The Ethical Consequences, Contestations, and Possibilities of Designs in Educational Systems

Kevin Close

Melissa Warr

Punya Mishra

Under Review

> The coming of an 'electronic age' brings the stringencies of the profit system into even greater conflict with the potentialities such an age has for richer sociobiological economy.... The need for this coordination makes more pertinent than ever the social obligations of the designer as a designer. (Maholy-Nagy, 1947, p. 55)

Design provides a way to consider possibilities–possible “courses of action” (Simon, 1969, p. 111). Designers look for variables they can change in a design space and create paths that move from what is to possible desirable futures; "design brings forth what would not come naturally" (Krippendorff, 2005, p. 25).” This also implies that designers, as those who have the power to create towards a “desirable future” have an ethical responsibility to design for just futures (Ishimaru & Bang, 2022).

Emerging technologies present new possibilities for schools, but also present ethical issues for designers. Ethical issues related to the ways in which designers conceive of, access, adopt, and implement emerging technologies in schools cannot be untangled from entrenched power dynamics, hierarchies, and decision-making norms that perpetuate past systems. For example, many local education budgets tie to property tax revenues reflecting historical choices

by policymakers from decades ago (Baker, 2021), teachers in underfunded schools tend to use drill-and-practice software more than teachers in well-funded schools (Hohlfeld et al., 2008), and school districts with more financial resources tend to get better deals for software from companies like Apple or Google (Butrymowicz & Mathewson, 2018). Recognizing that technologies emerge within and as part of complex systems, brimming with histories, is vital for thinking through issues of ethics, equity, and power.

In this paper we will address issues of ethics, equity, and power of emerging technology through the lens of a design framework, the *five spaces for design in education*. Rooted in work positioning teachers and administrators as designers (Author(s), 2021; Author(s), 2020), the framework presents five spaces for design including:

1. Artifacts
2. Processes
3. Experiences
4. Systems
5. Culture

These “spaces” can be thought of as sites bearing the **consequences** of previous design decisions (e.g., the decision to divide a school day into periods). They can also be thought of as sites for **contestation** where stakeholders working toward solutions using emerging technologies often experience unexpected resistance. More idealistically, they can be thought of as sites for possibility and **reimagining** (Beghetto, 2021). Almost everything is designed, from the shape and size of a desk to the culture of school-going. Therefore, almost everything can be redesigned. Lastly, the five spaces can be thought of as scales of a design problem, so the framework is simply a tool to help consider these scales.

In this paper, we will use the five spaces for design in education framework to investigate the ethics of two emerging technologies in education: remote proctoring software (e.g., Proctorio, LockDown Browser) and large language model (LLM) ChatBots such as

ChatGPT3. Pairing these two together as examples provides an illustrative juxtaposition of two pieces of technology that have or will carry **consequences,** invite **contestation**, and elicit opportunities for **reimagining** for the culture of educational institutions, our assessment systems, the way students experience school, our processes for testing, and the artifacts we will use to write and think.

Literature Review

What Are We Designing? The Five Spaces for Design in Education

Our use of the word "design" is based on the oft-cited definition by Herb Simon (1969): "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (p. 111). We emphasize two parts of this definition: first, what is considered a "course of action" and, second, what does it mean for a situation to be "preferred." We will begin with a focus on the first part: what are we designing?

We draw upon the work of several design scholars. First, perhaps the most well-known typology of *what* is designed comes from Richard Buchanan (1992, 1998). Buchanan used "areas" or "orders" of design to highlight the historical move from design as focused on visual or graphic communication to design of material objects, activities/services, and ultimately complex systems or environments. As design moves across these orders, required human abilities shift from inventing to judging, deciding, and evaluating. Buchanan described these orders as "places of invention . . . where one discovers the dimensions of design thinking by a reconsideration of problems and solution" (1992, p. 10).

