

# C1: critical thinking

## Ward 24

<https://universitybusiness.com/these-5-ai-tools-are-the-most-popular-among-students/>

Roughly 86% of college students say they use AI in their studies.

Source: A survey of college students by the Digital Education Council suggests. Among them, 54% say they use it on a weekly basis. Another 24% rely on it daily.

## Coffey 24

<https://www.insidehighered.com/news/tech-innovation/artificial-intelligence/2024/07/29/students-and-professors-expect-more>

While faculty concerns about the use of AI to cheat are nothing new, the study also polled more than 2,000 students—who agreed that generative AI will boost cheating potential. Nearly half of them (47 percent) said it is easier to cheat than it was last year due to the increase in use of generative AI, with 33 percent pointing toward ChatGPT specifically as a reason.

## Barshay 24

<https://hechingerreport.org/kids-chatgpt-worse-on-tests/>

Researchers at the University of Pennsylvania found that Turkish high school students who accessed ChatGPT while doing practice math problems did worse on a math test compared with students who didn't have access to ChatGPT. Those with ChatGPT scored 17 percent worse on a test of the topics that the students were learning. A third group of students had access to a revised version of ChatGPT that functioned more like a tutor. This chatbot was programmed to provide hints without directly divulging the answer. The students who used it did spectacularly better on the practice problems, solving 127 percent more of them correctly compared with students who did their practice work without any high-tech aids. But on a test afterwards, these AI-tutored students did no better. Students who just did their practice problems the old-fashioned way — on their own — matched their test scores. The researchers titled their paper, "Generative AI Can Harm Learning," to make clear to parents and educators that the current crop of freely available AI chatbots can "substantially inhibit learning." The researchers believe the problem is students use the chatbot as a "crutch." When they analyzed the questions that students typed into ChatGPT, students often simply asked for the answer. Students were not building the skills that come from solving the problems themselves.

Students who are still learning to think for themselves grow overdependent on AI, they must first learn to creatively problem solve before using AI or else it will become a crutch.

## Goteka 24

Schools need to be transparent about the data collected by AI-powered learning platforms and ensure it's stored securely in accordance with regional regulations. This is particularly important in countries with stricter data privacy laws, such as the European Union and South Korea. Tech Dependence and Reduced Critical Thinking Overdependence on AI for problem-solving can hinder students' ability to develop critical thinking skills and develop independent learning skills. An AI homework helper might churn out solutions to complex math problems in seconds. However, this deprives students of the opportunity to grapple with the problem themselves, develop logical reasoning skills, and experience the satisfaction of arriving at a solution independently.

Empirics prove: There is a direct correlation between increased AI and decreased critical thinking

## Daniel 25

Your Brain On AI: 'Atrophied And Unprepared'

<https://www.forbes.com/sites/larsdaniel/2025/02/14/your-brain-on-ai-atrophied-and-unprepared-warns-microsoft-study/>

Generative AI models like ChatGPT, Copilot, Claude and Gemini are increasingly embedded into workplace operations, and in conjunction, the question of AI's impact on **critical thinking** is under scrutiny. As these tools become more sophisticated and widely adopted, the balance between efficiency and independent thought is shifting in ways that are both promising and concerning. A recent **study** conducted by **Carnegie Mellon University [study]** and Microsoft Research offers a closer look at how knowledge workers interact with AI-generated content and the cognitive trade-offs involved. The research, based on a survey of 319 professionals, reveals a nuanced transformation: while AI can reduce the mental effort required for many tasks, it may also lead to diminished critical engagement in certain contexts. How AI is Changing Critical Thinking in the Workplace One of the most striking findings from the study is **[found] that 62% of participants reported engaging in less critical thinking when using AI**, particularly in routine or lower-stakes tasks. Conversely, **those who had greater confidence in their own expertise were 27% more likely to critically assess AI-generated outputs** rather than accept them at face value. This suggests that AI's role is evolving from a passive assistant to an active participant in decision-making processes — one that must be evaluated carefully to prevent overreliance.

## Critical thinking is also erased on the long term

Gerlich 25

<https://www.mdpi.com/2075-4698/15/1/6>

**The correlation between AI tool use and critical thinking was found to be strongly negative ( $r = -0.68$ ), suggesting that greater reliance on AI tools is associated with a decline in critical thinking skills.** This outcome is

consistent with the theory of cognitive offloading, where **AI reduces the necessity for users to employ deep analytical reasoning independent problem-solving.** **The diminished practice of these skills can result in a long-term erosion of critical thinking capabilities,** a finding supported by prior studies highlighting the risks of over-reliance on technology for decision-making and information evaluation [4,6]. A strong negative correlation ( $r = -0.75$ ) between cognitive offloading and critical thinking further supports this interpretation. As individuals increasingly offload cognitive tasks to AI tools, their ability to critically evaluate information, discern biases, and engage in reflective reasoning diminishes. This relationship underscores the dual-edged nature of AI technology: while it enhances efficiency and convenience, it inadvertently fosters dependence, which can compromise critical thinking skills over time. This study investigated the impact of AI tool usage on critical thinking, considering cognitive offloading as a potential mediating factor. The analyses encompassed descriptive statistics, ANOVA, correlation analysis, multiple regression, and random forest regression. 4.1. Descriptive Statistics **The dataset comprised 656 responses detailing AI tool usage, cognitive offloading tendencies, and critical thinking scores. Younger participants (17–25) exhibited higher AI tool usage and cognitive offloading, but lower critical thinking scores. In contrast, older participants (46 and above) showed lower AI tool usage and cognitive offloading, with higher critical thinking scores.** Table 4. ANOVA results for deep thinking activities. Table 3 presents the ANOVA results **examining the relationship between levels of AI tool usage and critical thinking scores. The analysis revealed a highly significant effect ( $p < 0.001$ ), indicating that increased reliance on AI tools is associated with reduced critical thinking abilities. These findings align with theories of cognitive offloading, where the automation of analytical tasks reduces the need for independent reasoning. The residual variance suggests the influence of additional factors, such as educational background and cognitive engagement, on critical thinking.** These patterns highlight the cognitive impact of AI tool usage, particularly how reliance on AI tools may reduce critical thinking by encouraging cognitive offloading. The relationships between the key variables, namely, AI Tool Use, Cognitive Offloading, and Critical Thinking, are summarised in Table 6. These correlations provide critical insights into how reliance on AI tools impacts cognitive processes and critical thinking abilities. Table 6. Summary of correlations. **The analysis revealed a strong positive correlation ( $r = +0.72$ ) between AI tool use and cognitive offloading, indicating that increased reliance on AI tools is associated with a higher degree of cognitive offloading.** This finding aligns with existing literature suggesting that AI tools reduce the cognitive burden by automating routine tasks, allowing users to delegate memory, attention, and decision-making processes to technological systems [5,16]. However, this convenience comes at a cost, as it reduces the opportunity for individuals to engage in cognitively demanding tasks, potentially undermining

cognitive engagement over time

**AI use uniquely destroys critical thinking skills. Only our studies are specific to generative AI in education.**

### Basiouny

Angie Basiouny, Writer and editor at the Wharton School of UPenn, August 27, 2024, Knowledge at Wharton, "Without Guardrails, Generative AI Can Harm Education",

[<https://knowledge.wharton.upenn.edu/article/without-guardrails-generative-ai-can-harm-education/>] winkly

