senior fellow at the Hoover Institution], May 2018, "Polarization Is Not the Problem", Stanford Magazine, https://stanfordmag.org/contents/polarization-is-not-the-problem, 3-6-2025 //cai

Since the early years of this century, **political commentators have told the American public that the country is coming apart**. Although survey data indicates that majorities of the American public believe such claims, a sober look at the data reveals a more complex picture.

In common parlance, **polarization** means that the middle of an opinion distribution decreases while the tails increase. Think of a bell-shaped curve morphing into a U shape. **Nothing like that has happened in the American public, considered as a whole**. When we look at how citizens classify themselves ideologically, we find no change since the 1970s, with "moderate, middle-of-the-road" registering as the plurality position today, as it did then. **When we look at particular issues**, even very contentious ones like abortion, **we again see little change.** Majorities consistently favor something between the liberal and conservative poles. **If we look at partisan affiliations, the picture is even less consistent with the polarization narrative.** Rather than flock to one party or the other, Americans increasingly refuse to pledge allegiance to either: Today, more than 40 percent of the public claims to be independent.

The **vast majority of Americans** are going about their daily lives as they always have, largely **disengaged from politics and certainly not girding for civil war.**

What has happened in the United States **is not polarization, but sorting.** Consistent with the historical norm in two-party systems, in the mid-20th century our parties were "big tents." The Democrats were a slightly left-of-center party with a significant conservative wing and the Republicans were a somewhat right-of-center party with a significant liberal wing. Today, conservative Democrats and liberal Republicans are all but extinct.

Personalization solves

Oguz A. **Acar 24**, Professor of Marketing and Innovation at King's College London, 2-19-2024, "With Generative AI we can reimagine education — and the sky is the limit", World Economic Forum, https://www.weforum.org/stories/2024/02/with-generative-ai-we-can-reimagine-education-and-the-sky-is-the-limit/, Accessed 2-8-2025, ARC

Personalized education has long been a luxury for a privileged few. **Generative AI stands to change this**. It offers a future where **personalization** becomes **accessible to all**, including those 250 million children currently not in school. Imagine a world where AI tutors generate **learning materials** and **answers tailored** to each student's **specific needs, preferences** and **capabilities** wherever they are in the world. This might sound like science fiction, but it is already happening to some extent. Consider Khanmigo, an AI tutor assisting young students in various subjects made by Khan Academy. Similarly, it is now possible to create customized ChatGPT bots, GPTs, without any programming skills. I, for example, was able to develop a chatbot helping educators adapt the PAIR framework in just 10 minutes. Generative AI also holds the promise to provide educators a suite of virtual assistants that can take on various tasks, from administrative duties to the creation of novel learning materials. Given the prevalence of teacher shortages and burnout, AI can be a game-changer, enabling educators to devote more time and energy to their true calling: teaching. In a future where AI plays a pivotal role in delivering information, the purpose of the classroom itself should evolve. We could, for example, shift towards a flipped-classroom model, where class is spared for activities that promote **active engagement** and **collaboration**. Generative AI is **far more than the latest tech fad**; it is a general-purpose technology that will impact, if not **reshape, every facet of our lives**. Perhaps the greatest threat to education in the age of AI is not the technology's inherent risks, but our

reluctance to fully explore and thoughtfully harness AI's vast potential to foster a **new era of learning, teaching and development**.

3. Critical thinking is needed to use AI

Gibson 25 (Jen Gibson is an Instructional Coach, Instructional Technology Facilitator, and teacher at Capuchino High School, "From GPS to GPTs: Steering Students Toward AI Literacy", Krause Center for Innovation, https://krauseinnovationcenter.org/from-gps-to-gpts-steering-students-toward-ai-literacy/, 1-6-2025, DOA: 2-20-2025) //Bellaire MC

AI is like your GPS. You plug in the destination, **and it gives you directions. It's great at finding the fastest route**, avoiding traffic, and even letting you know when there's an In-N-Out Burger nearby. **But** here's the thing: **if you don't know where you're going in the first place,** the **GPS is useless.** And if the GPS tells you to turn into a lake (it happens!), you're the one who has to catch the mistake before things go off the rails. That's **AI**. It**'s a tool** that helps you get from point A to point B more efficiently. But it doesn't know why you're going there, and it won't tell you if the destination doesn't make sense. **It needs your critical thinking** and judgment **to steer it in the right direction.** Otherwise, you might end up at "Lake In-N-Out!"