Golsby-Smith (1996) similarly highlighted design as multi-faceted, describing design "domains" as a tool for broadening understandings of value in design. Instead of design domains being "places of invention and discovery" (as Buchanan described the orders of design), Golsby-Smith seeks to "explore these places with regard to a widening domain for design" (p. 5). The four domains begin with "word/image" and then extend to "object," placing value in a designed artifact. The third domain, "strategic design planning" calls on designers to

become facilitators and the value they bring to the situation is realized through their role as a facilitator. Finally, Golsby-Smith's fourth domain is "culture/system." This domain moves design to a less tangible domain of values, beliefs, and a wide context. It addresses culture, integration, and systems. Culture, in this case, describes an activity; "the activity of ordering, disordering and reordering in the search for understanding and for values which guide action" (Golsby-Smith, 1996, p. 13).

A third scholarly approach to describing the broad nature of design comes from Krippendorff (2005). He described a "trajectory of artificiality," where design has become more complex in order to address more complex problems. He highlighted five "phases of extending design considerations" (p. 6): products; goods, services, and identities; interfaces; multiuser systems and networks; projects; and discourses. This trajectory shifts design towards a more constructivist and human-centered emphasis.

The framework that we use in this article–the five spaces for design in education–builds on the work of these scholars. We identify five "spaces" for design (artifact, process, experience, system, culture; see Figure 1). Like Buchanan (1998), we see each space as a place of invention or **reimagination**, a domain in which action can be taken to make a situation "more preferred." However, we extend the instrumental nature of the five spaces and propose they also provide spaces for considering **consequences** and **contestations**, allowing a deeper investigation into the intended and unintended effects of designs, and supporting a more ethical design practice.

Table 1

Definitions of each of the five spaces

Space	Definition
Artifact	(Relatively) Stable objects that can be perceived through the senses
Process	A procedure or directions that can be used outside of the context within which it was created to achieve a goal
Experience	A piece of time with associated sights, sounds, feelings, and thoughts
System	An organized and purposeful structure of interrelated and interdependent elements
Culture	A pattern of shared basic assumptions that allows groups to perceive and interpret the world in similar ways, develop and communicate meaning, and transmit values to new group members

Who is Designing? Power and Reproduction in Design

Using the lens of the five spaces to examine the ethical consequences, contestations, and possibilities of design in educational systems provides a tool for seeing "spaces" of design (e.g., for linking how newly designed technologies for remote proctoring reflect a culture around testing that has not been redesigned). This is a useful lens because it widens the view of what can be redesigned. However, redesigning something without simply reproducing the same problems (e.g., Benjamin, 2019; Benjamin, 2020), the same inequities, and the same entrenched power requires considering the role and the humanity of actual designers.

Scholars argue that creating new spaces, tools, and practices which defy reproductions of current entrenched power dynamics means thinking intentionally about how power, race, and culture play out in the way we practice design and conceptualize learning (Bang & Vossoughi, 2016). One way to do this is by considering three questions when designing: *for what*, *for whom*, and, importantly, *with whom* (Philip, Bang, & Jackson, 2018). Designers often cover the *for what* and *for whom* categories (e.g., designing remote proctoring software for university instructors), but may not include the *with whom* (e.g., with university instructors, with students).

Emerging technologies present exciting opportunities in education, but emerging technologies do not inherently reduce inequities or dislodge power dynamics. In 1980, philosopher Langdon Winner asserted that artifacts are often "inherently political" (p. 128), and their physical properties either require or are most compatible with certain social and economic patterns. "We find certain devices and systems almost invariably linked to specific ways of organizing power and authority" (p. 131). This means designers have the ability to impact social and economic structures, and with this power comes a responsibility for careful consideration of both intended and unintended consequences of a design. Sometimes the *with whom* question is considered, without attending to previously established power dynamics, dynamics that privilege one "designer" over another (e.g., the software designer, may partner with a university professor giving input, but ultimately the software designer makes the design decisions).

Educational technologists need to incorporate intentional partnership in a) our educational designs and b) the scope of who we consider is a designer. For example, Bang & Vossoughi (2016) intentionally treat "the domains of "researcher," "theorist," and "designer" … as porous categories, open to the questions, concerns, ways of knowing, and designing that are both historically present within communities … and potentially asserted and developed in new ways" (p. 174). This also means attending to "(a) critical historicity, (b) power, and (c) relational dynamics shape processes of partnering: (Bang & Vossoughi, p. 174). Leaning on work by Gutiérrez and Jurow (2016), we are interested in how "new spaces, tools, and practices could be remediated and designed where youth could have dignity and take risks" (p.20).