A new study led by researchers at Wharton and Penn reveals that using generative AI improves student performance, but also makes it harder for students to learn and acquire new skills. The researchers designed an experiment with nearly 1,000 high school math students in Turkey to determine whether large language models can harm or help their education. One group of students was given GPT Base, a chat interface similar to ChatGPT-4, to help them during practice sessions. A second group was given GPT Tutor, an interface similar to ChatGPT-4 but with safeguards. It includes teacher input and is designed to guide students with hints rather than directly giving answers. The third group – the control group – had no technology assistance and relied only on traditional resources such as the textbook and notes. During the AI-assisted practice session, the GPT Base group performed 48% better than the control group. But when AI assistance was taken away from the Base group and they were given an exam on the material, they performed 17% worse than the control group. “We’ve been really interested in how humans interact with algorithms for a while.” — Hamsa Bastani The GPT Tutor group performed an astonishing 127% better in the AI-assisted practice session, yet scored about the same on the exam as the control group. According to the paper, the results suggest that the Base group depended on the software to solve the problems and didn’t learn the underlying mathematical concepts deeply enough to do well on the exam. In contrast, the performance by the Tutor group shows that these harms are mitigated when AI is deployed with teacher-guided conditions and limits. “We’re really worried that if humans don’t learn, if they start using these tools as a crutch and rely on it, then they won’t actually build those fundamental skills to be able to use these tools effectively in the future,” said Hamsa Bastani, a Wharton professor of operations, information and decisions who co-authored the paper. “As educators, we worry about that.” Bastani spoke to Wharton Business Daily about the paper, “Generative AI Can Harm Learning.” (Listen to the podcast.) The co-authors are Osbert Bastani, computer and information science professor with Penn Engineering; Alp Sungu, operations, information and decisions professor at Wharton; Haosen Ge, data scientist at the Wharton AI and Analytics Initiative; Özge Kabakcı, math teacher at Budapest British International School; and independent researcher Rei Mariman. The Generative AI Paradox and How It Impacts Education The paper’s finding is consistent with similar studies, and Hamsa Bastani said it reflects the paradox of generative AI: It can make tasks easier for people while simultaneously deteriorating their abilities to learn the skills required to solve those tasks. “We’ve been really interested in how humans interact with algorithms for a while. But I think it gets really interesting with large language models just because of the extent of their reach and the number of people who are using them with such a diversity of tasks,” she said. “One thing that really drew us to this conversation was a lot of teachers are struggling with students copying answers from homework, and they were worried that this would negatively impact their skill-building and their fundamental understanding of concepts. That’s why we decided to dig into this.” “If we use it sort of lazily and ... completely trust the machine learning model, then that’s when we could be in trouble.” — Hamsa Bastani The study also found that students who used AI assistance were overly optimistic about their learning capabilities, even the high-achieving students. Teachers, on the other hand, seem to be overly concerned and tend to dismiss the advantages of AI. Bastani thinks that’s because students and teachers aren’t yet trained on how to use AI effectively to augment traditional teaching methods. Bastani and her colleagues said the study is a “cautionary tale” about deploying AI in educational settings, and they remind everyone that the software still has significant limitations. ChatGPT, for example, is known to spit out false information known as hallucinations, which can also potentially harm student learning. Just like in a workplace setting, generative AI in the classroom still requires a lot of human finesse and fact-checking to make it valuable, Bastani said. “If we are thinking of this tool as an assistant and doing the higher-level tasks, checking its outputs and so on, it can be a huge benefit,” she said. “But if we use it sort of lazily and kind of outsource the work that we’re supposed to be doing and completely trust the machine learning model, then that’s when we could be in trouble.”

**Critical thinking is integral to innovation, to create something new you must think creatively outside the box.**

Forbes ‘16

<https://www.forbes.com/sites/sap/2025/03/13/how-ai-driven-customer-support-creates-proactive-outcomes/>

## Innovation With Design Thinking Demands Critical Thinking

Critical thinking does not hinder—but rather augments—innovative thinking. Some people believe that critical thinking hampers innovative thinking and, therefore, consider it as incompatible with design thinking. This notion is misleading and relies on the misinterpreted assumption of what critical thinking means and how it applies to design. There is nothing in the design-thinking process that prohibits the ability to challenge consensus or pursue alternative views. Instead, it encourages us to observe a complete view of the user experience and paint an accurate picture of reality. Critical thinking is a key ingredient in evaluating and improving our ideas, regardless of how we label them. It should not be confused with being argumentative. If used effectively, critical thinking can help us acquire vital insight about the user experience and strengthen our design assumptions. Innovation with design thinking demands critical thinking because we must understand our assumptions that frame our ideas and shape our design.

Let’s take this a step further. When we seek to design and deliver innovative solutions, it’s not enough to just have new or creative ideas. To drive growth and profitability, the new or creative ideas have to be useful and relevant. Critical thinking provides a vigorous and crucial perspective when evaluating these ideas and transforming them when necessary. Design thinking is the art of mindful restraint. Exhibiting mindful restraint is at the heart of design thinking because it eliminates conscious and unconscious bias. This is especially important

when it comes to empathy. The more knowledge we enjoy and the more credentials someone has, the more assumptions we may make. If these assumptions are left untested or remain unfiltered, the solutions built on them risk failure when presented or consumed by actual users.

Critical thinking gives us the tools to remove perceived success. This capability is especially important as we become more critical, not less, when examining our own assumptions. When we design, our human instincts crave validation based on our prior knowledge, justification of our prior decisions, and support of earlier conclusions or beliefs. In the process, we may deny ourselves the opportunity to design inside-out—rather than outside-in. Find invaluable insights hidden in plain sight. Invaluable insight is best discovered in areas hidden from plain sight. When critical thinking blends with design thinking, we not only design human-centered models for understanding the problem, but also present alternative ways of looking at a problem. SAPVoice Synchronous Design by Kaan Turnali

Similarly, to identify and understand the logical connection between each idea, we should become active design thinkers, not passive recipients of information. **Through critical thinking, we are encouraged to rigorously question ideas and assumptions, rather than accepting them without deeper reflection.** In turn, design thinkers apply critical thinking to determine whether their ideas and findings represent a realistic picture of the user experience. From my experience, “asynchronous design,” as I call it, is restrictive because it is typically formed through separate steps in a “design and think” or “think and design” approach. Instead, design must be viewed as a “synchronous” process, where we observe the situation and identify needs and opportunities while applying thinking that thoroughly represents the reality of our intended target users. With synchronous design, we no longer separate design from thinking; we become a critical thinker in the design. Bottom line **Critical thinking helps us break down assumed models taken for granted by the status quo.** By eliminating artificial structures that are inherent in traditional approaches, we foster design thinkers who are encouraged to identify new opportunities for innovation in all roles and at all levels of the enterprise. By systematically cultivating our talent, we promote, what I call, a growth philosophy in design that says: “Don’t just teach me design thinking—show me how to think in the design.” And that’s how we compete on design thinking to drive growth and profitability.

### **Independently, it shapes thinking in a way that caps intellectualism.**

Chris **Westfall 24**, 12/18/2024, International keynote speaker, The Dark Side Of AI: Tracking The Decline Of Human Cognitive Skills, DOA: 3/02/2025,

<https://www.forbes.com/sites/chriswestfall/2024/12/18/the-dark-side-of-ai-tracking-the-decline-of-human-cognitive-skills/>/// JZ

The rise of artificial intelligence (AI) has brought about numerous innovations that have revolutionized industries, from healthcare and education to finance and entertainment. However, **alongside the seemingly limitless capabilities of ChatGPT and friends, we find a less-discussed consequence: the gradual decline of human cognitive skills.** Unlike earlier tools such as calculators and spreadsheets, which made specific tasks easier without fundamentally altering our ability to think, **AI is reshaping the way we process information and make decisions, often diminishing our reliance on our own cognitive abilities.**

**AI: A Double-Edged Sword for Human Cognitive Skills**

Tools like calculators and spreadsheets were designed to assist in specific tasks—such as arithmetic and data analysis—without fundamentally altering the way our brains process information. In fact, these tools still require us to understand the basics of the tasks at hand. For example, you need to understand what the formula does, and what output you are seeking, before you type it into Excel. While these tools simplified calculations, they did not erode our ability to think critically or engage in problem-solving - the tools simply made life easier. AI, on the other hand, is more complex in terms of its offerings - and cognitive impact. As AI becomes more prevalent, effectively “thinking” for us, scientists and business leaders are concerned about the larger effects on our cognitive skills.

Declining Cognitive Skills in Education

The effects of AI on cognitive development are already being identified in schools across the United States. In a report titled, “Generative AI Can Harm Learning”, researchers at the University of Pennsylvania found that students who relied on AI for practice problems performed worse on tests compared to students who completed assignments without AI assistance. This suggests that the use of AI in academic settings is not just an issue of convenience, but may be contributing to a decline in critical thinking skills.

Furthermore, educational experts argue that AI's increasing role in learning environments risks undermining the development of problem-solving abilities. Students are increasingly being taught to accept AI-generated answers without fully understanding the underlying processes or concepts. As AI becomes more ingrained in education, there is a concern that future generations may lack the capacity to engage in deeper intellectual exercises, relying on algorithms instead of their own analytical skills.

## AI cannot innovate, it can only rephrase pre-existing ideas.

Schwanke 24

<https://medium.com/@axel.schwanke/generative-ai-never-truly-creative-68a0189d98e8#:~:text=AI%20Limitations%3A%20Generative%20AI%20cannot.human%20experience%2C%20emotion%20and%20intuition.>

Generative AI: A Tool for Creativity, Not a Creator

DeepMake shows that generative AI is triggering a debate in the art world that echoes earlier skepticism about digital art and personal computers. Critics question whether AI-powered creations can be considered real art. DeepMake advocates AI as an artistic tool, but believes that true creativity remains a uniquely human trait. AI Limitations: Generative AI cannot create something new on its own; it relies on human prompts and pre-existing data which limits its ability to innovate beyond existing patterns.

Human Creativity: True creativity is about bringing new ideas to life, which requires human experience, emotion and intuition. AI lacks the ability to think originally and innovate.

