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Introduction

A Human in the Loop

> Machines are worshipped because they are beautiful, and valued because they confer power; they are hated because they are hideous, and loathed because they impose slavery.
>
> —BERTRAND RUSSELL

> I like the dreams of the future better than the history of the past.
>
> —THOMAS JEFFERSON

> I am not sure exactly which applications will be profitable. But you never bet against technology.
>
> —YOUNG VENTURE CAPITALIST AT A BLOCKCHAIN CONFERENCE

Since the middle of the twentieth century, professors, administrators, and staff at some of the United States' most prestigious universities have been creating educational technology that has changed the way we experience and think about college education. At the same time, cogent arguments have been made that disruption from educational technology is a potent myth[1] perpetuated by elite scientists who assume they can use science and technology to improve education.[2] It is certainly true that belief in these ideas of disruption in 2025, accelerated by the financial incentives for standardization and scaling of education, guides those who are inventing these new technologies to

perpetuate a traditional style of education (e.g., listening to lectures, reading, taking tests) that favors the wealthy, Western, and already educated.[3] Digging deeper, these technologies first benefit a remarkably homogeneous group of venture capitalists, technology executives, and university administrators before they help students. This is by design: the Silicon Valley playbook calls for "keeping the networks tight and personal" to tilt the odds in favor of success. As historian Margaret O'Mara writes, "The business of entrepreneurship and VC took place not only in boardrooms and cubicles but over beers and peanuts . . . late-night coding sessions and poker games, on forty-mile bicycle rides. . . . It was a wonderful world if you were in it, and a tough place to hack into if you didn't have the time, the money, the poker skills, or the $10,000 bike."[4] Today, the elite universities that created and profit from these technologies educate the overwhelming majority of the venture capitalists and tech executives who fund and run them.

Yet there is a deeper history of these uses of educational technology, a history that predicted AI-enabled tutoring, online learning communities, and the power of teaching children to use technology as a tool to build their own knowledge. In the 1960s three institutions—Stanford, MIT, and the University of Illinois—backed significant experiments in using computers in education. Patrick Suppes at Stanford pursued a vision of the computer as an "individual Aristotle," the intellectual progenitor of intelligent tutors and instructional chatbots. Seymour Papert at MIT, an inaugural codirector (with Marvin Minsky) of the Artificial Intelligence Lab (now CSAIL), created a programming language for children so that they might use computers as a tool. And Don Bitzer, of the University of Illinois, created PLATO, a networked course distribution system that educated up to a thousand learners at once, featuring touch-

screen technology, plasma displays, and real-time communication with other users (in 1972!). Each of these experiments was revolutionary for its time, decades before the "financialization of higher education" that began in the 1990s[5] concurrent with the rise of for-profit universities as a means of saddling learners with student loan debt for the enrichment of investors.[6]

We are now in a moment when these older experiments can have greater resonance. The Covid-19 pandemic revealed the limits and the benefits of online education, generative AI has the capabilities to fulfill Suppes's vision of "individual Aristotles" providing individualized tutoring at scale, and the justifiability of higher education is at an all-time low. The power of generative AI alone should have us revisit Papert's vision that "*the child programs the computer,* and, in doing so, . . . acquires a sense of mastery over a piece of the most modern and powerful technology."[7] The ideas and practices of the earliest days of online education can be a valuable resource for designing its future and resisting the forces of financialization if those who are creating it understand the political, financial, and personal stories that have brought the field to where it is today.

Sociologists use the term "educational entrepreneurs" to define academic leaders who pursue the expansion of the funding, influence, and function of their universities and whose efforts have been responsible for the massive growth of higher education in the United States. Alexander Kindel and Mitchell Stevens have expanded the concept of "educational entrepreneurship" to mean time periods when "academic credentials can be made (into) viable solutions to social problems."[8] Adopting this framework, this book examines two periods of educational entrepreneurship, one in the 1960s and 1970s and a second beginning in 2012. Each of these periods was partially defined by the technology that enabled it: the computer, or hardware, used as an

educational tool in the 1960s and the internet and software of the 2010s that allowed first for the broad dissemination of online courses and then, shortly after, rapid assimilation of artificial intelligence into the classroom. Each of these technologies conferred power on those who were able to finance it, giving them control over how it was developed and implemented. The first part of this book reveals the history of the use of computers in education as an instrument of government authority during the Cold War, a time when many believed that education was a public good that would enable a thriving society and ensure U.S. power internationally. The second part focuses on the development of online education as a tool for universities and investors to generate revenue and expand their influence during a time when higher education was seen, increasingly, as a private investment. The differences in the social and historical contexts of these periods, and what educational entrepreneurship means in each era, reveal a set of considerations any student, parent, school, or university must keep in mind when developing and using technology to improve and extend education.

