

own world and that of Koganzon's historical subjects. The absence of prescriptive religious and political material in Locke and Rousseau's authoritarian educational plans may be striking and noteworthy, as Koganzon rightly points out, but there are few indications that authoritarian, parentally controlled education in the age of partisan politics, politicized school boards, and social media bubbles would be similarly free. Nevertheless, even those readers of *Liberal States, Authoritarian Families* not (yet) persuaded that authoritarian families and schools are among the best available solutions to the problems faced by liberal states today will learn a great deal from Koganzon's nuanced and penetrating study.

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Audrey Watters. *Teaching Machines: The History of Personalized Learning*

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Justin Reich 

Massachusetts Institute of Technology, MA
jreich@mit.edu

The 2020s are off to a roaring start for historians of education technology. Larry Cuban has spent four decades laying the foundation of the field, starting with the landmark *Teachers and Machines* (1986), then continuing with *Oversold and Underused* (2001), and, most recently, *Inside the Black Box of Classroom Practice* (2013).¹ In the last few years, the field has expanded in new directions with Morgan Ames's *The Charisma Machine* (a ethnographic investigation of the One Laptop per Child project), Victoria Cain's new *Schools and Screens: A Watchful History* (an archival investigation of arguments for and against technology adoption), and my own *Failure to Disrupt* (an effort to carry *Teachers and Machines* from the 1980s to the present day).² As learners and educators across the world rethink their relationship to digital learning in the course of the pandemic, these new entries provide a guide for understanding why the dreams of edtech reforms are so often dashed on the shoals of actual schools.

¹Larry Cuban, *Teachers and Machines: The Classroom Use of Technology since 1920* (New York: Teachers College Press, 1986); *Oversold and Underused* (Cambridge, MA: Harvard University Press, 2001); Larry Cuban, *Inside the Black Box of Classroom Practice: Change without Reform in American Education* (Cambridge, MA: Harvard Education Press, 2013).

²Morgan G. Ames, *The Charisma Machine: The Life, Death, and Legacy of One Laptop per Child* (Cambridge, MA: MIT Press, 2019); Victoria Cain, *Schools and Screens: A Watchful History* (Cambridge, MA: MIT Press, 2021); Justin Reich, *Failure to Disrupt: Why Technology Alone Can't Transform Education* (Cambridge, MA: Harvard University Press, 2020).

To this bounteous harvest, we can now add Audrey Watters's new *Teaching Machines*, an archival history of the mechanical devices from the 1920s through the 1960s designed to automate instruction, precursors to the "intelligent tutors" of our own time.

Watters has been a singular voice in education technology history, journalism, and criticism for two decades, first through her work as a freelance technology journalist and later as a wholly independent critic. In a field cluttered with pundits funded by edtech companies, Watters has remained independent and free to speak her carefully researched truth. Her blog *Hack Education* was required reading in education technology through the 2010s. With *Teaching Machines*, Watters adds a major contribution of archival research to her long track record of journalism and commentary.

Teaching Machines makes three important contributions to the literature of education technology for historians, students, and designers. First, Watters unearths a forgotten history of a stunted line of technology development. In *Teachers and Machines*, Cuban frames the history of education technology around the adaptation of new consumer media to classroom applications, tracing a line from radio to filmstrips to television to personal computers. These technologies had, and in some cases still have, substantial implementation in schools and colleges, even if their actual impact is up for debate. But in roughly the same period spanning the shift from radio to television, educationists with entrepreneurial inclinations sought to develop a set of specialized machines solely for instructional purposes.

Sidney Pressey led these initiatives with the development in 1924 of a mechanical device, built from typewriter parts, that could administer and assess multiple-choice questions. Pressey's efforts to mass-produce the machine faltered in the Great Depression, and the International Business Machine corporation picked up the torch in the 1930s with an electronic test correction machine, a predecessor of the Scantron. In the 1950s, efforts to develop new teaching machines were championed by none other than B. F. Skinner, who sought to operationalize his theory of behaviorism in mechanical devices. His entrepreneurial efforts were a failure, but the ideas of behaviorism became encoded in programmed instruction and other automated approaches to teaching. In unearthing this history, Watters interrogates the stories that these entrepreneurs tell about the schooling challenges of their time, and the perceived potential of new technologies to bring about a wholesale transformation of educational systems, to be faster, better, more efficient, and more equitable.

The second major accomplishment of *Teaching Machines* is to situate these stories in their historical context while also rendering them instantly recognizable to anyone who for the last two decades has listened to the people that Morgan Ames calls "charismatic technologists." For instance, Watters revisits the 1957 manifesto of Simon Ramo, a businessman who, after helping develop the intercontinental ballistic missile, turned his attention toward educational computing in its earliest days. "The whole objective of everything I will describe," wrote Ramo, "is to raise the teacher to a higher level in his contribution to the teaching process, and to remove from his duties that kind of effort which does not use the teacher's skill to the fullest" (pp. 154-55). Such defenses have been mounted many times in the past seventy years in response to teachers' warnings that computers were coming not to aid but to replace them.