AI as a Tool: Artists use AI like any other tool, such as a paintbrush or software, to enhance their creativity. AI supports the creative process, but does not replace human ingenuity. AI can support the creative process, but the essence of innovation and originality remains in the hands of humans. The combination of human ingenuity and AI capabilities can lead to a more diverse and comprehensive art. [Deepmake, and AI company, agrees:]

“Because generative AI isn’t capable of imagining new ways of doing, seeing, or feeling things — aka creating. Only people can do that — AI simply builds what humans have already imagined.” [DeepMake]

## INNOVATION IS CRUCIAL FOR 2 MAIN REASONS;

### 1. Healthcare

Medical systems face lots of challenges right now including

## Tulane 24

### Types of Healthcare Innovation Improving Patient Outcomes

<https://publichealth.tulane.edu/blog/healthcare-innovation/>

Healthcare innovation is an expansive term. In its simplest form, it can be defined as the creation and implementation of concepts, ideas, technologies, processes, and services that benefit clinical outcomes and patient experiences. These innovations can range from simple to complex. Most of them stem from the healthcare industry's persistent guiding forces, including stringent regulations, financial limitations, and health equity. Most healthcare innovations are born of the need to overcome these industry challenges. For example, if the risk associated with a specific surgical procedure is deemed too great, innovators look for new procedures or even non-surgical options. When hospitals or networks face financial challenges, they innovate new ways to reduce spending and increase revenue. According to the Advisory Board, the industry research and information source, the modern healthcare industry currently faces six major challenges that range from financial woes to concerns over health equity.

**innovation is the only path to overcoming them and saving lives: Innovation is particularly critical in vaccines:**

## Pfizer

[https://www.pfizer.com/news/articles/the\\_next\\_frontier\\_of\\_vaccine\\_innovation](https://www.pfizer.com/news/articles/the_next_frontier_of_vaccine_innovation)

### The Next Frontier of Vaccine Innovation

Edward Jenner changed the world when he used cowpox virus to inoculate a young boy against smallpox.<sup>1</sup> Less than 200 years later, smallpox was eradicated from the Earth.<sup>2</sup> Dozens of vaccines have since been created, leading to dramatic improvements in public health as well as a marked decline in deaths due to diseases such as measles, pertussis (whooping cough), and tetanus. Imagine what Jenner would say if he knew that at least two vaccines now help prevent cancers!<sup>3</sup> Or that the world's scientists developed multiple highly effective COVID-19 vaccines approximately one year after clinicians first reported cases of a then-unknown viral illness?

Vaccine innovations have paved the way toward improved human health and will continue to do so. "So much has been achieved, yet we are only scratching the surface of the potential vaccines hold," says Nanette Cocero, PhD, Global President of Pfizer Vaccines. Here are three areas to watch as we enter the next frontier of vaccine innovation: mRNA Technology

In 2021, the Pfizer and BioNTech COVID-19 vaccine became the first mRNA product to achieve full approval from the U.S. Food and Drug Administration. Traditionally, vaccines have been made using the whole or part of a bacteria or virus, but mRNA technology has taken vaccine development to the next level. mRNA vaccines contain messenger RNA (that's what mRNA stands for), which is essentially a genetic blueprint that tells the body how to produce a protein

that will trigger the immune system to generate the precise antibodies and immune cells needed to destroy a particular bacteria or virus. Scientists have been exploring the potential of mRNA for a long time. That's one reason COVID-19 vaccines were developed so quickly. Another reason: mRNA molecules are easier to produce in the laboratory than the proteins or viral fragments used in other types of vaccines, which means that mRNA vaccines can be manufactured more rapidly.<sup>4</sup> This ease of production can also make it easier to change mRNA vaccines if a new viral strain emerges. Expect more mRNA vaccines in the future. Pfizer has already launched Phase 1 clinical trials of mRNA influenza vaccines.<sup>5</sup> Pfizer and BioNTech are also working to co-develop the first-ever mRNA-based vaccine for shingles, a disease that currently infects one in three Americans during their lifetimes, according to the CDC, and causes significant pain, suffering, and even death.<sup>6</sup> "A shingles vaccine with improved tolerability and scalability could make a significant impact globally," Cocero says.

Maternal Vaccination  
Pregnant individuals are at higher risk of vaccine-preventable disease than non-pregnant individuals. Very young infants are also especially susceptible to infectious diseases because their immune systems are immature. Because pregnant people naturally share antibodies with fetuses via the placenta during pregnancy, vaccinating individuals during pregnancy has "emerged as a promising tool to tackle infant morbidity and mortality worldwide," according to a 2020 article published in *Frontiers in Microbiology*.<sup>7</sup> Since 2012, the CDC and American College of Obstetricians and Gynecologists (ACOG) have recommended that pregnant individuals receive a Tdap (tetanus, diphtheria, and pertussis vaccination) during the third trimester so that infants are born with protection against pertussis in their first months of life when they are extremely vulnerable to serious whooping cough disease.<sup>8</sup> Widespread maternal vaccination for pertussis can decrease infant deaths, as nearly 70% of all pertussis deaths in the U.S. currently occur in babies who are too young for childhood vaccination.<sup>9</sup> Another disease that disproportionately affects young infants is respiratory syncytial virus (RSV). As is the case with many infectious diseases, RSV can cause serious respiratory infection in infants and older adults. Infants under six months of age are at especially high risk due to their immature immune systems and their small airways. One to two out of every 100 children younger than 6 months of age with RSV may need to be hospitalized for difficulty breathing.<sup>10</sup> Pfizer is pioneering the development of a maternal vaccine to prevent RSV infection in infants, as well as a vaccine to prevent group B streptococcal (GBS) infection in newborns. "Group B strep is an infectious disease that has been associated with preterm births and stillbirths, and can cause meningitis, pneumonia, and bloodstream infections in babies," says Yasmeen Agosti, MD, Vice President, Global Maternal Immunization Franchise Medical Lead at Pfizer. Healthcare providers currently screen pregnant people for group B strep and administer antibiotics during labor if GBS is detected, but some babies still go on to develop this invasive disease. In addition, screening and intrapartum antibiotics as a prevention strategy has not been able to prevent late-onset group-B strep disease in infants. "Maternal vaccination has the potential to fight RSV, Group B strep, and



other common infant infectious diseases, including herpes simplex and cytomegalovirus,” Cocero says. “We look forward to more research and development in this space.” Vaccine Delivery Ensuring equitable access to vaccines can improve global well-being. Vaccine manufacturers, clinicians, politicians, business leaders, and engineers are working together to create and fund innovative vaccine delivery systems that will get vaccines to the people who need them. “There are still many people around the world who don’t have access to medicines and vaccines, and these ‘last mile’ communities face poorer health outcomes as a result,” Cocero says. “Innovation is crucial to closing this gap, and groundbreaking technology has offered a glimpse of what can be achieved.” In 2021, drones successfully delivered mRNA COVID-19 vaccines—vaccines that must be kept ultra-cold during transport – to rural Ghana.11 Watch for additional technological innovations that will assure timely delivery of essential vaccines to vulnerable locales.

## Johns Hopkins 23

<https://publichealth.jhu.edu/2023/game-changing-vaccine-developments>

“The Big Catch-Up,” the theme of this year’s World Immunization Week (April 24-30), is both a reference to the state of global immunizations following the acute phase of the COVID-19 pandemic and a call to action. The annual

observance “comes at a critical time” said William J. Moss, MD, MPH, moderator of a recent panel on potentially game-changing vaccine developments in honor of WIW. Because of COVID-19, “[immunization] levels decreased in more than 100 countries with millions of children missing out on lifesaving protection ... It’s critical that we restore immunization services.”