My own career has spanned both of these periods. I was hired by Pat Suppes in 2004 to work on a web-based grammar program that gave students feedback on their responses. My role was quite literally to be the "human in the loop," creating an adaptive learning experience by pushing prewritten feedback and next-question pathways in response to their work. (This software is still available, in a much-augmented form, through McGraw-Hill.)[9] As access to broadband internet expanded, our next big project was to create the Stanford Online High School,[10] which predated "Zoom School" by fourteen years. Then, in early 2012, I was hired by Andrew Ng at his new start-up, Coursera, as the mania about Massive Open Online Courses

(MOOCs) was gripping higher education. And since 2015, I have worked at the University of Pennsylvania and the University of Virginia to lead efforts to create online certificates and degrees in topics valued by industry (e.g., data science, business administration, computing, and information technology). In short, I have been an ensemble player in the transformation of online education from experimental and low status to "innovative" and "disruptive." I have also helped make wealthy institutions, venture capitalists, and more than a few professors even wealthier.

In fact, the questions that would animate the idea for this book began in the summer of 2012, when I was standing in a cramped office with a soul-sucking gray carpet at Coursera, trying not to weep at the endless flood of emails from professors at Princeton and the University of Michigan with whom I was creating their very first MOOCs. Online education wasn't new; it had been offered for decades, most publicly by the for-profit University of Phoenix. And its roots went back even further: the head of my group at Stanford, Professor Patrick Suppes, had helped establish the field of computer-assisted instruction before I was born.[11] Yet, the designs and technologies developed over the previous fifty years now were being "invented" by leading computer scientists in artificial intelligence, financed by prestigious venture capital firms, and used to offer open enrollment courses by universities that had built their reputations over hundreds of years by the high quality of students they could exclude. It seemed as though everyone had willfully forgotten all the work that had come before.

Although I spent a great deal of my time at Coursera feeling underwater, I wasn't naive enough to think that the preeminent financiers and higher education institutions backing and working

with the company were investing all this time and money to give education away for free. There had to be another angle. The most obvious motive was profit, but Coursera did not have a paywall. And the initial partner institutions (Princeton, Stanford, the University of Michigan, and the University of Pennsylvania) had newsworthy endowment wealth, so it was unlikely that they "needed" any money they might eventually make from MOOCs. And money didn't explain why no one was acknowledging the history and scholarship of the field in any meaningful way. After researching the social and historical contexts for this book, I believe the history of online education was deliberately ignored for three main reasons: innovation drives adoption (no one wants to invest in an "old" idea), venture capital profits from scale and standardization (which can leave individualization behind), and the idea of using technology to make education both more efficient and democratic consolidates power in the hands of the "disrupters" who are almost always businessmen and scientists educated at the most elite universities in the world.

The force of forgetting in educational technology should not be underestimated. One need look no further than Sal Khan, who seemingly can't help reinventing education (and announcing it in a TED Talk). In 2011, the popularity of his talk, "Let's Use Video to Reinvent Education,"[12] inspired the first highly publicized MOOCs and ignited interest in venture capital investment in educational technologies.[13] Kahn's promises about the ability of video to disrupt how people learn[14] were inspiring, so long as you were totally unaware of the ongoing experiments in computer-assisted math instruction that had been conducted over the previous decades.[15] Which, to be fair, the philanthropists and corporations that bankrolled Khan Academy probably were.

Never one to let a new technology go to waste in the service of transforming education, Khan returned to TED in April 2023 to claim, "We're at the cusp of using AI for probably the biggest positive transformation that education has ever seen. And the way we are going to do that is by giving every student on the planet an artificially intelligent but amazing personal tutor."[16] Khan gave little evidence beyond the anecdotal that an artificially intelligent tutor would be effective, nor did he address any reasonable downsides of giving an "amazing" personal chatbot to every student, including (but not limited to) devaluing teacher expertise and relationships with students, placing additional demands on teachers to understand and deploy the new technology, restricting the definition of "learning," and increasing bias and discrimination in classrooms and schools.[17]

He also did not mention (at least) three important facts.

1. Khanmigo, the amazing personal tutor, couldn't do math.[18]
2. The two-sigma effect he cited about the transformative effects of tutoring, authored by Benjamin Bloom in 1984, has been replicated only once in forty years.[19]
3. Education had already seen the power of giving students an artificially intelligent personal tutor; in fact, one widely publicized demonstration took place less than five miles away from Khan's elementary lab school.