Investigating the Ethics of Two Emerging Artificial Intelligence Technologies in Education

Artificial Intelligence (or AI) has received a great deal of media and popular attention lately, particularly with the release of chat bots based on Large Language Models such as ChatGPT3, Bard and others. It is important to contextualize these new technologies within the broader spectrum of AI. Broadly speaking, Artificial intelligence (AI) is the ability of a computer to perform tasks that normally require human intelligence, such as reasoning, learning, or understanding language. AI can be applied to various domains, such as medicine, education, entertainment, and business. AI systems can range from simple programs that play chess or recognize faces (e.g., remote proctoring software), to complex ones that can potentially drive cars or write novels (e.g., large language models).

Remote Proctoring Software

What is Remote Proctoring Software?

With the move from more in-person learning (e.g., classes at schools or training centers) to more at-home learning (e.g., online classes and asynchronous training) came the move from more in-person testing to more remote testing. Yet, the organizations that conduct tests such as universities or companies that give out skills certifications sought ways to ensure that test takers

did not cheat while taking tests at home. In this context, companies began to produce and sell artificial intelligence-based remote proctoring software, like LockDown Browser and Proctorio, to reproduce the task that in-person test proctors play. These pieces of software typically confirm the identity of the test-taker and reduce cheating on online exams by ensuring that test takers avoid certain behavior predictive of cheating. Sometimes remote proctoring software is used while a test proctor is monitoring online to help monitor behavior. Other times, remote proctoring software is used to monitor behavior to be reviewed later.

Driven by artificial intelligence, remote proctoring software often confirms the identity of test-takers by accessing the cameras of test-takers and either confirming the IDs of test-takers held up to the camera, using biometric scans of their faces, or even analyzing keystrokes. Additionally, remote test proctoring software often monitors the test-takers' environment by asking test takers to rotate their camera 360 degrees or by flagging when other people enter the testing space or when sounds occur in the environment. For example, to reduce the chance that someone is reading a note on their lap, remote proctoring software may automatically "flag" when a test-taker is looking down.

What is their current use and context?

In a 2016 report from *Educause,* the authors predict, correctly, that "remote proctoring tools might become a staple of online courses" despite downsides such as "a wide range of ethical considerations accompany software that takes video of students" (Eckenrode et al., p. 2). A few years later, in 2020, the New York Times published an article titled "Keeping Online Testing Honest? Or An Orwellian Overreach?" estimating that the use of online proctoring software went up 900% in one year (Hubler, 2020). Understandably, as the spread and uncertainty of COVID-19 impacted Education systems, software which facilitated so-called normal practices adapted for remote settings sold. However, the questions remained whether this software, as EdSurge stated in the title of their November 2021 article, would "Stick around" (Young, 2022). In the article, Young states that, despite widespread opposition from student

groups and some University leadership, 63% of colleges and universities in the U.S. and Canada indicate that they use remote proctoring software (2020). Potentially the reasons for why remote proctoring software continues to be so popular is that a) colleges and universities plan to continue to expand online learning options and b) more and more students are finding more ways to cheat including through paid services like Chegg which has a slick database of online quizzes and corresponding answers. Add into this mix, the recent growth of Large Language Model Chatbots and you have a standoff with no clear resolution.

What are the sites of contestation/reimagining?

Unlike LLMs, remote proctoring software is not a disruptive technology. The adoption of remote proctoring software reflects a response to the move from more in-person learning to more at-home learning. As more schools moved to online courses, decision makers wanted ways to maintain the entrenched assessment systems. However, taking tests at home meant easier methods to cheat. Hence, decision-makers began spending money to license remote proctoring software to solve this problem.

Thinking about this development through the five spaces for design in education highlights just how little has changed in the design of schooling even as administrators adopted sophisticated and expensive emerging technology (e.g., remote proctoring software) for their schools. Here the artifact, remote proctoring software, is a **consequence** of previously designed and entrenched cultures, systems, experiences, and processes around testing. Though the artifact (e.g., the software) is novel, not much else has changed. Despite the momentous opportunity caused by the shift from in-person to online learning, administrators at schools which adopt remote proctoring software have not redesigned the culture and systems of testing in schools (See Figure 2).

