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## Artificial Intelligence and Teachers' New Ethical Obligations

### Abstract:

Largely thought to be immune from automation, the teaching profession is now being challenged on multiple fronts by new digital infrastructures and smart software that automate pedagogical decision-making and supporting teaching practises. To better understand this emerging and ethically fraught intensification of technologies in today's classrooms, we asked, "what new ethical obligations are teachers facing as a result of AI technology adoption in schools?" We began by defining AI, then turned to posthumanism to grapple with how networked, AI-enhanced digital technologies extend and intermesh with human beings cognitively, affectively, morally, corporeally, spatially, temporally, socially and politically. We catalogued Artificial Intelligence (AI) technologies that have been deployed in some of today's K-12 classrooms (AIEDK-12)s and developed a topology of AIEDK-12 technologies based on (1) teachers' professional activities being supported by AI, (2) AI being used by and for learners to facilitate their learning and development; (3) additions to K-12 curricula about AI; and (4) AI-based technologies being used by schools, districts and ministries of education to inform decisions that affect teachers. We then consider how a posthumanist investigative approach to disclosive ethics—"interviewing objects"—can shed new light on the implications of widespread deployment of AIEDK12 on teachers' work. We interviewed three AI-based educational applications, recasting teachers and students as involved and evolving human-AI hybrids. In the process, we uncovered some of the new complications and ethical conundrums being introduced to teachers' professional practises.

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## 1. Introduction

Artificial Intelligence (AI) is increasingly being used to support and deliver a wide range of educational services: automatic essay scoring, learning analytics, intelligent tutoring systems, smart assistive technologies, natural language processing, autonomous pedagogical agents like teacher bots and robots that support social-emotional development. Largely thought to be immune from automation, teachers' professional work is now being challenged on multiple fronts by new digital infrastructures and smart software that enhance, extend and automate pedagogical decision-making and teaching activities (Shen & Su, 2020). The meteoric rise of machine learning, algorithmic governmentality and the cyborgization of education has some scholars predicting that technological unemployment for teachers is imminent (Peters, Jandrić & Means, 2019). Beyond the threat of job loss through automation, AI has provoked a host of new ethical concerns (e.g. racial bias, data insecurity) which in turn have been driving cross-sectoral policy development nationally and internationally (Jobin et al., 2019) including in education (Adams et al., 2021). Further complicating this moment is a decades-long history of Silicon Valley's "techno-solutionism" (Selwyn, 2021) in education that has driven technology adoption in schools, coupled with neoliberal politics and government agendas desiring to reform or even replace the teaching profession.

As part of a collaboration between a Canadian teachers' association, a Faculty of Education and members of a university-wide AI4Society signature area, we embarked on a study to investigate changes to and impacts on teachers' work as a result of AI integration. Specifically, we asked: what new ethical obligations are teachers facing as a result of AI technology adoption in schools? To approach this question, we first sought to define and clarify what is meant by AI. Here we turned to posthumanism to grapple with how networked, AI-enhanced digital technologies extend and intermesh with human beings cognitively, affectively, morally, corporeally, spatially, temporally, socially and politically. From a posthuman perspective, technology is not simply a tool taken up for instrumental purposes by agential teachers (and learners). Rather, technology, and digital technologies in particular, participate in co-constituting complex human-technology hybrids that mobilise new actions, transform knowledge frameworks and inaugurate novel ways of being in the world. Once integrated into teachers' professional practises (and learners' learning), an AIEK12 technology tends to fall into the background while it quietly interacts with, powerfully frames and inevitably translates teacher (and learner) actions and sense of agency. Posthumanism allowed us to consider a new unit of ethical consideration: the AI-teacher or teacher-AI hybrid.

We then catalogued some of the AI technologies currently deployed in K-12 (AIEK-12) classrooms and school systems globally. As we identified different types of AIEK-12 technologies, we tagged them based on (1) who is using them (e.g., teachers, students, school leaders and/or the school district or board); and (2) for what purposes or tasks. For example, teachers use AIEK-12 technologies to facilitate student learning and development, but also to accomplish other professional work such as lesson planning, classroom management, assessing student learning, assigning grades, writing report cards, communicating with parents, etc. AI is also employed by schools, districts and ministries of education to inform decisions that affect teachers and in some cases, their professional livelihood. We also noted curricular changes and additions of AI-related topics to K-12 programs of study, since such changes also implicate teachers' work and professional development needs in order to facilitate learners' AI literacy. Ultimately we developed a topology of AIEK-12 technologies to classify and show the wide range of teaching, learning and administrative tasks and practises artificial intelligence is supporting, and in some cases, automating, in today's classrooms (Table. 1.).

Finally, we returned to posthumanism to explore three of the AIEK12 technologies identified in the previous step by "interviewing" them in relation to an educational user. "Interviewing objects" (Adams & Thompson, 2016) is a posthumanist approach to disclosive (computer) ethics (Brey, 2000, 2010; Introna, 2005). In line with posthumanism, disclosive ethics assumes that every technological artefact is value-laden or biased in particular ways and which can have unintended and often unseen side-effects. Such technoethical investigations strive to "reveal hidden morally problematic features in the practice [of using a given technology] and to provide ethical reflections on these features, optionally resulting in specific moral judgements or policy recommendations" (Brey, 2010, p. 52). Posthumanist inquiries similarly intend to unblackbox the sociomaterial, ethico-political, human-nonhuman networks and agential redistributions that become opaque in the context of

practice. By briefly interviewing three different human-AIEdK12 technologies, we hoped to uncover some of the new complications and ethical conundrums being introduced to teachers' professional practises and to how learners are learning.

## 2. Background

The idea that machines could one day augment or replace teachers is hardly new. Almost a century ago, Sidney L. Pressey's "Automatic Teacher"—a four-key apparatus that posed multiple choice questions to a student then tallied the results—gave rise to excitement as well as fear that human teachers would soon be out of a job (Petrina, 2004). Then in the 1960s, the PLATO System and its "friendly orange glow" ushered in a powerful new version of *Praeceptor Ex Machina* with a touch screen, instant messaging, chat and screen sharing, a learning management system with automatic testing, and even multiplayer games and educational simulations (Dear, 2017). Fast forward through the personal computing years, the arrival of the internet, social media and networked learning to where we are today. In the current age of artificial intelligence, big data and machine learning, the automation of teaching seems to have found a more plausible future. However, today's "automatic teacher" is looking less like an autonomous robot roaming the front of a dystopian classroom of our imagination, and more like complex, AI-powered educational technologies and environmental infrastructures that teachers and learners will increasingly access, "plug in" to and become immersed in as they teach and learn. In fact, most teachers and learners today are perhaps better described as AI-enhanced cyborgs; they just don't recognize themselves as such.