Khan's influence on the use of technology in education is significant, and the products he is providing to students and schools systems are helpful to many. Additionally, Khan never incorporated and kept his business a nonprofit (although he draws a salary of over a million dollars a year).[20] He is clearly passionate about education, a phrase I have heard not only from Khan but from almost every edtech leader (including the

founders of edX, Coursera, Emeritus, and many of their senior staff). But why does having a passion for education and an MBA/PhD from Stanford/Harvard/MIT (or equivalent) qualify one to "disrupt" education in the first place?

There is a long history of scholarship on educational technology that rightly questions its ability to make much of a difference in addressing the educational problems of access, engagement, and relevance it seeks to solve. Currently, scholars like Larry Cuban, Roy Pea, Justin Reich, Audrey Watters, Ken Koedinger, Ryan Baker, and George Siemens, among many others, have sought to discover what technologies work in education and for whom they provide the most benefits. But universities generally don't use evidence-based research when selecting educational technology and they "buy as a pack" (i.e., do what everyone else is doing), behaviors edtech companies exploit to their own advantage. Universities also appoint innovation experts who look a lot like edtech founders and funders, which mutes questions about why venture capital and private equity find technological solutions to the educational attainment struggles of minorities, working adults, and veterans worthy of investment.

In the earliest days of computer-assisted instruction, the inventors of these technologies conducted scholarly studies themselves. Supported by their universities and government grants, and mindful of their reputations as scholars, they were not primarily motivated by profit. In this mid-twentieth century period of educational entrepreneurship, universities wanted to increase their influence and prestige and generate revenue to support faculty, curriculum, and students. In the second period of educational entrepreneurship, in the early part of this century, university professors and graduate students left the university to seek funding from venture capital, private equity, and, in Khan's case, philanthropy, where "sustainability" and "scalability"

(codes for profitability) are the main motives for investment. And while universities' aims today may be similar to those they held in the past, they are far more beholden to the market than in the previous century, when they essentially owned the technologies that were produced on their campuses.

One can compare two uses of technology in these two different eras at Stanford to see the contrast in historical context. In 1969, Stanford developed the Stanford Instructional Television Network (SITN), primarily to address the logistical challenges of transporting employed engineering students to and from Stanford's Palo Alto campus during weekdays, when they were working. By solving the logistical challenges of extending educational offerings to a new population of working learners, Stanford strengthened its connections to local technology firms and expanded its instructional reach. However, SITN was part of a more ambitious strategy to both increase the university's influence and prestige and generate revenue intended to support the expansion of the faculty, broaden the curriculum, and benefit both on-campus and off-campus students.

In 2011, this same strategy supported several Stanford professors in offering the first Massive Open Online Courses (MOOCs) to capture the public imagination. Although Stanford's aims in facilitating these initial courses were nearly identical to those for SITN, the execution of each initiative could not have been more different. While SITN was primarily homegrown—meaning the technology and designs for the program were created and controlled by the university—MOOCs were led by individual professors and financed by private capital; ultimately, the attention they received would spur hundreds of millions of dollars in investment and result in the formation of three companies whose evolving business models would begin to crack

open the purpose of the university and the value of an undergraduate degree.

The differences in these two experiments reveal a significant shift in the public perception of college: from a public good supported by the government through federal and state funding to a private investment in an individual financed through private loans. As education scholar Paul Tough said, "Over the last few decades, we've quietly changed our system from one that allowed people from working class backgrounds to get a reasonably priced education that would improve their opportunities, to a system with dramatically reduced public funding that puts the financial burden on individual students and their families."[21] But it is the similarities between these two periods that show us why online education has had such a destabilizing effect on the traditional business of education.

First, both periods rely on the belief that education is in crisis. The details of these crises may differ across decades, but the claim that education is in need of reform has been consistent for over a century. Second, many of the proposed educational reforms assume that education should be more efficient—in both costs and effectiveness. Third, technology is a perennial solution to creating higher-quality, lower-priced educational experiences that are available to a greater number of learners. And finally, technological disruptors are uniquely qualified to solve these problems by virtue of being able to sell the need for disruption to funders and buyers of the technologies, despite having little experience in trying to educate students (although they have generally done quite well at being educated, since most of them have multiple degrees from elite institutions).

At the same time, universities should be cautious about dismissing educational technologies, if only for the reason that if universities dismiss them, they will lose influence over how

these technologies are developed and deployed. Both online education and generative AI's uses in education will expand in the coming decades. My hope is that by knowing the origins of online education and its relationship with artificial intelligence, as well as its trajectory to the present, universities can be more clear-eyed about their business partnerships with technology companies, more thoughtful about their motives in distributing education "to the masses," and ultimately take inspiration from the past's successes and failures in order to create more equitable educational experiences that provide more returns to learners than edtech investors.

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