Figure 2

The Five Spaces for Design in Education around Testing and the Shift from In-Person to Online Learning

Artifact	Process	Experience	System	Culture
Tests, Quizzes, Essays	Proctored (Tests, quizzes). Individually created and graded (essays)	Carceral; Quiet; Stressful; Individual	Standardized. Used to judge "fairly"	Meritocracy

Shift from in-person to online learning

Remote Proctoring Software

Tests, Quizzes, Essays	Proctored (Tests, quizzes). Individually created and graded (essays)	Carceral; Quiet; Stressful; Individual	Standardized. Used to judge "fairly"	Meritocracy

Note. The design of remote proctoring software is a consequence of entrenched designs around the culture, system, experience, and process of testing in schools.

However, despite the design of remote proctoring software being a **consequence** of previous design decisions, it represents a symbol of the assessment system staying entrenched despite the momentous change shift from schooling in-person to schooling online. As a symbol it also became a potential site for **contestation** and, hopefully, a site of **reimagining**. As stated earlier, remote proctoring software spurred widespread opposition from student groups and some University leadership (Young, 2020). This was an example of groups protesting in solidarity to oppose an emerging technology. In New York, for example, these protests led to

legislation banning facial recognition in schools (Wood, 2020). Legislators in New York are now considering further bans of facial recognition for businesses and landlords. Designers working to solve questions around cheating while working toward just futures, should design with students, families and communities to reimagine the problem space. Is it really cheating they are trying to solve or something else?

Large Language Models and the Five Spaces for Design in Education

What are Large Language Models?

Within the broader spectrum of AI are large language models (LLMs). LLMs are neural networks with billions of parameters that are trained on huge amounts of text data using self-supervised learning. This means that they can learn from the data itself without any human labels or guidance (though that is technically untrue, and many of these models also include some human training components). What is fascinating is that these LLMs can generate natural language responses to prompts on a seemingly wide range of topics, effortlessly answering questions, summarizing articles, composing emails, and even creating code or poetry. These texts are often (though not always) coherent, relevant, and sometimes even, seemingly, creative.

These models have been pejoratively described as “auto complete on steroids” or being equivalent to “stochastic parrots”—i.e. they are computer models that generate text by probabilistically combining linguistic forms from massive amounts of data, but without any reference to meaning or context (Bender et al., 2021; Peters et al., 2023). In other words, these systems are like parrots, that mimic sounds, but do not understand what they mean.

This means that these large language models can be wrong (often hilariously so), but they can also be surprisingly good at what they *can* do. These LLM’s are particularly good when it comes to “formulaic” or “genre” writing and “genre-mashing”—such as writing a paper on astronomy in the voice of a 7th grader, or a sonnet on Franz Kafka’s *Metamorphosis* in the style

of Shakespeare. These models can also deal with counterfactuals and hypotheticals (what if Red Riding Hood never went to the forest, or what if the wolf were a cow). Clearly, there is some higher-level abstraction happening here (at least at the stylistic and genre convention level) that allows this to happen. It is often this slipperiness that makes it appear creative.

Thus, ChatGPT3 is incredibly powerful in regurgitating this surface sophistication making it sound like a more than plausible interlocutor. And this offers a challenge to educators, since students can leverage this ability of LLM chat-bots to write papers, and responses that can reproduce, in a reasonably authentic manner, prose about any topic, without the student ever having to deal with the ideas in any manner.

This clearly raises a serious question for educators and researchers: How to prevent and detect plagiarism by students or authors who use LLMs to generate essays or papers? The fact that fine-tuned LLMs reduce verbatim plagiarism but increase instances of paraphrase and idea plagiarism makes it harder for human evaluators and existing plagiarism detection software to identify machine-generated texts.

What is their current use and context?