Further, even though AI is increasingly being integrated into teachers' practises, students' learning and school administrative processes, for the most part, these smart technologies remain hidden in plain sight. As Lehoux and Rivard (2021) point out,

Our society has been altered by the rapid proliferation of new technologies and devices that produce digital data. Nested within and feeding on this data ecosystem, artificial intelligence (AI) executes cognitive tasks with more potency and speed than human beings. The large-scale transformative power of AI remains camouflaged in plain sight. (para. 2)

Selwyn (2019) has also noted the importance of looking beyond the arrival of teacher robots and pedagogical agents in classrooms, and giving more attention to technologies "behind-the-scenes" that are increasingly being made "smarter" via AI.

### 2.1 What is AI?

Defining AI is necessary since it remains both a fuzzy concept and "monolithic term" whose disciplinary ground, scope and insights continue to evolve (Kaplan & Haenlein, 2019). A common and relatively uncontroversial definition of AI is "any computational system that is able to 'perform tasks commonly associated with intelligent beings' (Copeland, 2020) such as carrying on a conversation, detecting a disease and driving a car" (Pente, Adams & Yuen, forthcoming). This definition could potentially include most contemporary digital applications, so for the purposes of our study we added that in order to qualify as AIEdK-12, the technology must use--or be "powered by"--some form of machine learning such as neural networks or reinforcement learning. Here, Karen Hao's (2018) "What is AI?" flowchart proved especially helpful in sorting out current AI from non-AI applications.

We were also interested in taking into account the intimate and formative relationships humans share with their technologies. We thus sought a complementary definition of AI that would help situate the question of AI, teachers' work and students' learning in a relational ontology and be able to draw on the insights of recent theories of extended cognition and philosophy of technology. Bernard Stiegler, a philosopher of technology, offers one such definition. For Stiegler (2018), artificial intelligence is "*a continuation of the process of the*

*exosomatization<sup>1</sup> of noesis [thinking] itself*" (italics in original, p. 2) which includes decision-making, and is based on human thinking processes but other characteristics as well. Such a definition highlights AI as continuing an evolutionary process of human (cognitive) extensions via technology that "makes it possible to access lived experiences of memory and imagination, which have accumulated since [prehistoric times], and [has passed] through writing, instruments of observation, calculating machines ..., and analogue [recording] technologies" (p. 2-3). Reckoning with AI as part of an ongoing process of extending human cognition in collaboration with technology re-situates our inquiry in a posthuman framework.

## 2.2 Posthumanism and Technoethics

In the preamble to an interview with Stiegler about childhood, education and the digital, Anna Kouppanou (2016) asks:

What would a discussion about education look like if the principle of dichotomy that paradoxically holds together so much of western philosophy is erased? What if our beginning is the realisation that the human being has no beginning and that the technical being is the human's invention as much as the human is the invention of the technical? (p. 241)

Posthumanism endeavours to "erase" familiar humanist dichotomies like subject/object, male/female, organic/non-organic, and instead approaches such binaries as hybrid assemblages and relational networks. As Neil Selwyn (2019) argues, in thinking about AI and education, it is not a matter of "distinguishing between 'human teachers' and robot teachers'...instead, we are concerned with how different sets of people are entwined with machines and software in increasingly complex and closely connected ways" (p. 17). Thus, in order "to make sense of the use of AI in education...we need to take a 'socio-material' approach" (p. 16). Similarly, Indigenous scholar Jason Edward Lewis (2018) suggests that we must "make kin with the machines" by understanding our digital technologies and "AI as relations" (para. 28). Rather than trying to imagine an education that is "robot-proof" (Aoun, 2017), posthumanism allows us to re-envision teachers' work and professional responsibilities in a more-than-human realm where humans share agency and mutually co-constitute themselves with their nonhuman collaborators. Posthumanism recognizes digital technologies like AI as cognitive collaborators in the educational project (Adams & Thompson, 2016).

As AI continues to evolve in combination with the human, ethical considerations about such a theoretical stance include new ethico-onto-epistemological (Barad, 2003) possibilities. This more inclusive, "cutting together-apart" (Barad, 2014) account of what human-nonhuman hybridised encounters become offsets more instrumental, anthropocentric and siloed identity constructions characterising much liberal, humanist discourse about AI. Posthuman "ethics is not simply about responsible actions in relation to human experiences of the world; rather, it is a question of material entanglements and how each intra-action matters in the reconfiguring of these entanglements, that is, it is a matter of the ethical call that is embodied in the very worlding of the world (Barad, 2007, p. 160).

Intra-relation and intra-action, theorised by Barad, as opposed to interrelation and interaction, represent a significant shift in language to assist in an expanded understanding of posthumanist agency. While "inter" denotes two separate entities in relation, "intra" assumes an entangled "ontological indeterminacy", (Barad, 2021, 38:41) where a comingling relationship continually emerges. Rather than separate boundaries between human and AI, the AI is entwined with the human and both act upon each other. As Barad (2007) asserts,

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<sup>1</sup> Exosomatization is humanity's evolutionary ability to shift our bodily and cognitive abilities outside of and beyond our physical bodies to technologies, and in the process significantly and powerfully extend our physical, sensory, actional, cognitive and social capacities.

The very nature of materiality is an entanglement. Matter itself is always already open to, or rather entangled with, the "Other." The intra-actively emergent "parts" of phenomena are co-constituted. Not only subjects but also objects are permeated through and through with their entangled kin; the other is not just in one's skin, but in one's bones, in one's belly, in one's heart, in one's nucleus, in one's past and future. (p. 392-393)

This approach represents a very different theoretical position from the idea that AI is simply a tool to be used (or not used) by humans in ethically responsible ways. AI influences human agency and vice versa.

Understanding human-AI relations as co-constitutive and co-responsive intra-actions opens up questions like who-what is the teacher (and the student) becoming in the midst of their entanglements with different artificial intelligences? This blurring of subject/object boundaries and the fluid nature of "within/without" shifts the notion of agency to a shared relational dependence that unfolds in human-nonhuman co-constitutions. Here, "agency is doing/being in its intra-activity" (Barad, 2007, 235). Within education, posthumanism troubles the assumed liberal humanist tradition that has structured formal educational institutions in the West. It supports and values a relational ethics that is embodied, enacted and emergent.

### 3. Methods and Discussion

This research began as part of a series of monthly meetings between a Canadian teachers' association, a Faculty of Education, and members of a university-wide AI4Society signature area, to develop knowledge capacity regarding AIEdK-12 (Artificial Intelligence and Education in K-12 settings) and any new ethical issues that these technologies may be provoking in schools. We asked, "what (new) ethical obligations are teachers facing as a result of AI technology adoption in schools?"