AI allows for more critical thinking -- analysis, complex problems, different perspectives

Walter 24, Yoshija. [Professor @ Kalaidos University], Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. *Int J Educ Technol High Educ* 21, 15 (2024). https://doi.org/10.1186/s41239-024-00448-3 DOA 2/26/25 //cy

Fostering critical thinking with AI

Critical thinking, in the context of AI education, involves the ability to analyze information, evaluate different perspectives, and create reasoned arguments, all within the framework of AI-driven environments. This skill is increasingly important as AI becomes more prevalent in various aspects of life and work. In educational settings, AI can be used as a tool not just for delivering content, but also for encouraging students to question, analyze, and think deeply about the information they are presented with (van den Berg & du Plessis, 2023). The use of AI in education offers unique opportunities to cultivate critical thinking. AI systems, with their vast databases and analytical capabilities, can present students with complex problems and scenarios that require more than just rote memorization or basic understanding. These systems can challenge students to use higher-order thinking skills, such as analysis, synthesis, and evaluation, to navigate through these problems. Moreover, AI can provide personalized learning experiences that adapt to the individual learning styles and abilities of students. This personalization ensures that students are not only engaged with the material at a level appropriate for them but are also challenged to push their cognitive boundaries. By presenting students with tasks that are within their zone of proximal development, AI can effectively scaffold learning experiences to enhance critical thinking (Muthmainnah et al., 2022).

No democracy impact---New tech, non-state actors, military autonomy, and eroding institutional constraints

Philip B.K. **Potter 16**, 10/14/2016, Associate Professor of Politics and Founding Director of the National Security Policy Center in the Frank Batten School of Leadership and Public Policy at the University of

Virginia; fellow at the Modern War Institute at West Point, Harvard University, and the University of Pennsylvania, Four Trends That Could Put the Democratic Peace at Risk, https://politicalviolenceataglance.org/2016/10/14/four-trends-that-could-put-the-democratic-peace-at-risk/)// JZ

The point is **that it's not democracy alone that matters.** Rather it is the limits that these regimes can put on their leaders to force them to be careful and selective when doing things like making threats and starting fights. This also means it's not a baked-in advantage that a democracy can take lightly – even well-meaning leaders in democracies have every incentive to figure out how to slip these constraints. Limits yield long-term advantages, but in the immediate term they tie leaders' hands, preventing them from engaging with the international problems or opportunities that they feel they should.

There are four trends that indicate this process is well under way and is putting the "democratic advantage" at risk.

Militaries are less closely tied to voters

Democratic advantages in conflict are commonly traced to the nature of democratic militaries and their relationship with political power. Going all the way back to Kant, there has been the notion that societies with citizen soldiers and the vote are not going to support unnecessary wars when they are going to bear the costs. The problem is that Kant's vision isn't what modern armies look like, and they're intentionally moving away from the target rather than toward it.

In the US, military service is all-volunteer, and the recruits are increasingly drawn from concentrated segments of society. This divorces the consequences of fighting from the day-to-day experience of most voters. Increasingly, **this is a limited force supplemented by private sector contractors, placing even more distance between the individual with the gun and the democratic process.**

The emphases on covert operations, Special Forces, and technological superiority further water down the link between society and soldiers. This was, in fact, part of the point of moving to an all-volunteer force and one of the rationales for investments in stealth, information technology, and precision guided munitions, e.g. the precision strike complex. **By replacing bodies with dollars, planners have consistently sought to increase the flexibility that the US has in its use of force.** In the immediate term, that goal makes sense – it allows policy makers to do what they believe needs to be done without having to worry about a fickle public. But **over the long term, it has the potential to lead to less caution and selectivity when engaging in conflicts.**