Until Watters's writing in the last decade, this connection between the behaviorist advocates of mechanical teaching machines and influences on the development of online learning had largely been forgotten. But some of those who facilitated the earliest days of e-learning saw these connections clearly. My venerable MIT colleague James Paradis sent me an email at the beginning of the 2021 fall semester—its argument familiar perhaps to anyone forbidden from teaching online during the pandemic—with the subject line: “Online education used to be hailed; now it is suspect--Oh well . . .” He forwarded a 1988 paper he coauthored with Edward Barrett about their earliest efforts at teaching writing in a networked classroom. The literature review opens with Pressey's call in 1932 for an “industrial revolution” in education before turning to the connections between Skinner's pigeons and his proposed mechanical teaching machines. Barrett and Paradis then cite a contemporary, Lynn Veach Sadler, who recognized the enduring influence of behaviorist thought in this field: “This Skinnerian approach to learning with a machine still informs contemporary educational software, especially drill-and-practice packages in grammar instruction.”³

Perhaps the most significant achievement of Watters's book is that it reforges for readers this troubling link between behaviorism and contemporary education technology. According to the master narrative of behaviorism, Noam Chomsky authored a ferocious review of Skinner's 1957 book *Verbal Behavior* that purged behaviorism from the academy and paved the way for cognitivism, situated learning, and other modern pedagogical philosophies to take over the field. Thus, as the story goes, when teaching machines died in the 1950s, cognitivism was better prepared to inform the development of computer-assisted instruction that emerged in its wake. Watters argues what Barrett and Paradis observed at the dawn of online instruction: for whatever criticisms Skinner suffered in the academy, his ideas are alive and well in edtech.

In the conclusion, Watters draws a connection between her argument and another warning about the pervasiveness of behaviorism contained in the arguments of Shoshanna Zuboff in *The Age of Surveillance Capitalism*.⁴ Zuboff studied at Harvard when Skinner was still teaching, and she provides a firsthand description of the revulsion that she and others felt when encountering his free-will-squelching ideas on open display. In Zuboff's telling, behaviorism wasn't rejected solely by the academy; as the Cold War heated up, efforts at behavioral control were deemed a threat to American democracy and publicly shunned in the military, government, and other sectors. Part of Zuboff's horror at seeing behaviorist technologies move from Skinner boxes to the slot machines of Las Vegas to the variable-dopamine-reward designs of contemporary smartphones involves watching a technology that was widely condemned in the 1950s begin to flourish anew in the twenty-first century. Watters and Zuboff both argue that despite widespread rejection of Skinner's ideas in his own time and ours, those ideas are influencing education and technology on a scale that rivals Skinner's own utopian dreams.

I find Watters arguments both compelling and distressing, but thoughtful critiques have emerged as well. Watters concludes her book by arguing that there are pathways

³Edward Barrett and James Paradis, “Teaching Writing in an On-Line Classroom,” *Harvard Educational Review* 58, no. 2 (July 1988), 154-72.

⁴Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: PublicAffairs, 2019).

for education technology away from Skinner—for instance, by following trails blazed by Seymour Papert and the Logo programming language, where students learn to program computers rather than being programmed by them. She ends, “These practices privilege the much messier forms of teaching and learning, forms that are necessarily grounded in freedom and dignity” (p. 264). But for anthropologist Shreeharsh Kelkar, contemporary technologists are also committed to ideals of freedom and autonomy; it is just that they are based on a different theory of freedom. He argues technology designers are adherents of behavioral economics and its neighbors in the behavioral sciences, rather than behaviorism per se. Whereas the behaviorists want to condition people to behave correctly, the behaviorists see themselves as letting people make choices and nudging them toward making better ones. Kelkar wonders aloud in his writing if this is a distinction without a difference, but ultimately concludes that addressing the ills of technology in our society requires making an accurate diagnosis. If there are important differences between the behaviorist “nudging” technocracy of Cass Sunstein and Daniel Kahneman and the behaviorist utopias of Skinner, then those need to be interrogated in order to resist edtech’s unwanted advances.⁵

Teaching Machines arrives in a world where the pandemic has made education technology seem simultaneously more essential and more fallible. Distance learning, as millions of families have learned, can be pretty lousy, but it is probably better than no learning at all. The COVID-19 pandemic may prove a test run for a world wracked by a climate emergency. Schools will close ever more frequently in the face of fires, floods, freezes, and new pandemics and disease events. As the need for more computers, more broadband, more apps, and more connectivity in schools feels inevitable, Watters reminds that there are always choices and alternatives. If we recoil at realizing the deep connections between the edtech of today and discredited views of freedom and autonomy from the past, then we have the responsibility to chart new directions.

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Megan Blumenreich and Bethany L. Rogers. *Schooling Teachers: Teach for America and the Future of Teacher Education*

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Andrea Guiden Pittman

George Mason University
 Aguiden2@masonlive.gmu.edu

⁵Shreeharsh Kelkar, “Are Surveillance Capitalists Behaviorists? No. Does it Matter? Maybe,” *The Startup*, Nov. 14, 2020, <https://medium.com/swlh/are-surveillance-capitalists-behaviorists-does-it-matter-no-and-maybe-a7327265eead>.