#### 3.1 Cataloguing and Categorising AIEdK-12 Technologies

We began by scoping the variety of AI technologies being deployed in K-12 schools today by searching the popular, professional and scholarly literature on AI in education, with a focus on ethical issues, pedagogical concerns and possible impacts on teachers' work and student learning. As our collection of AI applications multiplied, we started to organise the AIs according to who was using them and how they were being used. Four major categories emerged where AI directly or indirectly affected teachers' work:

- *Teachers Teaching with AI*: AI-based technologies that teachers are using to augment, extend or otherwise affect their work with their students;
- *Learners Learning with AI*: This refers to AI-based technologies that students are using to augment, extend or otherwise alter how they learn;
- *Curricular Level Impacts of AI*: Additions or changes to the curriculum because of new literacies demanded by AI and data science, and thereby teacher professional development needs;
- *Systems Level Impacts of AI*: AI-based technologies that are being used at the school, district, government level, where decisions directly or indirectly affect teachers' work

Within each of these four major categories, we further separated AI technologies according to the different activities or "tasks" in which they were being employed. For example, under "Teachers Teaching with AI", we identified the following tasks: Preparation; Administration; Teaching facilitating and/or tutoring (i.e., working with students one-on-one); Monitoring, diagnosis, management and remediation; and Assessment and grading (see Table 1.). Organising AIs in this way, that is, according to their deployment in specific work and learning practises, is in line with posthumanism, where the main unit of analysis is not AIs but human-AI hybridic relations.

The tasks could be differentiated further. However, in an effort to provide maximum coverage while maintaining a view of the whole landscape, we limited tasks to five per major category. There were also overlaps in some

of the tasks associated with the two main categories, “Teachers Teaching with AI” and “Learners Learning with AI”. Where overlaps occurred, we listed the AIEDK-12 technology under the category according to the task and by whom it was most *usually* used. For example, while a teacher may use Grammarly as they are marking an essay or writing a letter to a parent, the more usual use is educational, that is, by learners learning. Finally, our collection of AIEDK-12 technologies in Table 1. was not intended to be exhaustive. Instead, we sought to provide a representative sample of the breadth of AI technologies currently deployed in schools with a focus on different work and learning practises or “tasks.” By differentiating AIEDK-12 technologies based on teacher and learner tasks, we believe the first two columns of this topology (“Category” and “Task”) can assist others in classifying future AI technologies accordingly.

Category	Task	AIEDK-12 Technologies
<b>Teachers Teaching with AI</b> AI-based technologies that teachers are using to augment, extend or otherwise affect their work with their students	<i>Preparation</i>	- AI-powered presentation software (e.g., <a href="#">Beautiful AI</a> , n.d.) - Generating lesson plans (e.g., <a href="#">McCreary, 2020</a> )
	<i>Administrative tasks</i>	- facial recognition for attendance role calling, school entrance check (e.g., <a href="#">Smart Attendance</a> , Barber, 2020) - automated exam proctoring/invigilation (e.g., <a href="#">ProctorU</a> , n.d.)
	<i>Teaching and Facilitating; Tutoring (one-on-one)</i>	- tutor software, also called Intelligent Tutoring Systems (eg. <a href="#">Thinkster</a> , Math for K-8) - Virtual learning Assistant (e.g., <a href="#">Cognii</a> Virtual Learning Assistant; <a href="#">Amira</a> reading for K-3) - teacherbots (e.g., <a href="#">Bayne, 2015</a> , <a href="#">Breines &amp; Gallagher, 2020</a> )
	<i>Monitoring, diagnosis, management and remediation</i>	- Learner behavior and emotion monitoring and brain-wave trackers (e.g., <a href="#">Taj, 2019</a> ) - Student online activity monitoring (e.g. GoGuardian, Kumar, Vitak, Chetty, & Clegg, 2019) - Automated data analytics and cognitive insight (e.g. IBM Watson AI-based collaborative educational project). - AI-based diagnosis tools to detect special needs such as dyslexia, dyscalculia, spelling difficulties or Attention Deficit Hyperactivity Disorder (ADHD) (Drigas and Ioannidou, 2013).
	<i>Assessment and grading</i>	- automated essay scoring (e.g. GraderAide) - AI-based grade prediction (e.g., used by IB program during COVID: <b>need reference</b> )
<b>Learners Learning with AI</b> This refers to AI-based technologies that students are using to augment, extend or otherwise alter how they learn	<i>Assistive/Inclusive technologies &amp; UDL</i>	- Accessibility/assistive technologies: autocorrect, auto-fill, text prediction, grammar correction, speech-to-text (STT) and text-to-speech (TTS); (e.g., <a href="#">Grammarly</a> , <a href="#">otter.ai</a> , <a href="#">Natural Reader</a> , <a href="#">Read&amp;Write</a> )
	<i>Personalized learning and tutoring</i>	- virtual teaching assistants, chatbots - <a href="#">Feldstein &amp; Hill, (2016)</a> students are provided with one-to-one tutoring based on analysis of tests. e.g., <a href="#">Mindspark</a> , <a href="#">Teach to One</a> (ML) <a href="#">MATHiaU</a> , <a href="#">Squirrel AI</a> (China) - personalized learning - Automated data analytics and cognitive insight; to identify individual students' interests, strengths and weaknesses, learning pace modulation (e.g., IBM Watson AI-based collaborative educational project)
	<i>Subject Area Learning</i>	<b>Art:</b> e.g., <a href="#">GANbreeder</a> ( <a href="#">Artbreeder</a> ), Text2Art <b>English Language Arts:</b> e.g., NLP (Natural Language Processing) software like GPT-3 technologies for writing: Sudowrite, OpenAI, <a href="https://talktotransformer.com/">https://talktotransformer.com/</a> , <a href="#">Semantris</a> , <a href="#">Handwriting with a Neural Net</a> <b>Mathematics:</b> e.g., <a href="#">Wolfram</a> Alpha; Mathematica <b>Music:</b> e.g., <a href="#">AIDuet</a> , <a href="#">NSynth Sound Maker</a> , <a href="#">MuseNet</a> , <a href="#">Magenta studio</a> <b>Physical Education:</b> e.g., Strava <b>Science:</b> e.g., <a href="#">Wolfram</a> Alpha; <b>Language Learning:</b> e.g., DuoLingo
	<i>Accessing Learning Resources and Supports</i>	- Search Engines (e.g., Google)
	<i>Social, emotional and moral development</i>	- <a href="#">social robots</a> (Hao, 2020) to help children with autism spectrum disorder (ASD): e.g. <a href="#">Alcorn</a> et al. (2019) and <a href="#">Pakkar</a> et al, (2019)