Adversaries are proliferating and changing

The emergence of non-state actors as a primary threat has further loosened constraints on leaders. The shift from the possibility of total war with the Soviet Union to myriad smaller-scale challenges accelerated the transition from a mass military to an elite, highly specialized force more isolated from society. Compounding the challenge, this type of adversary and conflict leads to more significant informational advantages for leaders, which make democratic constraints less binding. Citizens and political opposition are always playing catch-up with the executive when it comes to foreign policy information, but the challenge is harder when the **adversaries are less familiar, the engagements shorter, and the issues more complex.**

Technology is reducing constraint

New technologies are driving citizens and political opposition ever further out of the loop. The extraordinary rise of unmanned vehicles in combat reduces the risk of casualties and extends the range for projecting force. **This has undeniable strategic advantages, but there is less visibility and, accordingly, less accountability associated with the use of this technology.** This means leaders worry less about the ex-post constraints and costs that typically come with casualties.

Institutions and practices increasingly favor the president

The recent nuclear agreement with Iran was an executive agreement rather than a treaty. This is the norm – **most international agreements are now unilateral actions of the president.** A polarized Congress is ever more cautious in its exercise of what little foreign policy power it has; two years into the campaign against Islamic State and Congress still hasn't weighed in one way or the other. In the US this is an expansion of the widely accepted argument that there are two presidencies – a constrained one in domestic politics and a relatively autonomous one abroad. What's unappreciated is that **this growingpresidential autonomy (which may well be needed to run a Superpower) also decreases constraint and with it the foreign policy "advantages" we associate with democracy.**

While these advantages are real, they are also fragile. Key institutional constraints – such as a robust political opposition and a knowledgeable citizenry – are susceptible to seemingly minor changes in institutions and/or practices that loosen the limits of leaders' foreign policy decisions. As technologies advance, threats shift, and institutional constraints wax and wane, the foreign policy advantages embedded

within democratic systems may begin to erode. The potential for such a shift is a possibility that should not be taken lightly.

Inequality

AI is already used more among minority communities

Ulrich **Boser 24**, 8-15-2024, [I am the CEO of The Learning Agency, a mission-driven, education consulting firm. I have been an advisor to many universities, foundations, and companies. My research and writing has appeared everywhere from the front page of USA Today to The Tonight Show.] "Students And Teachers Of Color Are Embracing AI In Schools At Greater Rates Than Others. Why?," Forbes, https://www.forbes.com/sites/ulrichboser/2024/08/15/students-and-teachers-of-color-are-embracing-ai-in-schools-at-greater-rates-than-others-why/, accessed 2-21-2025 //rzhao

Every child has heard the phrase at some point: Attitude is everything.

Parents share it to guide children through difficult times, teachers use it to motivate, and often it can affect outcomes. The inspirational mantra is especially true in education these days.

And **when it comes to embracing** artificial intelligence (**AI**) **in schools**, new surveys show **no group** has a **more open** attitude to adopting AI in the classroom **than students and teachers of color.**

The embrace of AI among minority students and teachers goes deeper than attitude, though. A survey released this summer by the Walton Family Foundation found that minority students and teachers also use AI more than their white counterparts.

Consider that **Black teachers** and educators in urban districts **had the highest usage rates at 86 percent.** In K-12 overall, Hispanic and Black students have higher usage rates at 77 percent and 72 percent respectively versus White students at 70 percent.

Other surveys hint at similar results, and they show that minority communities maintain positive attitudes about AI's educational benefits. They also use AI more than their peers.

In some ways, this is surprising. Technology has at times been used to harm students of color. Just consider the rise of surveillance technologies, which has disproportionately impacted American minorities.

Still, AI has clearly caught on among people of color. According to **a report** titled Teen and Young Adult Perspectives on Generative AI **released** in summer 2024 **from** Common Sense Media, Hopelab, and the **Harvard Graduate School of Education's Center for Digital Thriving**: "Among those who ever used generative AI, **Black young people are significantly more likely than their White peers to turn to generative AI** to get information (**72 % vs. 41%**), brainstorm ideas (68% vs. 42%), help with schoolwork (62% vs. 40%)."