The pandemic also made possible the potential for real innovation in terms of the technology, evaluation, and speed with which vaccines come to the market, Moss pointed out. It’s a good time to take stock. In the webinar, five public health experts presented exciting advances in the world of vaccines—some of which could help facilitate “The Big Catch-Up,” and perhaps even leapfrog the field beyond the previous status quo. These include microarray patches and new advances in much-needed vaccines for malaria, RSV, tuberculosis, and Shigella. There’s also interplay between these advances. As we learned with COVID, breakthroughs in vaccines for one disease can lend knowledge and problem-solving to others. INNOVATION 1: Microarray Patches Could Deliver Vaccines Virtually AnywhereMicroarray patches have “the potential to revolutionize accessibility,” said Brigitte Giersing, PhD, who leads the Vaccine Prioritization and Platform work within the WHO’s Immunization Department. In LMICs, which are disproportionately affected by many vaccine-preventable diseases, both cost and logistics present considerable challenges to immunization programs. More than half of the price tag required to vaccinate a child is “generated in the last mile,” Giersing said. That’s due to the costs of shipping and storing vaccines at cold temperatures upon arrival, then the mixing and administration by a registered health professional in a clinical setting. Then there are the logistics of actually getting shots into arms, which can be challenging in remote locations where health care might not be accessible. Microarray patches, or MAPs, are coin-sized patches covered either with tiny needles coated in dry vaccine that painlessly penetrate the skin or a formula that dissolves when the patch is pressed onto the skin for 2-5 minutes. These patches don’t require cold temperatures, weigh significantly less than vials requiring needles and syringes, don’t require any mixing, and can be given by untrained community health workers in almost any conditions. Plus, there’s a needle-free advantage of painless delivery, upping the odds that people will get all of the vaccinations they need. Importantly, although MAP vaccines would be more expensive to purchase up front than needle-and-syringe vaccines, said Giersing, the overall price tag would be lowered by eliminating many of the costlier factors of that “last mile.” There are currently two MAPs in the market pipeline: one for measles and one for rubella. Two important next steps, Giersing said, are to evaluate where and in what circumstances MAPs would most likely be used—i.e., for routine, seasonal, or other kinds of immunizations and in what countries or settings—and then leverage those use cases to spur commercial partnerships between vaccine manufacturers and MAP developers. Ultimately, “the public health and socioeconomic impacts of vaccinating groups you couldn’t previously reach” can’t be ignored, said Giersing, and there’s high interest in many lower- and middle-income countries. Ethiopia, for example, is looking for “a full switch from needle-and-syringe for routine immunizations,” and it’s likely other countries may follow suit. INNOVATION 2: Two Shelf-Stable Malaria VaccinesResearchers have been trying to develop a malaria vaccine for over 100 years, but “it’s been pretty tough,” said Dr. Adrian Hill, director of the Jenner Institute at Oxford University. “You need exceptionally high titres of antibodies to protect against any stage of the parasite’s life cycle,” which is hard to achieve. Two vaccines are now showing promise, however: RTS,S and R21/Matrx-A, both of which target a specific protein on the malaria parasite. Although both require four doses to achieve the immune response needed to fight off an infection, the vaccines showed efficacy of 67-75% in adults and up to 80% in children aged 5 to 17 months. Both have met safety standards and vaccinated people maintained good antibody levels for more than two years after the primary series. Even better: RTS,S and R21/Matrx-A don’t require sub-zero storage temperatures. R21/Matrx-A, in particular, has a long shelf life, comes in a single vial that doesn’t need to be mixed, and can withstand temperatures up to 104°F for two weeks, making it extremely portable in countries where malaria is endemic. Ghana and Nigeria have both approved the vaccine for use in children aged 5 months to 3 years, and in 2021 the WHO recommended RTS,S to all children under two in sub-Saharan Africa. INNOVATION 3: RSV Vaccines Could Put a Major Dent in Global Hospitalization“2023 is the year of RSV!” Ruth Karron, MD, professor in International Health said, in terms of licensure and, hopefully, deployment of new products. As we saw this past winter, RSV poses a significant threat to very young children and elderly adults in every country in the world, but the majority of hospitalizations and deaths occur in LMICs where care options may be limited at best and first come, first served at worst. There are currently three strategies to mitigate RSV/Passive immunization, which involves vaccinating pregnant women so they can pass on antibodies to the fetus. “Immunization” of infants with a single dose of monoclonal antibodies. Live attenuated or mRNA vaccines for infants, toddlers, and older adults. There are advancements across all three. The maternal RSVpreF vaccine from Pfizer, which was given to pregnant women at 24-36 weeks’ gestation during Phase III clinical trials, saw 70-80% protection against severe disease for infants up to 6 months after birth. Two monoclonals, arexmate and clesrovimab, in late-stage development show “high efficacy against all endpoints,” Karron said, which includes lower-respiratory tract infections, hospitalizations, and deaths. Both have been submitted to the FDA, and it’s anticipated that the new products will be on the market by the end of 2023. Several vaccine candidates for the young and elderly passed Phase 3 clinical trials, and two have applied for licensure from the FDA which has already given favorable reviews. But there are challenges with uptake to consider: Maternal vaccination rates in the U.S. for flu and Tdap are already abysmal, so it’s unclear what the demand would be for an RSV vaccine. Deployment strategies could get more bang for the buck by targeting countries where there are often severe shortages of hospital beds for children during RSV/respiratory virus seasons. INNOVATION FOUR: A Slow Process for a New TB Vaccine Creates Opportunities to Build Demand Ahead of TimeThe WHO’s End TB Strategy calls for reducing new cases by 80% and deaths by 70% before 2035, said Rupal Limaye, PhD, MPH, an associate scientist in International Health with joint appointments in Health, Behavior and Society and Epidemiology. If there’s not enough investment in new treatments and vaccines to meet these targets, she said, we could see 43 million people develop TB and 6.6 million die by then, totaling \$1 trillion in economic costs. There’s currently one TB vaccine on the market—Bacille Calmette-Guérin, or BCG—a live, attenuated (weakened) vaccine with so-so efficacy (18% against infection, and a 70% reduction in deaths but only through age 15) and limited use, as it’s not safe for those with HIV—a key population of people at risk of TB. A bacillus vaccine won’t move the needle towards ending TB but there are significant challenges inherent to cooking up a new TB vaccine. One is that there’s limited knowledge about the human protective immune response to TB. Another is a lack of animal models that can accurately predict how humans may respond, which significantly hampers a critical step in vaccine development. Other challenges include a lack of clear correlates that relate to protection (for example, the presence of a specific titer in the blood that can indicate higher immunity levels), the need for large and expensive trials to do all of this work, and a disproportionate lack of funding priority from international groups despite TB’s incredible burden. A TB vaccine pipeline with several candidates in Phase III clinical trials does exist. That process is slow and it’s unlikely we’ll see a new TB vaccine brought to market this year, Limaye said, but this offers another opportunity to start building demand “vaccines do not save lives, vaccinations do.” Limaye said, and now is an opportune time to restore trust in vaccines and apply lessons learned from the COVID-19 vaccine rollouts during the pandemic, while waiting for a TB vaccine to come to market, there’s time to collect and evaluate data around misinformation, mistrust in science, and look at what makes for successful vaccine campaigns. “Behavioral and social data collection is important to help prepare countries so once a vaccine is available people are interested in/able to access it.” INNOVATION FIVE: Considering Dual Markets for Shigella VaccinesShigella is the second leading cause of diarrheal deaths worldwide and the most common bacterial cause of moderate-to-severe diarrhea in children under 5, said Kwame Talat, MD, an associate professor in International Health and co-director of clinical research at the Johns Hopkins Institute for Vaccine Safety. In addition to huge numbers of infections in children in LMICs, Shigella infects travelers and is “a significant antimicrobial threat” all over the world, making it an excellent candidate for vaccine development. It’s been nearly 100 years since the first attempts at Shigella vaccines. A few things have stood in the way: first, the fact that Shigella vaccines must be “quasulicent,” or containing four different serotypes in order to protect against the majority of strains. Second, oral vaccines showed less efficacy in LMICs so needle-and-syringe vaccines would most likely be needed. Finally, many attempts have resulted in vaccines that cause too many side effects or aren’t effective, so there’s little incentive for manufacturers to invest time or money in creating a low-cost vaccine but there are some potential solutions, Talat said. First, presenting a “dual market” for the vaccines to include children in LMICs and travelers from higher-income countries to those same LMICs. Travelers could pay more for the vaccine which might offset costs for children. Another idea is to create a combination vaccine that protects against other diarrheal diseases that could work for both populations in a dual-market solution. With these

In mind, Talat said, there are some promising candidates in clinical trials and she hopes there will be something brought to market in the next five to 10 years. Bottom Line: Vaccine Innovations Save Lives

New methods of delivery, shelf-stable formulas, consideration of benefits of a vaccine campaign beyond preventing disease in an individual, creating robust communications to build vaccine demand, and tapping into new and innovative markets can all build global momentum towards better immunization coverage. “We’re looking towards the future where we can protect millions of more lives from malaria, TB, RSV, and Shigella,” Moss concluded.



## C2 : Inequality

### AI is fundamentally biased

#### O'grady '24

Cathleen O'Grady is a South African science journalist based in Scotland. She has a Ph.D. in cognitive science from the University of Edinburgh, where she studied evolutionary linguistics at the Centre for Language Evolution. Her work has appeared in The Atlantic, National Geographic, FiveThirtyEight, Hakai, and The Guardian, among others. Cathleen covers behavioral and life sciences, climate and environment, and science policy. <https://www.science.org/content/article/ai-makes-racist-decisions-based-dialect>

Just like humans, artificial intelligence (AI) is capable of saying it isn't racist, but then acting as if it were. Large language models (LLMs) such as GPT4 output racist stereotypes about speakers of African American English (AAE), even when they have been trained not to connect overtly negative stereotypes with Black people, new research has found. According to the study—published today in Nature—LLMs also associate speakers of AAE with less prestigious jobs, and in imagined courtroom scenarios are more likely to convict these speakers of crimes or sentence them to death.

“Every single person working on generative AI needs to understand this paper,” says Nicole Holliday, a linguist at the University of California, Berkeley who was not involved with the study. Companies that make LLMs have tried to address racial bias, but “when the bias is covert ... that's something that they have not been able to check for,” she says.