<b>Curricular Level Impacts of AI</b> Additions to the curriculum, new literacies (and therefore also suggests teacher PD needs)	<i>Digital Citizenship</i>	- additions to K-12 Digital Citizenship curriculum: (e.g., understanding Deepfakes such as <a href="#">Face Swap</a> (Deepfakes web, n.d.) that use Generative Adversarial Networks: GANs); algorithmic bias (critically assessing the social effects of computing on various groups, including women, visible minorities, people with disabilities, and Indigenous peoples.);
	<i>Computational &amp; Data Literacy</i>	- additions to K-12 Computer science and computational thinking curricula (e.g., <a href="#">Pan-Canadian K-12 CS framework</a> : example outcomes: “Assess how human biases are embedded within technical systems and artificial intelligence”; “Explain how machines learn. Discuss specific ethical challenges with machine learning and AI”.)
<b>Systems Level Impacts of AI</b> Policies and higher-level activities affecting teachers’ work, e.g. school, district, government level decision-making	<i>School district-level administration</i>	- Predictive Analytics (e.g. <a href="#">Social Solutions</a> ’s Case Management Software where “predictive and diagnosis models to support decisions and generate feedback at the establishment (school, university, etc.) or education system level (district, region, country, etc.)” ( <a href="#">Vincent-Lancrin, S. &amp; Van der Vlies, R., 2020, p. 9</a> ) - Monitoring and assessing student risk (e.g., GoGuardian)
	<i>Teacher evaluation</i>	- Teacher assessment tools (e.g., IMPACT used by a school district to fire all teachers whose scores put them in the bottom 2%, and inadvertently fired at least one teacher who should not have been fired. See <i>Weapons of Math Destruction</i> ( O’Neil, 2016)

Table 1. A Topology of AIEdK-12 Technologies and Teachers’ Work

### 3.2 Interviewing AIEdK-12 Technologies in Conversation with Human Teachers and Learners

One posthumanist and disclosive ethical approach to investigating the integration of digital technologies in educational settings is to “interview” them (Adams & Thompson, 2016, 2020; Gourley, 2020). Adams and Thompson (2020) outline a set of eight heuristics to collect posthuman data—Gathering anecdotes; Following the actors; Listening for the invitational quality of things; Studying breakdowns, accidents and anomalies; and then analyse it by: Discerning the spectrum of human-technology-world relations; Applying the McLuhan’s laws of media; Unravelling translations; Tracing responses and passages (p. 250). The eight heuristics are not intended to be used all at once; rather, each offers a different lens for apprehending the world in a posthuman way (Adams & Thompson, 2016).

We conducted three brief posthuman interviews, each with a different AIEdK-12 technology selected from Table 1: GraderAide, SudoWrite and Text2Art. GraderAide is an automated essay grading application for teachers. SudoWrite is a text generator based on GPT-3, a deep learning neural network; Text2Art is an art generator powered by VQGAN+CLIP technology. Sudowrite and Text2Art can be used in English Language Arts and Visual Art classes respectively to extend learners’ subject area learning; learners may also employ these AIs on their own to complete assigned school work, potentially without the knowledge of the teacher.

Each interview involved documenting a user’s—a teacher’s or learner’s—*initial encounter* with an AI technology as a way to uncover its affordances, (pre)scripts and invitations in relation to the user. As media theorist Marshall McLuhan (1964) once pointed out, a technology’s “spell can occur immediately upon contact, as in the first bars of a melody” (p. 15). The interviews endeavoured to record “the first bars of [the AIEdK-12’s] melody” as experienced and perceived by a teacher or learner. The following questions, based on the heuristic, “Listening for the invitational quality of things,” (Adams & Thompson, 2016, p. 40) guided each Human-AIEdK-12 interview and the subsequent discussion about the ethical and pedagogical implications uncovered:

- What is a technology inviting (or encouraging, inciting, or even insisting) its user to do, think, or perceive?
- What is a technology discouraging (or constraining, or even prohibiting) its user from doing, thinking, or perceiving?
- What prereflective “conversations” (van Lennep 1987) or gestural “correspondences” (Ingold 2012b, p. 435) unfold between human being and a technology and/or their material surround?
- What kind of scaffolding is a technology explicitly or implicitly offering to help frame thinking, intensify perception, or enhance action? (Adams & Thompson, 2016, p. 40)



Each posthuman interview is constructed as an extended anecdote in an attempt to “reassemble and resemble the concrete, lived-through particulars of the eventing lifeworld, and thereby prepare a space to reflectively grasp and analyse our pre-reflective conversations with (digital) things” (p. 30). Following each human-AI interview, we identify ethical implications that surfaced in the context of these brief human-AI intra-actions and consider how a teacher may seek to address them in the context of their own professional practice.

### 3.2.1 An interview with a Teacher-GraderAide

A teacher signs up for a 48-hour trial version of GraderAide, hoping to find a way to ease the amount of essay marking consuming their evenings. Logging on to the trial version, they are presented with a simple webpage with two large buttons: Grade Papers and View Gradebook. The teacher selects “Grade Papers” and is prompted to fill out a webform with the following fields: Identifier (with a note about not including student names), Assignment Name, Class/Section, Assignment Type (Expository/Informative, Narrative, Literary or Persuasive/Argument), Grade Level (4 - 12 or Higher Education), and the option to either upload a txt, doc or docx file or copy and paste the essay into the box provided. As a quick test, they copy and paste a student essay they had written a few years ago as a graduate student, and select Expository/Informative and Grade 12 level and press the “Grade this Paper” button. The results are instantaneous: 80%!

The teacher excitedly chooses the “View Gradebook” option to View the Report. A bar chart displays a set of six different criteria graded out of 6: Holistic (5), Focus (5), Content (4.4), Organization (4.2), Language (4.3) and Mechanics (3). No other details are provided regarding how these numbers have been tabulated to arrive at 80%. Scrolling down, the teacher can see the “Marked Up Essay.” The essay is littered with GraderAide comments denoted by bold red text in square brackets: [Spelling errors], [Punctuation errors], [Subject-verb agreement errors], [Clause errors] and even [Jargon expressions], [Stock phrases] and [Pretentious words]! The comments are linkable, and when clicked, provide a generic popup window with “Grammar Feedback” specific to the named error, but without detail about the actual error in the paper.

The teacher looks through the linked comments. Some of the GraderAide comments are fair and indeed very helpful. However, other comments make little sense or are simply wrong. The teacher clicks through all the information available to them about the essay scoring on the View Report Page, searching for an explanation about how the grade of 80% was calculated. Frustrated, they search the internet and discover a *GraderAide User Guide* (Vantage, 2019) that provides the following information about how GraderAide evaluates a piece of student writing:

GraderAide integrates advanced artificial intelligence scoring technology that emulates the process carried out by human scorers. The system must be “trained” with a set of previously scored responses containing “known score” marker papers for each score point for a **specific genre and grade level**. These papers are used as a basis for the system to infer the rubric and the pooled judgments of the human scorers. The system “internalizes” the characteristics of the responses associated with each score point and applies this intelligence in subsequent scoring.