AI broadens educational experiences

Fetty 24 Nick Fetty, 8-14-2024, [Communications at New York Academy of Sciences] "Using AI to Redefine Accessible Classrooms," NYAS - The New York Academy of Sciences, https://www.nyas.org/ideas-insights/blog/using-artificial-intelligence-to-redefine-accessible-classrooms/, accessed 2-19-2025 //cy

250 million children worldwide lack access to a decent education due to extreme poverty, child labor, or discrimination, according to data from the United Nations. A shortage of teachers, lack of resources and logistical constraints further undermine countless children's educational outcomes.

This talented international team, comprising students from India, Qatar, and the United States, tackled this massive disparity with their project AI4Access. Tasked with devising innovative ways of harnessing the power of immersive technologies like artificial intelligence/machine learning (AI/ML) and virtual reality/augmented reality (VR/AR) to create a more inclusive, fair, and efficient environment in classrooms and improve students' learning experience, the team more than met the challenge.

The team members learned that students respond to different learning styles (visual, auditory, and kinesthetic), but traditional teaching favors read/write learner types. 1 in 59 students, according to the UN, is affected by learning disabilities such as dyslexia, ADHD, dyscalculia and dyspraxia, which

undermine their academic success in a rigid, one-size-fits-all education system.
This is the aspect that the AI4Access team chose to focus on.

Advancing Education Through Digital Technology

The team developed an AI-led application designed to diversify the education experience, give students access to new visualized learning styles, and enable teachers to monitor individual students' performance and provide support when needed.

The tool analyzes the students' learner profile and enables teachers to provide them with a personalized teaching plan that considers their strengths and weaknesses. By providing visual learning features, such as 3D models and live simulations using VR/AR, the app enhances the learning experience and supports students with learning difficulties. The teacher can more easily track individual students' progress, track their response, and identify when individuals need additional attention.

The team drew on individual members' skills to build their app. "I've enjoyed working with the team, capitalizing on our respective strengths for the best possible outcome," explains Anoushka. "This journey helped me truly appreciate the power of collaboration and teamwork!" Their end product—an elegant app that uses OpenAI API, Python and Eleven Labs API to improve the classroom experience for both students and teachers—won praise from the judges.

Despite barriers in rural education, educational AI would create solution

Ethan Smith, 11-xx-2024, "How AI is Shaping Personalized Learning in Rural Areas," Education, https://vocal.media/education/how-ai-is-shaping-personalized-learning-in-rural-areas, DOA 2-23-2025 //Wenzhuo

Breaking the barriers: AI and accessibility in the countryside

For centuries, **rural areas** have been **inaccessible to** quality **education.** These regions have **fewer** qualified **teachers,** ill-fitted educational programs, and even **old materials** that are in use. Updated resources cannot be readily accessed due to the **geographical isolation** and poor infrastructure; thus, rural students are relatively

disadvantaged. Students in these regions are several times behind their urban counterparts in being successful academically and in future prospects without the aid of qualified teaching forces and the advanced technology.

AI can serve as a good learning tool to **overcome** such **challenges by making it** easy and **accessible for students**. AI-based platforms can provide rural students with quality education content via the internet and cell phones. Such systems can **accommodate learning material in local languages** and formats **tailored to** students' **learning styles** in a respectful manner. Students can then engage with **interactive**, personalized **lessons** right **from their homes**-whatever adaptive applications or AI-powered virtual classrooms might become.

A notable example here is the **AI implementation** across classrooms **in rural Montana**. AI-based virtual assistants offer real-time guidance to the students, keeping them even more occupied with their coursework. The outcome has been remarkable with **significant improvements in participation** as well as **academic performance**, therefore **breaking educational barriers in** even the **most remote areas** due to AI implementations.