The question, however, that arises is why are these tools receiving so much attention suddenly? It is not as if these AI systems had not been an integral part of our digital lives for over a decade. These neural networks and machine learning algorithms have been in use for a while, powering the autocorrect feature in our email clients, identifying people, locations and more in our photo albums among other things. We suggest that there are *four* key reasons for taking these large language model based chatbots as being fundamentally different from any previous technology we have engaged with. Taking each in turn.

First, Is the ability to engage with humans through the medium of language, an ability that was till now restricted just to humans. Second, is the ability to engage in extended conversations, with memory of past interactions, turn taking and more. Third, is the ability of these LLM chatbots to mimic “genres” of interaction, humorous, serious, mimic expertise in

various domains and more. Finally, is its almost inexhaustible knowledge of various domains, though it is prone to hallucination and confabulation.

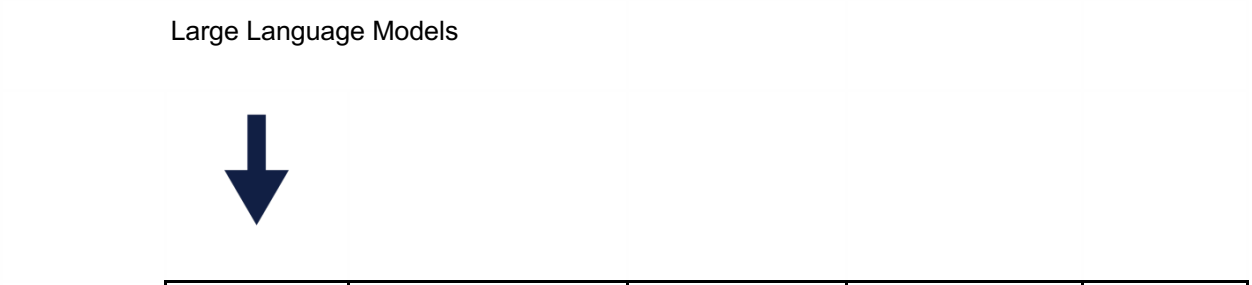
The first three of these capabilities make these software-based interlocutors appear "psychologically real," to us, as having personality and agency. Thus, it becomes almost inevitable to ascribe psychological states (such as beliefs, desires and intentionality) to them. In other words, these interactive, generative technologies are now "psychologically real social agents" in our world, engaging with us in ways that no other technology has ever been. This combined with the wide breadth and depth of its knowledge and its ability to make things up lead it to being a potent disruptor of a variety of social systems, including education.

The Sites of Consequences, Contestations, and Possibilities

If we take the five spaces for design in education approach towards thinking about educational design, these new AI based technologies can cause change and disruption in all the five spaces. Much of the focus on these technologies has been on the way these technologies will disrupt standard assessment systems (such as quizzes, tests, and essays) making it easy for students to cheat with little possibility of being caught. Thus, the entrance of this artifact into the world will inevitably lead to changes in evaluation and assessment processes.

Figure 3

Introducing Large Language Models to The Five Spaces for Design in Education around Testing



	Artifact	Process	Experience	System	Culture
Entrenched	Tests, Quizzes, Essays	Proctored (Tests, quizzes). Individually created and graded (essays)	Carceral; Quiet; Stressful; Individual	Standardized. Used to judge "fairly"	Meritocracy

Note. Large Language Models enter the entrenched evaluation and assessment processes.

These changes could include many possibilities. We could see a move back to classroom-based assessments without the use of technology, increased use of surveillance based proctoring systems, or educators embracing these technologies in creative, productive ways. Educators may find that having intelligent software agents can take some of the everyday drudgery out of the teaching process. Each of these decisions will have a significant impact on the nature of student experience of learning. Educational systems will have to shift as these tools become ubiquitous.

Moreover, as these agents get more advanced, we could see the advent of software tutors that can monitor student learning, providing just in time input, as and when needed, fundamentally changing the nature of the teaching profession. This implies that broader systems (of textbook publishing, test prep, and more) will have to adapt and change as well, where entrenched, economically powerful entities will fight to maintain the status quo or at least to remain leaders within that space.