Below this blurb, the teacher finds the four writing genres which they had encountered in GraderAide with links to their respective rubrics. They select the Informative/Expository link which downloads a pdf with a detailed, one-page rubric organised by five of the six grading criteria from the bar graph: Focus, Content, Organization, Language and Mechanics. Under Content, for example, a score of “5-Good” means “Develops ideas by successfully integrating specific details and/or citing credible, source-based evidence to support the thesis/controlling idea. Uses consistent elaborative techniques.” The second page provides a description of the Holistic rubric. Here, a 5 is summarised as “clearly communicates the writer’s message” and below, a bulleted list repeating the balance of the criteria at the 5-Good level. On some level, this seems nonsensical since these criteria have already been accounted for in much finer detail in the first rubric.

In another section of the User Guide, the teacher finds this statement: “The report summary provides the percentage score (%) and scores for the writing traits (focus & purpose, content development, organization,

language usage, and grammar and mechanics). However, no formula is provided for how the final score is calculated, not to mention the scores for each of the criteria. They take out a piece of paper and perform a few calculations by hand using the numbers assigned to the essay: Holistic (5/6), Focus (5/6), Content (4.4/6), Organization (4.2/6), Language (4.3/6) and Mechanics (3/6), trying to arrive at 80%. With or without the Holistic score, and assuming the criteria are all equally weighted, it simply does not add up to 80% or even 75% (if rounded up). Clearly some weighting scheme is being applied, but what that is remains a mystery to the teacher. [End of interview]

### 3.2.2 Discussion about the ethical implications of a Teacher-GraderAide

In assigning a number or letter grade to a piece of student work, the teacher must be able to provide to learners a set of criteria--such as a rubric--describing on what basis their work will be assessed. While a comprehensive rubric is provided by GraderAide, the trial version does not provide the teacher with transparent access to how the scores are being assigned by the AI. On the one hand, based on the large number of grammar errors [marked in bolded red], it is somewhat apparent "why" a 3/6 was assigned for Mechanics. On the other hand, there is no information provided for any of the other criteria. Nor is there an explanation or weighting formula available for how GraderAide arrives at the final "Holistic" score. Ethically, it seems inappropriate for the teacher to abide or stand by a grade that they themselves cannot explain or justify to the learner. Nonetheless, perhaps over time and use, the teacher will come to see that the AI score provides relatively accurate results across their learners, even if no explanation is available.

From a posthuman view, GraderAide appears to *assist* the teacher in performing one aspect of their professional work: grading learners' texts. However, it does so without providing clear rationale beyond the insertion of grammar error notations. Instead, the teacher must "trust" the AI as a blackbox able to magically produce a fair score. Here, the ethical principle of AI *transparency* is evoked and specifically in relation to a teacher's pedagogical responsibilities. As a teacher's assistant or their cognitive collaborator in carrying out the professional work of marking essays, the GraderAide trial version fails to perform a key aspect of the needed assessment, that is, providing formative feedback for the learner to learn from.

As a professional, can a teacher ethically *rely* on the AI-generated grade? According to the OED, the verb *rely* comes from Anglo-Norman and Middle French *relier* which meant to attach or bind together, or sometimes to rally, reassemble; in legal use, it meant to bind as to consequences, warranty. Being able to *rely* on a technology, that is, to rally it to participate in one's professional practice, to perform specific tasks and subsequently produce good results, is crucial for posthumans. Binding themselves to GraderAide, the teacher receives less than the desired results. Now what? Perhaps in the interim, that is until GradeAide can assist the teacher in completing a more meaningful assessment, the teacher may choose to only use it as a formative (rather than summative) assessment for learners. The AI's assigned score and grammar feedback may at least be used to assist learners in strengthening their writing before their final submission. However, in its current form, GradeAide appeared not (yet) able to free the teacher of evenings spent essay marking.

### 3.3.1 An interview with Learner-Sudowrite

The subject line of the email is welcoming: "You're invited to try Sudowrite!" Having read about "automated" writing done by artificial intelligence, the learner is sceptical and curious about how it works, wondering how technology can possibly *write*. The email text invites: "We have a spot for you in our private beta!". Ignoring many other things to do, the learner immediately clicks on the link. The saturated pastel shades of the website include a button: Start Tour. A blank white space appears, and letters and words materialise in the rhythm of typing, highlighted with yellow.

Hello, Gillian!  
I'm Sudowrite, an AI-powered writing assistant.  
I'll show you around.

When you're ready, click anywhere and I'll type up a quick story for us to work with.

The learner clicks. The message disappears and more typing starts. The opening to a story is written before their eyes: the first few lines describe a man waking up in an unfamiliar hotel room, when a phone rings. The room is described vividly: "a plush Renaissance bedroom with Louis XVI furniture, hand-frescoed walls, and a colossal mahogany four-poster bed". The passage ends with the main character, Robert Langdon, saying "Hello?" into the phone. The typing pauses as if to let the reader catch up. Then the typing continues but the text is highlighted indicating that Sudowrite is no longer writing the story but rather is back to talking to the learner. The message explains that the story is meant to represent what a human writer would enter into the textbox. It commiserates: "but now you've hit a block". Bold text encourages action: "Click Wormhole and see what happens!" A gently bouncing conversation bubble directs the learner to the *Wormhole* button and they click it. Since this is a tour, more highlighted text appears and explains that Wormhole takes what the human author has written and "keeps going ... as if different versions of you in parallel universes were writing the next few paragraphs."

Alongside the white writing box, two separate blocks of text appear, each of them starting with a voice on the other end of the phone call but heading in different directions. One, a woman's voice inviting Robert to play chess in an hour, which he recognizes as a trap. The other, warning of unexpected guests to the Vatican and referring to Robert as "doctor". The learner chooses the mysterious visitors and clicks *Insert*. The text appears just under the first passage in purple characters, a reminder that it is a rough draft written by Sudowrite. It will turn black once edited or revised. The learner feels some relief, somehow comforted knowing that Sudowrite differentiates between the human writer's text and AI text. Next, Sudowrite prompts the learner to highlight the words *jacquard bathrobe* and click *Describe*. Momentarily, several ideas for more detailed descriptions appear. On offer are different sensual categories (sight, smell, taste, touch, and metaphorical), each of which have two or three different suggestions for ways to describe the bathrobe. There are other features called *Character* and *Twist* to explore later.