For decades, linguists have studied human prejudices about language by asking participants to listen to recordings of different dialects and judge the speakers. To study linguistic bias in AI, University of Chicago linguist Sharese King and her colleagues drew on a similar principle. They used more than 2000 social media posts written in AAE, a variety of English spoken by many Black Americans, and paired them with counterparts written in Standardized American English. For instance, “I be so happy when I wake up from a bad dream cus they be feelin too real,” was paired with, “I am so happy when I wake up from a bad dream because they feel too real.” King and her team fed the texts to five different LLMs—including GPT4, the model underlying ChatGPT—along with a list of 84 positive and negative adjectives used in past studies about human linguistic prejudice. For each text, they asked the model how likely each adjective was to apply to the speaker—for instance, was the person who wrote the text likely to be alert, ignorant, intelligent, neat, or rude? When they averaged the responses across all the different texts, the results were stark: The models overwhelmingly associated the AAE texts with negative adjectives, saying the speakers were likely to be dirty, stupid, rude, ignorant, and lazy. The team even found that the LLMs ascribed negative stereotypes to AAE texts more consistently than human participants in similar studies from the pre-Civil Rights era.

Creators of LLMs try to teach their models not to make racist stereotypes by training them using multiple rounds of human feedback. The team found that these efforts had been only partly successful: When asked what adjectives applied to Black people, some of the models said Black people were likely to be “loud” and “aggressive,” but those same models also said they were “passionate,” “brilliant,” and “imaginative.” Some models produced exclusively positive, nonstereotypical adjectives. These findings show that training overt racism out of AI can’t counter the covert racism embedded within linguistic bias, King says, adding: “A lot of people don’t see linguistic prejudice as a form of covert racism ... but all of the language models that we examined have this very strong covert racism against speakers of African American English.” The findings highlight the dangers of using AI in the real world to perform tasks such as screening job candidates, says co-author Valentin Hofmann, a computational linguist at the Allen Institute for AI. The team found that the models associated AAE speakers with jobs such as “cook” and “guard” rather than “architect” or “astronaut.” And when fed details about hypothetical criminal trials and asked to decide whether a defendant was guilty or innocent, the models were more likely to recommend convicting speakers of AAE compared with speakers of Standardized American English. In a follow-up task, the models were more likely to sentence AAE speakers to death than to life imprisonment. Although humans aren’t facing AI juries just yet, LLMs are being used in some real-world hiring processes—for instance, to screen applicants’ social media—and some law enforcement agencies are [experimenting with using AI to draft police reports](#). “Our results clearly show that doing so bears a lot of risks,” Hofmann says. The findings are not unexpected, but they are shocking, says Dartmouth College computer scientist Soroush Vosoughi, who was not involved with the paper. Most worrying, he says, is the finding that larger models—which have been shown to have less overt bias—had even worse linguistic prejudice. Measures to address overt racism could be creating a “false sense of security,” he says, by addressing explicit prejudices while embedding more covert stereotypes. Vosoughi’s own work has found [AIs show covert biases against names and hobbies stereotypically associated with particular groups, such as Black or LGBTQ+ people](#). There are countless other possible covert stereotypes, meaning trying to stamp them out individually would be a game of Whac-A-Mole for LLM developers. The upshot, he says, is that AI can’t yet be trusted to be objective, given that the very data it’s being trained on are tainted with prejudice. “For any social decision-making,” he says, “I do not think these models are anywhere near ready.”

### **Predictive AI is racist :(**

#### **Pham 24**

Hoang Pham et al, 6-29-2024, [Hoang Pham is the Director of Education and Opportunity at the Stanford Center for Racial Justice at Stanford Law School, where he leads research and policy initiatives to address entrenched racial inequities in the U.S. education system and promote economic mobility. Tanvi Kohli (JD ’26) is a Research Assistant at the Stanford Center for Racial Justice interested in international human rights and environmental justice. Emily Olick Llano (MA ’24) is a Summer Fellow at the Stanford Center for Racial Justice interested in the intersection of immigration, post-secondary access, and policy. Imani Nokuri (JD ’25) is a Research Assistant at the Stanford Center for Racial Justice interested in the intersections of race and technology. Anya Weinstock (JD ’24) was an Advanced Clinic student in the Stanford International Human Rights and Conflict Resolution Clinic and is interested in international human rights

and technology law and policy.] "How will AI Impact Racial Disparities in Education?," Stanford Law School, <https://law.stanford.edu/2024/06/29/how-will-ai-impact-racial-disparities-in-education/>, accessed 2-12-2025 //rqli

AI algorithms may **exacerbate racial disparities in education** when developers input historical data into the technology that **replicate pre-existing biases** that the model is trained to believe are accurate. For example, predictive analytical tools in education use data, statistical algorithms, and machine learning to help educators **support students** on their academic and professional journeys. **These predictive analytical tools also play a role in determining the likelihood of future student success.** Nevada is one of six states where every district uses Infinite Campus, a **program that tracks students' attendance**, behavior, and grades to support an "early-warning system" that "employs a machine-learning algorithm to assess the likelihood that each student whose data enters the system will or will not graduate." While these tools are intended to assist educators in improving outcomes for students, **predictive analytics often rate racial minorities as less likely to succeed academically.** This is because race is included as a risk factor in the algorithms and treated as an indicator of success or failure **based on the historical performance** of students with those identities. For example, an analysis conducted in 2021 found that **Wisconsin's Dropout Early Warning System**, which uses race as a data point to predict the likelihood a student will graduate high school on time, **generated false alarms** about Black and Latino students **"at a significantly greater rate than it did for their White classmates."** This false alarm rate, defined as "how frequently a student [the algorithm] predicted wouldn't graduate on time actually did graduate on time," was **42% higher for Black students than White students.** Instead of clarifying what extra support students need, risk scores tend to have a negative influence on how teachers perceive students and students' own beliefs about their academic potential. Universities are also using algorithms, for example, in the admissions process to determine the likelihood a student is admitted, how much financial aid they should receive, and whether they decide to enroll. Admissions algorithms **use a university's admissions criteria** and historical admissions data, comparing them with an applicant's transcript, essay answers, and even recorded interviews to assist an admissions officer in streamlining admissions decisions, often by sorting applicants into tiers based on their likelihood of admission. Companies such as OneOrigin, Student Select, and Transparency in Education **offer algorithmic tools to universities and students** that claim to improve efficiency, cut costs, increase admissions yield, and provide transparency to applicants. However, critics argue that because AI algorithms use historical data to make predictions they are more prone to producing **discriminatory outcomes.** For example, **AI enrollment algorithms use a college's past applicant data**—including high school GPA, standardized test scores, socioeconomic status, zip code, and even how frequently applicants attended college recruitment events—to **help determine** levels of **scholarship funding** and the likelihood of enrollment for future students. Although these data inputs are race-neutral and used for a legitimate reason (i.e. predicting the likelihood a student will enroll, which helps with ensuring course availability), the AI tool can nonetheless produce disparate racial impacts. **For example, because Black and Latino students have historically scored lower on the math section of the SAT** than White and Asian students, the **AI algorithm may allocate more scholarship funding to White and Asian students** than Black and Latino students.

[jennings needs to go here]

## Education is where inequality starts

### Ireland 16

— Corydon Ireland (journalist); this is based on interviews with Harvard professor of economics Roland Fryer, Harvard Graduate School of Education Dean James E. Ryan, Ronald Ferguson, adjunct lecturer in public policy at Harvard Kennedy School and faculty director of Harvard's Achievement Gap Initiative, Robert Putnam, the Peter and Isabel Malkin Professor of Public Policy at Harvard Kennedy School, and Harvard economist Lawrence Katz, "The Costs of Inequality: Education is the Key to It All, US News & World Report, 2-16-2016, <https://www.usnews.com/news/articles/2016-02-16/the-costs-of-inequality-education-is-the-key-to-it-all>

If **inequality starts** anywhere, many scholars agree, it's **with faulty education.** Conversely, a strong **education can** act as the bejeweled key that **opens gates through every other aspect of inequality**, whether political, economic, racial, judicial, gender- or health-based. Simply put, a top-flight education usually changes lives for the better. And yet, **in the world's most prosperous major nation, it remains an elusive goal for millions of children and teenagers.** Plateau on Educational Gains The revolutionary concept of free, nonsectarian public schools spread across America in the 19th century. By 1970, America had the world's leading educational system, and **until 1990 the gap between minority and white students**, while clear, **was narrowing.** **But educational gains in this country have plateaued since then, and the gap between white and minority students has proven stubbornly difficult to close,** says Ronald Ferguson, adjunct lecturer in public policy at Harvard Kennedy School and faculty director of Harvard's Achievement Gap Initiative. **That gap extends along class lines as well.** In recent years, scholars such as Ferguson, who is an economist, have puzzled over the ongoing achievement gap and what to do about it, even as other nations' school systems at first matched and then surpassed their U.S. peers. Among the 34 market-based, democracy-leaning countries in the Organization for Economic Cooperation and Development (OECD), **the United States ranks around 20th annually, earning average or below-average grades in reading, science, and mathematics.** **By eighth grade, Harvard economist Roland G. Fryer Jr. noted last year, only 44 percent of American students are proficient in reading and math. The proficiency of African-American students, many of them in underperforming schools, is even lower.** Education Gap: The Root of Inequality **Education may be the key to solving broader American inequality,** but we have to solve educational inequality first. Ferguson says there is progress being made, **there are encouraging examples to emulate, that an early start is critical, and that a lot of hard work lies ahead.** But he also says, "There's nothing more important we can do." "The position of U.S. black students is truly alarming," wrote Fryer, the Henry Lee Professor of Economics, who used the OECD rankings as a metaphor for minority standing educationally. "If they were to be