AI Closes the Rural-Urban Gap in Education

Through more equitable distribution of educational resources, one of the best methods by which **AI** is helping to **bridge the gap** between education in rural and urban areas would be **through** the **large-scale analysis of student** performance **data,** saying where the students face the most difficulties. This insight **enables** instructors and **policymakers to target** the **resources**—be it additional training to teachers or facilitating access to specialized educational tools—to precisely the students and schools **where most** are **needed.** In the rural regions, for example, education infrastructure is often deficit, and this **targeted approach may make all the difference.**

Equity extends beyond just the allocation of resources in the hands of AI**. AI provides level playing fields for** the majority of students from **rural schools who may not have** quality access to educational facilities since they do not offer higher-class **teachers** and programs associated with urban schools. The use of AI ensures that their lessons and resources come to suit every learner's specific ways and paces, thereby helping them possibly catch up or even outdo their city siblings. This technology reduces the disparities in the quality of education by **giving rural students** the same **personalized attention** and diverse learning materials available to students in better-funded urban schools.

For instance, a real-life example to illustrate this would be the multi-tiered approach of Infinity Learn has empowered rural learners by providing them with AI-powered mentors and customized learning paths. This virtual tutor helps in giving interactive lessons as well as in tracking the performance of the students. Consequently, **rural students** have an opportunity to **receive a** personalized **level of education that was only** hitherto **available to people** residing **in** more **developed regions**, thus bridging the gap in education.

Empowering Educators and Learners: AI as a Teaching Assistant

Recently, **AI** became an **indispensable tool for teachers**, especially **in rural regions** where resources are scarce. It enables the **automation of** routine tasks like grading or **administrative work, freeing up** valuable **time** for teachers **to spend** more **with** direct instruction and meaningful **student i**nteraction. This calls for effective addressing of individual students' needs hence making teaching more efficient and enjoyable. In the rural setup, where many students are found in one multi-grade class with the head teacher teaching, AI will probably be an essential means of making classrooms more efficient and effective.

Besides task automation, AI can also **transform** the **professional development of teachers**. These platforms with AI ensure that rural school educators get access to updated teaching techniques, resource tools, and training programs without any geographical barrier. This is relatively important for teachers in remote areas lacking an opportunity for continuous professional development compared to their peers in urban centers. Thus, these platforms afford opportunities for updating themselves to the latest education trends and strategies, thus upgrading the quality of

education in those rural areas.

AI tool support means more freedom for the students. Adaptive lessons and immediate feedback allowed students to own their learning journey fully, hence gained full confidence in learning. The personalized support of such assistance ensures every learner pushes through at his or her own pace over challenges, thus surmounting barriers and achieving optimal performance (EdTech Magazine).

Infrastructure and Technology : Overcoming the Challenges

Even with such revolutionizing potential of AI, then, vast **technological barriers are** still **looming i**n the rural regions. There is a lack of internet connectivity and digital equipment in many remote regions that bars the overall implementation of AI. The obstacles further deepen the gap in education among rural and urban communities since students as well as teachers are barred from using AI-driven tools requiring advanced internet connectivity and equipment.

However, AI engineers are finding ways to **transcend these barriers** day in and day out. For instance, AI-based learning **interfaces** can also be **designed with offline capabilities and low data**, hence compliant with internet conditions in most areas. Such systems enable students to download the learning contents and materials where the student happens to access the internet for full utilization later on. Many AI tools also **use low-bandwidth** formats today, hence **rural learners can enjoy** personalized e**ducation without** necessarily **requiring** an **Internet connection** that remains constant.

Future initiatives include the **upgradin**g of **rural** areas' technological **infra**structure. Governments and private organizations will engage in efforts to increase internet access and promote cheaper, easier-to-use digital gadgets for students and schools alike. Once these initiatives find their bearing, it will **become even easier to inject AI tech**nology **into rural education**, causing a **narrowing of the remaining gaps** discovered between rural education systems and their urban peers.

Conclusion: The Future of AI and Rural Education

AI is not just a tool, but that potential force that can actually bridge the long-established educational divide between rural and urban areas. AI provides personal learning, reduces routine teachers' tasks, and works with technology constraints to empower educators and students in areas of their remoteness. And with developing AI, the scope for even more comprehensive, accessible, and customized education will only continue to grow in these rural areas, bringing quality learning into places that need it the most.

The time now: for educators and policymakers to collaborate with technologists and invest in AI-driven educational reforms that may lift rural education systems worldwide, so that every student-whether local or not-is given a fair chance at their fullest potential.