The learner exits the tour to try Sudowrite, experimenting first with passages from a favourite novel by Margaret Atwood and poems by David Whyte. Neither of these experiments improve upon the original authors, but all are plausible and descriptive. The learner writes a few lines making up their own story. Their scepticism is fading as they become caught up with the process. Some of the writing is very good, all of it plausible, and some of it sounds more or less like the learner's own voice. It is strange to read something they have not written but that they could have written. They turn to their current writing project--their dissertation--and select a passage where they are stuck. At first, it seems prudent to not mention this experiment to anyone, the feeling of cheating and dishonesty is strong. After all, they have no plan to use any AI writing that comes up, perhaps just get some language, as when reading other texts, or discussing ideas with colleagues. The learner selects these five lines:

There is a structure of touch between people that I have caught glimpses of and hinted at in this study of the nurse's touch that philosopher Kym Maclaren (2014) articulates well: touch is "essentially transgressive: it involves inherently an encroachment upon the bodily intentionality of the others". To transgress, from the Latin, means to step across, climb over, go beyond.

Unlike the fictional examples, Sudowrite has more problems with this phenomenological research text. For example, the samples of text that appear in *Wormhole* include references to authors with dates that do not exist. The first line that Sudowrite adds is nonsensical: "The transgression of boundaries between others draws on those boundaries." It goes on: "When you are nursing, to touch is to transgress boundaries.", and then: "The transgressive nature of touch is what gives it its depth, intensity and meaning." Ooof, the learner thinks while reading the last sentence, that is exactly what I am trying to say. [End of interview]

### 3.3.2 Discussion about the ethical implications of Learner-Sudowrite

A learner first encountering Sudowrite may have mixed feelings about writing in collaboration with an artificial intelligence. Questions regarding proper attribution and academic dishonesty surface. Lines begin to blur between who, what or who is writing: the human writer or Sudowrite.

Anyone who has experienced the despair of writer's block will recognize the relief of being given an idea, or a prompt to carry on. Sudowrite provides even more than a prompt with its suggestions of new ideas and new characters all in full sentences, with a variety of narrative directions. The experience is framed as a collaborative project, for example, differentiating the AI text with purple font to frame it as a rough draft, converting to standard black once the human writer has reviewed and made changes. The AI writing can be sophisticated, following a cardinal rule of fiction by showing instead of telling. In the example above, the AI-generated text includes a character mentioning the Vatican, an iconic area that immediately reveals the place of the story, an important task in fiction writing. The voice on the other end of the phone refers to our protagonist as *Dr. Langdon*, revealing personal details of the character within relationship instead of through exposition.

The plentiful and diverse options offered by Sudowrite are simultaneously constraints – once presented, the human author may be unable to see other ideas or directions for their writing project. There is a risk of shaping the learner's writing practises to require the input of another, leading us to wonder what might be lost along with writer's block. Creative endeavours like learning to write may come to fruition in the resolution of the very moments when writing is difficult.

Sudowrite is marketed for use by writers, tailored to the experience of how writing feels when it is going well: smooth, effortless, creative. However, Sudowrite may be taken up by high school learners to help with writing assignments, and teachers may integrate Sudowrite into their lessons to help students learn to write. In this sense, Sudowrite may act as a role model, for example demonstrating the different tones of descriptive writing, or as a helpful assistant, offering ideas for story directions. Given the intentions of Sudowrite's developers, teachers might consider whether Sudowrite is meant to help the learner learn to write, or if it is meant to create a story.

If high school learners write with Sudowrite without the teacher's knowledge, it would be very difficult for a teacher to recognize a final writing project as not having been done solely by the student. Since it is original work, the essay would not show up in online plagiarism checkers. Teachers may notice a change in quality or tone of a student's writing but may also need to anticipate such possibilities and transparently address honesty about one's work with students. Further, regarding Sudowrite's references to non-existent citations, how would a teacher check the references in every student's paper to determine if they were real?

On the other hand, if teachers invite students to write with Sudowrite, there may be ethical and pedagogical concerns, such as how to determine and express authorship. In early 2021, author Jukka Aalho published a book of poems, *Aum Golla: poems on humanity by an artificial intelligence*, acknowledging GPT-3 technology as a co-author. Can the result of writing with an application of GPT-3 technology like Sudowrite be regarded as a product of two separate entities? As well there exists a genuine possibility of over-involving Sudowrite to such an extent that the learner's participation is hardly more than clicking digital buttons. In either instance, whether the teacher is aware that Sudowrite is involved or not, OpenAI (an AI research and deployment company) has reported racial, gender and religious bias in AI models like GPT-3. (Brown et al, 2020) At least two possible issues for teachers arise here: could Sudowrite inadvertently teach a student bias, and how would a teacher know if the student was revealing their own unfair bias or Sudowrite's?

### 3.4.1 An interview with Artist/Learner/ArtTeacher-Text2Art

An artist/learner investigates many creative activities, including projects that involve image and text. Additionally, an art teacher is always on the hunt for different ways that they can inspire students so that they are encouraged to nurture and develop their creative impulses. *Text2Art* (T2A), an AI that generates art from

text and other images, is one such opportunity. Before the teacher introduces it to students, however, they take the time to explore it as an artist/learner. The project that they are currently working on, a graphic novel, is the perfect choice to explore this AI that turns text into images.

They open T2A and immediately their attention is drawn to the words, "Try it now!" and an empty text box. They select a couple of sentences from their graphic novel, and paste them into the text box, being sure to add one of a selection of descriptors, "ArtStation." They had read that this addition will generate a higher quality of image. They pause to research this term, and realise that it, and a number of other platforms for artists, must be part of the data set available to Text2Art. They see that they can choose from qualifiers such as draft/normal, image/pixel art, and widescreen/portrait/square frame. They are impressed with these options, which indicate that there has been consideration of the choices that an artist must make when creating images. They press "Generate", and it is immediately "queued at 4341. Estimated waiting time is 21710 mins. This may take a while...". Waiting, as if waiting on a surprise package, they are curious how their words will be visualised using this program.