Figure 4

Introducing Large Language Models to Testing (Possibilities)

	Artifact	**Process**	**Experience**	**System**	**Culture**
Currently	Tests, Quizzes, Essays	Proctored (Tests, quizzes). Individually created and graded (essays)	Carceral, Quiet, Stressful, Individual	Standardized. Used to judge "fairly"	Meritocracy. Instructors as experts
One Possibility	Assessments without the use of technology	Increased use of surveillance based proctoring systems	Similar experience	Similar system	Similar culture
Another Possibility	Assessments that embrace LLMs	Using LLMs as tool (to write) and tutor (to discover)	Supported, Feedback-driven. Feels like a conversation.	Personalized. Formative.	?

Figure 4. LLMs provide a chance to reimagine the possibilities.

What will be most interesting, however, is the changes that will appear in the long run, particularly the impact these tools and technologies will have on the broader culture, and how *that* will impact education. Educators would be short-sighted if they kept their focus just on the roles that these tools will play within classroom contexts.

Conclusion

When social media first came on board, educators focused on how these could be used in classrooms. They that tools such as Instagram, and YouTube would have a significant impact on young people's mental health. By constantly comparing their own lives to those of others, reducing in-person social interactions, experiencing body dysmorphia, enduring cyberbullying,

and partaking in popularity contests, these young minds appear to be subjected to catastrophic effects. Alarming statistics reveal a tripling of the suicide rate among children aged ten and above over the course of a decade (Curtin & Heron, 2019). Moreover, the situation appears to be more severe for girls, who spend more time on social media compared to boys. Such concerns are of such magnitude that the U.S. Surgeon General recently issued an advisory specifically addressing the impact of social media on the mental health of teenagers (Cohen et al., 2022). While we were discussing how to use social media in classrooms, the very ground underneath had shifted, it has changed the kinds of challenges schools were expected to deal with.

It is imperative, therefore, to bear in mind a principle referred to as "Amara's Law," named after Roy Amara, an esteemed American scientist, futurist, and President of the Institute of the Future. Amara's Law is encapsulated in his renowned adage that states, "We have a tendency to overestimate the impact of a technology in the short term and underestimate its impact in the long term" (*What is Amara's law*, 2022). This insightful observation pertains to the common phenomenon where individuals swiftly become enthralled by the potential and transformative nature of new technologies, often leading to a narrow focus solely on the capabilities of the technology in question. Consequently, people may either become overly enthusiastic, perceiving only the positive benefits, innovation, and efficiency it can bring to their lives and businesses, or they may envision it as a destructive force threatening the status quo. However, as time progresses, the initial excitement surrounding the technology diminishes, and both utopian and dystopian visions appear exaggerated. Nevertheless, we often fail to recognize the longer-term and unanticipated changes or repercussions that new tools can have on human existence and society, both for the better and worse. Neil Postman contends that technological change is not merely an additive process; rather, it is an ecological one, where the introduction of a new technology profoundly alters the entire system, making it challenging to foresee all its consequences.

These new technologies of AI will transform our social, political, entertainment, and economic structures in ways that we cannot predict precisely. The rise of misinformation will only grow with the ease with which tools can generate precisely targeting messaging which will have significant consequences in the space of politics. The radicalization that we are already seeing in the political space (due to social media) will only increase. Combined with changes in jobs that are inevitable and other social upheavals (such as due to climate change and more) means that the role of educators will have to change-to focus on the long term, on how we develop the next generation of citizens.

However, designers have an important role to play:

> While a traditional tool waits for someone to use it, AI programs can act somewhat autonomously react to, and affect their environment. Due to this, the ethical considerations traditionally applied to the design and use of technology (safety mechanisms, emergency buttons, etc.) no longer fill the needs behind AI systems. As a tool gets more autonomous, the responsibility for its ethical use gets farther away from its intended user and needs to consider a broader set of scenarios. (Casas-Roma et al., 2021).

In other words, designers may have a bigger role in ethical decision-making than ever before.

The five spaces framework offers an analytical tool for reflecting on ethical consequences–both positive and negative–of designs in education. The five spaces also suggest areas for transforming education from what it is to what it could be. Ultimately, we hope to begin a critical conversation about the two technologies by thinking about the sites of consequence, contestation, reimagining in the designed cultures, systems, experiences, processes, and artifacts of schooling.

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Declarations

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