considered a country, they would rank just below Mexico in last place." Harvard Graduate School of Education Dean James E. Ryan, a former public interest lawyer, says geography has immense power in determining educational opportunity in America. As a scholar, he has studied how policies and the law affect learning, and how conditions are often vastly unequal. His book "Five Miles Away, A World Apart" (2010) is a case study of the disparity of opportunity in two Richmond, Virginia, schools, one grimly urban and the other richly suburban. Geography, he says, mirrors achievement levels. A ZIP Code as Predictor of Success "Right now, there exists an almost ironclad link between a child's ZIP code and her chances of success," said Ryan. "Our education system, traditionally thought of as the chief mechanism to address the opportunity gap, instead too often reflects and entrenches existing societal inequities." The Costs of Inequality: When a Fair Shake Isn't Fair Enough Urban schools demonstrate the problem. In New York City, for example, only 8 percent of black males graduating from high school in 2014 were prepared for college-level work, according to the CUNY Institute for Education Policy, with Latinos close behind at 11 percent. The preparedness rates for Asians and whites — 48 and 40 percent, respectively — were unimpressive, too, but nonetheless were firmly on the other side of the achievement gap. In some impoverished urban pockets, the racial gap is even larger. In Washington, D.C., 8 percent of black eighth-graders are proficient in math, while 80 percent of their white counterparts are. Fryer said that in kindergarten black children are already 8 months behind their white peers in learning. By third grade, the gap is bigger, and by eighth grade is larger still. According to a recent report by the Education Commission of the States, black and Hispanic students in kindergarten through 12th grade perform on a par with the white students who languish in the lowest quartile of achievement. There was once great faith and hope in America's school systems. The rise of quality public education a century ago "was probably the best public policy decision Americans have ever made because it simultaneously raised the whole growth rate of the country for most of the 20th century, and it leveled the playing field," said Robert Putnam, the Peter and Isabel Malkin Professor of Public Policy at Harvard Kennedy School, who has written several best-selling books touching on inequality, including "Bowling Alone: The Collapse and Revival of the American Community" and "Our Kids: The American Dream in Crisis." Historically, upward mobility in America was characterized by each generation becoming better educated than the previous one, said Harvard economist Lawrence Katz. But that trend, a central tenet of the nation's success mythology, has slackened, particularly for minorities. "Thirty years ago, the typical American had two more years of schooling than their parents. Today, we have the most educated group of Americans, but they only have about .4 more years of schooling, so that's one part of mobility not keeping up in the way we've invested in education in the past," Katz said. As globalization has transformed and sometimes undercut the American economy, "education is not keeping up," he said. "There's continuing growth of demand for more abstract, higher-end skills" that schools aren't delivering, "and then that feeds into a weakening of institutions like unions and minimum-wage protections." Fryer is among a diffuse cohort of Harvard faculty and researchers using academic tools to understand the achievement gap and the many reasons behind problematic schools. His venue is the Education Innovation Laboratory, where he is faculty director. "We use big data and causal methods," he said of his approach to the issue. Fryer, who is African-American, grew up poor in a segregated Florida neighborhood. He argues that outright discrimination has lost its power as a primary driver behind inequality, and uses economics as "a rational forum" for discussing social issues. Better Schools to Close the Gap Fryer set out in 2004 to use an economist's data and statistical tools to answer why black students often do poorly in school compared with whites. His years of research have convinced him that good schools would close the education gap faster and better than addressing any other social factor, including curtailing poverty and violence, and he believes that the quality of [K-12] kindergarten through grade 12 matters above all. Supporting his belief is research that says the number of schools achieving excellent student outcomes is a large enough sample to prove that much better performance is possible. Despite the poor performance by many U.S. states, some have shown that strong results are possible on a broad scale. For instance, if Massachusetts were a nation, it would rate among the best-performing countries. At Harvard Graduate School of Education, where Ferguson is faculty co-chair as well as director of the Achievement Gap Initiative, many factors are probed. In the past 10 years, Ferguson, who is African-American, has studied every identifiable element contributing to unequal educational outcomes. But lately he is looking hardest at improving children's earliest years, from infancy to age 3. Partly through an organization he founded called the Tripod Project, he launched the Boston Basics project in August, with support from the Black Philanthropy Fund. The first phase of the outreach campaign, a booklet and spot ads, starts with advice to parents of children a year old or younger. "Maximize love, manage stress" is its mantra and its foundational imperative, followed by concepts such as "talk, sing, and point." ("Talking," said Ferguson, "is teaching.") In early childhood, "The difference in life experiences begins at home." At Age 1, Children Score Similarly Fryer and Ferguson agree that the achievement gap starts early. At age 1, white, Asian, black, and Hispanic children score virtually the same in what Ferguson called "skill patterns" that measure cognitive ability among toddlers, including examining objects, exploring purposefully and "expressive jabbering." But by age 2, gaps are apparent, with black and Hispanic children scoring lower in expressive vocabulary, listening comprehension and other indicators of acuity. That suggests educational achievement involves more than just schooling, which typically starts at age 5. Key factors in the gap, researchers say, include poverty rates (which are three times higher for blacks than for whites), diminished teacher and school quality, unsettled neighborhoods, ineffective parenting, personal trauma, and peer group influence, which only strengthens as children grow older. "Peer beliefs and values," said Ferguson, get "trapped in culture" and are compounded by the outsized influence of peers and the "pluralistic ignorance" they spawn. Fryer's research, for instance, says that the reported stigma of "acting white" among many black students is true. The better they do in school, the fewer friends they have — while for

whites who are perceived as smarter, there's an opposite social effect. Fryer suspects that peer behavior among minorities was adversely affected by two main factors: the fading aspirational effects of the Civil Rights Movement that worked to the advantage of children in the 1960s, and the emergence of gangster rap culture in the 1980s. The researchers say that family upbringing matters, in all its crisscrossing influences and complexities, and that often undercuts minority children, who can come from poor or troubled homes. "Unequal outcomes," he said, "are from, to a large degree, inequality in life experiences." Trauma also subverts achievement, whether through family turbulence, street violence, bullying, sexual abuse, or intermittent homelessness. Such factors can lead to behaviors in school that reflect a pervasive form of childhood post-traumatic stress disorder. At Harvard Law School, both the Trauma and Learning Policy Initiative and the Education Law Clinic marshal legal aid resources for parents and children struggling with trauma-induced school expulsions and discipline issues. At Harvard Business School, Karim R. Lakhani, an associate professor who is a crowdfunding expert and a champion of open-source software, has studied how unequal racial and economic access to technology has worked to widen the achievement gap. At Harvard's Project Zero, a nonprofit called the Family Dinner Project is scraping away at the achievement gap from the ground level by pushing for families to gather around the meal table, which traditionally was a lively and comforting artifact of nuclear families, stable wages, close-knit extended families and culturally shared values. Lynn Barendsen, the project's executive director, believes that shared mealtimes improve reading skills, spur better grades and larger vocabularies, and fuel complex conversations. Interactive mealtimes provide a learning experience of their own, she said, along with structure, emotional support, a sense of safety, and family bonding. Even a modest jump in shared mealtimes could boost a child's academic performance, she said. The Rich and the Rest "We're not saying families have to be perfect," she said, acknowledging dinnertime impediments like full schedules, rudimentary cooking skills, the lure of technology, and the demands of single parenting. "The perfect is the enemy of the good." Whether poring over Fryer's big data or Barendsen's family dinner project, there is one commonality for Harvard researchers dealing with inequality in education: the issue's vast complexity. The achievement gap is a creature of interlocking factors that are hard to unpack constructively. Going Wide, Starting Early With help from faculty co-chair and Jesse Climenko Professor of Law Charles J. Ogletree, the Achievement Gap Initiative is analyzing the factors that make educational inequality such a complex puzzle: home and family life, school environments, teacher quality, neighborhood conditions, peer interaction, and the fate of "all those wholesome things," said Ferguson. The latter include working hard in school, showing respect, having nice friends, and following the rules, traits that can be "elements of a 21st-century movement for equality." In the end, best practices to create strong schools will matter most, said Fryer. He called high-quality education "the new civil rights battleground" in a landmark 2010 working paper for the National Bureau of Economic Research called "Racial Inequality in the 21st Century: The Declining Significance of Discrimination." Fryer tapped 10 large data sets on children 8 months to 17 years old. He studied charter schools, scouring for standards that worked. He champions longer school days and school years, data-driven instruction, small-group tutoring, high expectations, and a school culture that prizes human capital — all just "a few simple investments," he wrote in the working paper. "The challenge for the future is to take these examples to scale" across the country. How long would closing the gap take with a national commitment to do so? A best-practices experiment that Fryer conducted at low-achieving high schools in Houston closed the gap in math skills within three years, and narrowed the reading achievement gap by a third. "You don't need Superman for this," he said, referring to a film about Geoffrey Canada and his Harlem Children's Zone, just high-quality schools for everyone, to restore 19th-century educator Horace Mann's vision of public education as society's "balance-wheel."