The image arrives a few hours later via email. The image is a literal translation of the words, "blue jewel", and misses the intended metaphorical relationship to the earth. Nonetheless, perhaps provoked by the description of an evil force approaching the earth, "the Grinder" has generated an interesting grey swirling image that envelops the blue jewel. The artist-learner heads to their studio where they create another image based upon the original imagined image combined with the one that T2A has delivered. They then move back to the Text2Art page where there is an opportunity to begin the image generation again based on an image that they can input. They do so and include further text from the novel. After a wait, the image generated is an interesting iteration that has combined the text and the image they created. They take this iteration and once again move to their paints and continue to refine the image. Interestingly, the Text2Art program also supplies an animation of the way that the image is generated, which adds another creative outlet for the artist to use as inspiration. [End of interview]

### *3.4.2 Discussion about the ethical implications of Text2Art for the art teacher*

At times, the generated images instigate the artist-learner's creative exploration into their anticipated direction, directly augmenting what they have written. However, at times, the image created is so unusual that they rethink their writing/image creation. The artist-learner reconsiders the development of their characters and their actions, as well as the plot structure of the story. This kind of posthuman collaboration where the AI and human are generating iterations of creative work reveals limitations in definitions of creativity that are based on human agency. As AI continues to develop, definitions of creativity expand and shift to include "computational creativity" (Greenfield, 2021, 3). However, whether AI is creative is a hotly debated issue that continues with much of the population considering creativity as "a fundamental feature of human intelligence" (Boden, 1998, 347), and a distinctly human form of agency valued higher than AI artmaking (Hong & Curran, 2019).

As an art educator, they anticipate taking this program into the classroom and are immediately aware of ethical concerns. This kind of collaboration raises questions regarding copyright parameters, privacy concerns, and bias. Firstly, for both artists and art students, the question of ownership becomes more complicated with this kind of posthuman collaboration, so care must be taken to investigate copyright laws with respect to this kind of image generation (Zurth, 2021). Secondly, while there is an ability to opt out of displaying the image in a public gallery on the Text2Art site, privacy concerns within schools are important considerations. Protection of student data includes their creative works and exposure of student art in public spaces requires permissions. Also, this kind of AI program requires an email, which can also violate student privacy. Thirdly, the ways that youth create images and stories may affect their "social, emotional and moral development" as noted in the table under learning with AI. Students may become dependent upon input from data sets that are not transparent with respect to content. Thus, inappropriate images could be generated. This problem also extends to the ethical concern of potential bias within the data set with respect to women, visible minorities, people with disabilities and indigenous peoples.



## 4. Conclusion

Recent advances in AI—made possible through high performance computing architectures combined with the provision of big data sets needed by neural networks to “learn”—have sparked the public’s imagination while simultaneously raising a wide-range of ethical concerns. All technologies are Janus-faced, mobilising sometimes “ironic, perverse and paradoxical” consequences and implications (Arnold, 2003, p., 232). Artificial Intelligence is no exception. Indeed, AI’s most ironic, perverse and paradoxical consequences may be its implications for our own intelligence. This study sought to reveal new ethical obligations teachers may face as a result of the adoption of different AIEdK12 technologies. Our intent was to provide a more comprehensive and theoretically robust picture of how AI is impacting and changing teachers’ work across multiple professional activities: from lesson preparation and administrative tasks to facilitating learning and behaviour management. We attended to the different ways AI is being integrated into classrooms and changing how learners learn; we noted changes in curriculum, as well as involvement of AI in district level decision-making that affects teachers’ work and professional livelihood.

We employed posthumanism to help theorise human-AI intra-relations and intra-actions, and to shed new light on the AIEdK-12 and the future of teachers’ work. Posthumanism is uniquely equipped to address a continuum of human-AI relations, automations and performances “from task substitution (AI substitutes humans) to task augmentation (AI and humans complement one and another) to task assemblage (AI and humans are dynamically brought together to function as an integrated unit)” (Rai et al., 2019, p. iv). Using posthumanist research methods, we briefly interviewed three AIs currently deployed in classrooms. In the process of conducting these disclosive ethics investigations, we encountered the need for new vocabularies to describe the complex variation of relations being convened between and through human-AI intra-actions.

A posthuman view of the hybridic relation of human and AI systems represents a radical shift in understanding teachers’ work and shows that the digital will increasingly confront teachers with new ethical obligations. Further disclosive ethics investigations are called for including “interviewing” a broad range of AIEdK-12 in collaborative discourses with teachers and students. Left unaddressed is the question of posthuman learners, their evolving cyborg identities and the possible developmental implications of ongoing cognitive extensions in the context of an evolving AI-technosphere is surely of pressing concern. What would a posthumanist ethics of AIEdK-12 consist of?

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## References

- Aalho, Jukka, and GPT-3: *Aum Golly: poems on humanity by an artificial intelligence*. Basam Books (2021).
- Adams, Catherine, and Terrie Lynn Thompson: *Researching a posthuman world: Interviews with digital objects*. Springer (2016).
- Adams, Catherine, and Terrie Lynn Thompson: "Interviews with digital objects: a special issue on speaking with the digital." *Explorations in Media Ecology* 19.3 (2020): 249-254.
- Alcorn, Alyssa M., et al.: "Educators' views on using humanoid robots with autistic learners in special education settings in England." *Frontiers in Robotics and AI* 6 (2019): 107.
- Amira Learning: "Reading Science Meets AI". Available at <https://www.amiralearning.com>.
- Arksey, Hilary, and Lisa O'Malley: "Scoping studies: towards a methodological framework." *International journal of social research methodology* 8.1 (2005): 19-32.
- Barad, Karen: *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press, 2007.
- Barad, Karen: "Diffracting Diffraction: Cutting Together-Apart", *Parallax*, 20:3 (2014), 168-187.
- Barad, Karen: "On Touching the Stranger Within – The Alterity that therefore I Am" *The Poetry Project*, 29 March, 2021. Available at [www.youtube.com/watch?v=I9OQjStWVGg](http://www.youtube.com/watch?v=I9OQjStWVGg).
- Barber, Gregory: "Schools adopt face recognition in the name of fighting Covid." *Wired*. Available at <https://www.wired.com/story/schools-adopt-face-recognition-name-fighting-covid>.
- Bayne, Sian: "Teacherbot: interventions in automated teaching." *Teaching in Higher Education* 20.4 (2015): 455-467.
- Beautiful ai.: "The first presentation maker that designs for you". Available at <https://www.beautiful.ai>.
- Boden, M.: "Creativity and artificial intelligence" *Artificial Intelligence*, 103.1-2 (1998): 347-356
- Bostrom, Nick, and Eliezer Yudkowsky: "The ethics of artificial intelligence." *The Cambridge handbook of artificial intelligence* 1 (2014): 316-334.
- Brey, Philip. "Disclosive computer ethics." *ACM Sigcas Computers and Society* 30.4 (2000): 10-16.
- Brey, Philip. "Values in technology and disclosive computer ethics." *The Cambridge handbook of information and computer ethics* 4 (2010): 41-58.
- Brown, Tom B., Mann, Benjamin, Ryder, Nick, Subbiah, Melanie, et al: "Language Models are Few-Shot Learners". *arXiv:2005.14165v4*, 2020.
- Carnegie Learning: "MATHiaU: Take your math classroom to the next level". Available at <https://www.carnegielearning.com/solutions/math/mathiau>.
- Cognii. "Artificial Intelligence for Education". Available at <https://cognii.com/technology>
- Dear, Brian: *The friendly orange glow: The untold story of the rise of cyberculture*. Vintage, 2017.
- Deepfakes Web. Available at <https://deepfakesweb.com>.
- Eicher, Bobbie, Lalith Polepeddi, and Ashok Goel: "Jill Watson doesn't care if you're pregnant: Grounding AI ethics in empirical studies." *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society*. 2018.
- Feldstein, Michael, and Phil Hill: "Personalized learning: What it really is and why it really matters." *Educause Review* 51.2 (2016): 24-35.
- Greenfield G.: "Artificial Life and Artificial Intelligence Advances in the Visual Arts", edited by Machado P., Romero J., Greenfield G. *Artificial Intelligence and the Arts. Computational Synthesis and Creative Systems*, Springer, 2021, [https://doi.org/10.1007/978-3-030-59475-6\\_1](https://doi.org/10.1007/978-3-030-59475-6_1)
- Goel, Ashok K., and David A. Joyner: *An experiment in teaching cognitive systems online*. Georgia Institute of Technology, 2015.
- Goel, Ashok K., and David A. Joyner. "Using AI to teach AI: lessons from an online AI class." *AI Magazine* 38.2 (2017): 48-59.