## Inequality is bad

Joseph E.

### Stiglitz, Columbia Professor, 14.

University Professor, Columbia University. "The Price of Inequality: How Today's Divided Society Endangers our Future." <http://www.pas.va/content/dam/accademia/pdf/es41/es41-stiglitz.pdf>

2. The second observation entails looking at the current levels of inequality in a historical context. While I have emphasized the growth of inequality in the last third of a century, Thomas Piketty in his recent book notes that the preceding four decades should perhaps be viewed as an historical anomaly: we are returning to the high levels of inequality that prevailed in the 19th century and in the 20th in the years before the Great Depression. Piketty concludes that inequality is likely to get worse.<sup>13</sup> I will comment on this forecast later. But his analysis has some profound implications: it means that Kuznets's optimism that increasing inequality in the initial process of development gives way to a decrease (an idea referred to as the Kuznets curve),<sup>14</sup> may well be wrong. Countries should not accept increasing inequality today, in the blind faith that it will eventually be reversed.

3. The third observation is that much of the inequality at the top cannot be justified as "just deserts" for the large contributions that these individuals have made. If we look at those at the top, they are not those who have made the major innovations that have transformed our economies and societies; they are not the discoverers of DNA, the laser, the transistor; not the brilliant individuals who made the discoveries without which we would not have had the modern computer. Disproportionately, they are those who have



excelled in rent seeking, in wealth appropriation, in figuring out how to get a larger share of the nation's pie rather than enhancing the size of that pie. (Such rent seeking activity typically actually results in the size of the economic pie shrinking from what it otherwise would be). Among the most notable of these are, of course, those in the financial sector, some of whom made their wealth by market manipulation, by engaging in abusive credit card practices, predatory lending, moving money from the bottom and middle of the income pyramid to the top. So too, a monopolist makes his money by contracting output from what it otherwise would be, not by expanding it.

The inaptness of the “just deserts” argument was shown by the Great Recession, a recession which in no small measure was caused by the financial sector, which itself is responsible for so much of the inequality today. Even as they were bringing their firms and the global economy to the brink of ruin, the managers of these firms walked off with multimillion dollar bonuses.

The notion that large fractions of today's inequality are associated with rent seeking is supported by a look at the composition of the wealthiest and top income earners. But there is additional evidence. Three striking aspects of the evolution of the American economy (and the economies of other wealthy countries) in the last 35 years are (a) the increase in the wealth-to-income ratio; (b) the stagnation of median wages; and (c) the failure of the return to capital to decline. Standard neoclassical theories, in which “wealth” is equated with “capital”, would suggest that the increase in capital should be associated with a decline in the return to capital and an increase in wages. The failure of wages to increase has been attributed by some (especially in the 1990s) to skill-biased technological change, which increased the premium put by the market on skills. Hence, those with skills saw their wages rise, and those without skills saw them fall. But recent years have seen a decline in the wages paid even to skilled workers. Something else must be going on. While in production functions with multiple inputs (say multiple kinds of labor), an increase in capital does not necessarily increase the wages of each type of labor (capital and unskilled labor can be substitutes rather than complements), if the production function exhibits constant returns to scale (a standard assumption in neoclassical theory), then the average wage must increase.<sup>15</sup> This does not seem to be happening.

There are two alternative explanations. The first is that rents are increasing (the fraction of income that is appropriated by monopolists and by other forms of exploitation). These rents are captured by (large) owners of capital, and since they are, at least in part, marketable, the present discounted value of these rents themselves become part of “wealth”. But an increase in this form of wealth does not lead to an increase in the productivity of the economy – or to an increase in the average wage of workers; to the contrary, it reduces the amounts received.

The second is that there may be other assets – like land – that can increase in value. These assets may not be very directly related to the production of goods and services,<sup>16</sup> and indeed, with more wealth invested in these assets, there may be less invested in real productive capital. (A disproportionate part of America's savings in the years before the crisis went into the purchase of housing, which did not increase the productivity of the “real” sectors of the economy).

Monetary policies that lead to low interest rates can increase the present value of these fixed assets – an increase in the value of wealth that is unaccompanied by any increase in the flow of goods and services. By the same token, a bubble can lead to an increase in wealth – for an extended period of time – again with possibly adverse effects on the stock of “real” capital. Indeed, it is easy for capitalist economies to generate such bubbles (a fact that should be obvious from the historical record,<sup>17</sup> but which has been confirmed in theoretical models).<sup>18</sup> There has been a “correction” in the housing bubble (and in the underlying price of land); but we should not be confident that there has been a full correction. We still may be on a “bubble” trajectory.

Still another piece of evidence supporting the importance of rent-seeking is that showing that increases in taxes at the very top do not result in decreases in growth rates. If these incomes were a result of their efforts, we might have expected those at the top to respond by working less hard, with adverse effects on GDP.<sup>19</sup> Piketty's recent research has emphasized a different aspect of the “just deserts” argument: the increasing fraction of inequality arising from inheritance.

4. The idea that one shouldn't worry about inequality – because everyone will benefit as money trickles down – has been thoroughly discredited. In some ways, it would be nice if it were true, because it would mean that the average American would be doing very well today, since the country has been thrown so much money at the top. But the statistics show that trickle-down is a fallacy: while the top has been doing very well, the rest has been stagnating.

In the absence of a change in the degree of inequality, if mean income (GDP) increases, everyone can benefit. But I emphasized above that there has been a large increase in inequality, and this gives rise to an increasing disparity between the mean and the median, between what is happening on average, and what is happening to the typical individual. Those at the very top, in the 1% or the .1%, can see their income increase; while incomes for the bottom 99% (or the bottom 99.9%) can actually decrease. That is what has been happening. An economic system that only delivers for the very top is a failed economic system. If the failures were of a short duration, that would be one thing. But they have been persistent – and there is no evidence of a turnaround.

5. Some go further: it is not just that everyone will benefit from trickledown, but inequality is actually necessary for growth. One of the popular misconceptions is that those at the top are the job creators; and giving more money to them will thus create more jobs – and indeed this is the only way by which jobs can be created. This view, I believe, is fundamentally wrong: America and other countries are full of creative entrepreneurial people throughout the income distribution. What creates jobs is demand: when there is demand, firms (especially if the financial system could be made work in the way it should, providing credit to small and medium-sized enterprises) will create the jobs to satisfy that demand. But in the United States, for example, the distorted tax system provides incentives for those at the top to destroy jobs by moving them abroad.

6. In contrast to those who believe that inequality is necessary for good economic performance, recent research has shown that inequality – when it gets to the level that characterizes the US and some other countries and when it is generated in the manner that it is created in the US and some other countries – is bad for growth, stability, and economic efficiency. This was the central thrust of my book *The Price of Inequality*, where I argued that inequality was not just a moral issue, but an economic one – we were paying a high price for our inequality. This view has now become mainstream, and the IMF has produced research supporting it, and endorsed it. Thus, the IMF finds that countries with greater inequality tend to be marked by lower growth and greater instability.<sup>20</sup>

Economists used to think of there being a trade-off: we could achieve more equality, but only at the expense of giving up on overall economic performance. Now we realize that, especially given the extremes of inequality achieved in the United States and the manner in which inequality is generated, greater equality and improved economic performance are complements. By the same token, one of the reasons for the poor economic performance in many countries in recent years is the high and growing level of inequality.

This is especially true if we focus on appropriate measures of growth. If we use the wrong metrics, we will strive for the wrong things. Economic growth as measured by GDP is not enough – there is a growing global consensus that GDP does not provide a good measure of overall economic performance. What matters is whether growth is sustainable, and whether most citizens see their living standards rising year after year. This is the central message of the International Commission on the Measurement of Economic Performance and Social Progress, which I chaired.<sup>21</sup> Economists and policymakers need to focus not on what is happening on average, or to those at the top, but how the economy is performing for the typical citizen, reflected for instance in median income. We value opportunity directly, not just for the benefits which it might bring to conventionally measured GDP. And as inequality increases, so does insecurity. Everyone, even those higher up the rungs in the ladder, worry about slipping down: they know the consequences. Once this is taken into account, the surge in inequality looks every worse.

7. One of the reasons that inequality is bad for economic performance is that this growing inequality is weakening demand. The reason that inequality leads to weak demand is easy to understand: those at the bottom spend a larger fraction of their income (they need to, just to get by) than those at the top.

The problem of weak demand is compounded by the flawed responses to this weak demand by monetary authorities, by lowering interest rates, which can easily give rise to a bubble, the bursting of which leads in turn to recessions. This indeed describes what has happened in recent years. (This is not the only possible response: fiscal authorities could lower taxes on say the middle class, or increase government investments in infrastructure, technology and education. But the Bush administration took exactly the opposite strategy – lowering taxes on the rich. These responses are perhaps not a surprise: as I emphasize below, economic inequality translates into political inequality, and those at the top have a tendency to seek their own advantage).

8. There are still other reasons that inequality is bad for the economy and growth. One of the reasons is that today, inequality is associated with rent seeking, and rent seeking distorts the economy. Another is the observation made earlier that inequality of outcomes is associated with inequality of opportunity, and that means that those unfortunate enough to be born at the bottom of the income distribution are at great risk of not living up to their potential. We thus pay a price not only in terms of a weak economy today, but lower growth in the future. With nearly one in four American children growing up in poverty,<sup>22</sup> many of whom face a lack of access to adequate nutrition and education, the country's long-term prospects are being put into jeopardy.

A third is related to the corrosive effect of inequality on morale, especially when it cannot be well-justified (and as I have noted, the inequality evidenced in the United States and elsewhere cannot be justified). There is a widespread understanding of the adverse effects of corruption on morale, societal solidarity, and the functioning of the economy. But increasingly, inequality in the US is viewed as unfair, arising out of a corrupt political and economic system.

Still two further reasons are related to the political economy of inequality: societies with greater inequality are less likely to make investments in the common good, in say public transportation, infrastructure, technology, and education. The rich don't need these public facilities, and they worry that a strong government which could increase the efficiency of the economy might at the same time use its powers to redistribute. Moreover, with so many at the top making their money from financial market shenanigans and rent-seeking, we wind up with tax and other economic policies that encourage these kinds of activities rather than more productive



activities. When we tax speculators at less than half the rate that we tax workers, and when we give speculative derivatives priority in bankruptcy over workers, and when we have tax laws that encourage job creation abroad rather than at home, we wind up with a weaker and more unstable economy.

9. The ninth observation is that the weaknesses in the economy (partly caused by the high levels of inequality) have important budgetary implications. Deficits have become a central focus of policymakers in many countries. But worries about the deficit are exacerbating the real inequalities in our society; it is those at the bottom and middle that suffer the most from government cutbacks in expenditures.

The budget deficits of recent years are a result of the weak economy, not the other way around. If we had more robust growth, the budgetary situation would be far improved. That's why investments in decreasing inequality and increasing equality of opportunity make sense not only for the economy, but for the budget. When we invest in our children, the asset side of our country's balance sheet goes up, even more than the liability side: any business would see that its net worth is increased. In the long run, even looking narrowly at the liability side of the balance sheet, it will be improved, as these young people earn higher incomes and contribute more to the tax base. But if we look at these issues the wrong way, the budgetary weaknesses will lead to cutbacks in public investments – including those that help ameliorate inequality – and we reinforce the vicious circle, with lower investment in the public sector (including education) leading to a weaker economy and more inequality, and leading in turn to still lower investments and growth.

10. Countries also pay a high price for this inequality in terms of their **democracy** and the nature of their societies. A **divided society** is different – it **doesn't function** as **well**. **Democracy is undermined**, as **economic** inequality inevitably **translates into** **political inequality**. I describe in my book how the outcomes of America's politics are increasingly better described as the result of a system not of one person, one vote but of one dollar, one vote. 23 And just as we described earlier how the rules of **the economic game affect the outcomes, so too in the realm of politics**: with the **rich** having more and more **influence**, they **write the rules** of the political game to give them more power and influence, which means economic inequality gets even more translated into political inequality, and the political inequality gets translated into ever more economic inequality, in a vicious circle. The same process is occurring in other countries where the wealth and income have become stubbornly concentrated.

11. There are further adverse effects of this economic/political inequality as we view societal well-being from the broader perspective that I argued for earlier. **Special interests** have incentives and scope to **shape our society – in their interests**. Even when most citizens care about the environment, they see actions to protect the environment as costing them profits, and they use their economic and political power resist such actions. **This** has **proved to be a major impediment to dealing with** the challenges of **global warming**. But as I comment on more extensively in the second part of this paper, the costs of failing to deal with climate change and other environmental hazards are borne disproportionately by the poor.

12. With extreme inequality, **the nature of society changes** in fundamental ways. Those at the top come to believe that they are entitled to what they have. And this can lead to behaviors which themselves undermine the cohesiveness of society. **Those excluded** from prosperity begin to **expect the worst from** their **governments** and leaders. **Trust is eroded**, **along with** **civic engagement** and a sense of common purpose.

13. For those who believe we would have a better world were more countries to become committed to market economies with democracy, there are further adverse effects: Will other countries want to emulate an economic system in which most individuals' incomes are simply stagnating? A political system which seems to be captured by the wealthy?

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BD, Stith AY, Colburn L, et al.; Institute of Medicine (US). The Right Thing to Do, The Smart Thing to Do: Enhancing Diversity in the Health Professions: Summary of the Symposium on Diversity in Health Professions in Honor of Herbert W. Nickens, M.D.. Washington (DC): National Academies Press (US); 2001. Inequality in Teaching and Schooling: How Opportunity Is Rationed to Students of Color in America. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK223640/>

Despite the rhetoric of American equality, the school experiences of African-American and other "minority" students in the United States continue to be substantially separate and unequal. Few Americans realize that the U.S. educational system is one of the most unequal in the industrialized world, and that students routinely receive dramatically different learning opportunities based on their social status. In contrast to European and Asian nations that fund schools centrally and equally, the wealthiest 10% of school districts in the United States spend nearly 10 times more than the poorest 10%, and spending ratios of 3 to 1 are common within states. Poor and minority students are concentrated in the least well-funded schools, most of which are located in central cities

or rural areas and funded at levels substantially below those of neighboring suburban districts. Recent analyses of data prepared for school finance cases in Alabama, New Jersey, New York, Louisiana, and Texas have found that on every tangible measure—from qualified teachers to curriculum offerings—schools serving greater numbers of students of color had significantly fewer resources than schools serving mostly white students.

Not only do funding systems allocate fewer resources to poor urban districts than to their suburban neighbors, but studies consistently show that, *within* these districts, schools with high concentrations of low-income and “minority” students receive fewer instructional resources than others in the same district. And tracking systems exacerbate these inequalities by segregating many low-income and minority students within schools (Kozol, 1991; Taylor & Piche, 1991). In combination, policies associated with school funding, resource allocations, and tracking leave minority students with fewer and lower-quality books, curriculum materials, laboratories, and computers; significantly larger class sizes; less qualified and experienced teachers; and less access to high-quality curriculum. **The end results of these educational inequalities are increasingly tragic.** More than ever before

in our nation's history, **education is not only the ticket to economic success, but also to basic survival.** Whereas a high school dropout had two chances out of three of getting a job 20 years ago, today he or she has less than one chance out of three, and the job he or she can get pays less than half of what would have been earned 20 years earlier (WT Grant Foundation, 1988). The effects of dropping out are much worse for young people of color than for whites. In 1993, a recent school dropout who was black had only a one in four chance of being employed, whereas the odds for his or her white counterpart were about 50% (NCES, 1995, p. 88). Even recent graduates from high school struggle to find jobs. Among African-American high school graduates not enrolled in college, only 42% were employed in 1993, as compared with 72% of white graduates. **Those**

**who do not succeed in school are becoming part of a growing underclass, cut off from productive engagement in society.** In addition, working class young people and adults who were prepared for the disappearing jobs of the past teeter on the brink of downward social mobility. Because the economy can no longer absorb many unskilled workers at decent wages, **lack of education is increasingly linked to crime**

**and welfare dependency.** Women who have not finished high school are much more likely than others to be on welfare, while men are much more likely to be in prison.

National investments in the last decade have tipped heavily toward incarceration rather than education. Nationwide, during the 1980s, federal, state, and local expenditures for corrections grew by over 900%, and for prosecution and legal services by more than 1000% (Miller, 1997), while prison populations more than doubled (U.S. Department of Commerce, 1996, p. 219). During the same decade, per pupil expenditures for schools grew by only about 26% in real dollar terms, and much less in cities (NCES, 1994). The situation is worse in some parts of the country. While schools in California have experienced continuous cutbacks over the last decade, the prison population there has increased by more than 300%. In 1993, there were more African-American citizens on probation, in jail, in prison, or on parole (1,985,000) than there were in college (1,412,000) (U.S. Department of Commerce, table numbers 281 and 354, pp. 181 and 221). Increased incarceration, and its disproportionate effects upon the African-American community, are a function of new criminal justice policies and ongoing police discrimination (Miller, 1997) as well as lack of access to education. More than half the adult prison population has literacy skills below those required by the labor market (Barton & Coley, 1996), and nearly 40% of adjudicated juvenile delinquents have treatable learning disabilities that went undiagnosed in the schools (Gemignani, 1994). Meanwhile, schools have changed slowly. Most are still organized to prepare only about 20% of their students for “thinking work” —those students who are tracked very early into gifted and talented, “advanced,” or honors courses. These opportunities are least available to African-American, Latino, and Native American students.