- Gourlay, Lesley: *Posthumanism and the digital university: Texts, bodies and materialities*. Bloomsbury Publishing, 2020.
- Grammarly. Available at <https://www.grammarly.com>.
- Hao, Karen: "What is AI? We drew you a flowchart to work it out". *MIT Technology Review*, 10 November 2018. Available at <https://www.technologyreview.com/2018/11/10/139137/is-this-ai-we-drew-you-a-flowchart-to-work-it-out/>
- Hao, Karen: "Robots that teach autistic kids social skills could help them develop". *MIT Technology Review*, 26 February 2020. Available at <https://www.technologyreview.com/2020/02/26/916719/ai-robots-teach-autistic-kids-social-skills-development>.
- Hong, Joo-Wha, and Nathaniel Ming Curran: "Artificial intelligence, artists, and art: attitudes toward artwork produced by humans vs. artificial intelligence." *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM)* 15.2s (2019): 1-16.
- IBM Watson AI-based collaborative educational project. Available at <https://www.ibm.com/training/ailearning>.
- IntelliMetric. Available at <http://www.intellimetric.com/direct>.
- Introna, Lucas D. "Disclosive ethics and information technology: Disclosing facial recognition systems." *Ethics and Information Technology* 7.2 (2005): 75-86.
- Kaplan, Andreas, and Michael Haenlein: "Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence." *Business Horizons* 62.1 (2019): 15-25.
- Kouppanou, Anna: "...Einstein's most rational dimension of noetic life and the teddy bear...": An interview with Bernard Stiegler on childhood, education and the digital. *Studies in Philosophy and Education*, 35.3 (2016): 241-249.
- Kumar, Priya C., et al.: "The platformization of the classroom: Teachers as surveillant consumers." *Surveillance & Society* 17.1/2 (2019): 145-152.
- Lehoux, Pascale., & Rivard, Lysanne: "Hidden in plain sight: The infrastructures that support artificial intelligence", 24 January, 2021. Available at <https://theconversation.com/hidden-in-plain-sight-the-infrastructures-that-support-artificial-intelligence-146087>.
- Lewis, Jason Edward, et al.: "Making kin with the machines." *Journal of Design and Science* (2018). 10.21428/bfafd97b.
- Liu, Yi-Ling: "AI applications in Chinese education. The Future of the Classroom? China's experience of AI in education" (pp. 27-33). Nesta. (2020). Available at [https://media.nesta.org.uk/documents/Nesta\\_TheAIPoweredState\\_2020.pdf](https://media.nesta.org.uk/documents/Nesta_TheAIPoweredState_2020.pdf).
- Luckin, Rose, et al.: "Intelligence unleashed: An argument for AI in education." (2016).
- Lundie, David: "The givenness of the human learning experience and its incompatibility with information analytics." *Educational Philosophy and Theory* 49.4 (2017): 391-404.
- Lupton, Deborah, and Ben Williamson: "The datafied child: The dataveillance of children and implications for their rights." *New Media & Society* 19.5 (2017): 780-794.
- Maclaren, Kym: "Touching matters: Embodiments of intimacy." *Emotion, Space and Society* 13 (2014): 95-102. <https://doi.org/10.1016/j.emospa.2013.12.004>.
- McCreary, Dan: "Using AL to Generate Detailed Lesson Plans". *Medium*. 12 November, 2020. Available at <https://dmccreary.medium.com/using-al-to-generate-detailed-lesson-plans-29a5af200a6a>.
- McStay, Andrew.: "Emotional AI and EdTech: serving the public good?." *Learning, Media and Technology* 45.3 (2020): 270-283. doi: 10.1080/17439884.2020.1686016.
- Mindspark. Available at <https://mindspark.in>.
- Mishra, Punya, and Matthew J. Koehler.: "Technological pedagogical content knowledge: A framework for teacher knowledge." *Teachers college record* 108.6 (2006): 1017-1054. doi:10.1111/j.1467-9620.2006.00684.x.
- Natural Reader. Available at <https://www.naturalreaders.com>.
- O'Neal, Cathy: *Weapons of math destruction: How big data increases inequality and threatens democracy*. Crown, 2016.

- Otter.ai*: Available at <https://otter.ai>.
- Pakkar, Roxanna, et al.: "Designing a socially assistive robot for long-term in-home use for children with autism spectrum disorders." *2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*. IEEE, 2019. doi: 10.1109/RO-MAN46459.2019.8956468.
- Pardo, Abelardo, and George Siemens: "Ethical and privacy principles for learning analytics." *British Journal of Educational Technology* 45.3 (2014): 438-450.
- Pente, Patti, Cathy Adams, and Connie Yuen: "Artificial Intelligence, ethics, and art education in a posthuman world". In A. Knochel & O. Sahara (Eds.), *Global Media Arts*. Palgrave, forthcoming.
- Peters, Michael A., Petar Jandrić, and Alexander J. Means, eds: *Education and technological unemployment*. Springer, 2019.
- Petrina, Stephen: "Sidney Pressey and the automation of education, 1924-1934." *Technology and Culture* 45.2 (2004): 305-330. Available at <https://doi.org/10.1353/tech.2004.0085>.
- Postma, Dirk: "Critical Posthumanism in Education." *Oxford Research Encyclopaedia of Education*. 2020.
- Prinsloo, Paul, and Sharon Slade: "Educational triage in open distance learning: Walking a moral tightrope." *International Review of Research in Open and Distributed Learning* 15.4 (2014): 306-331.
- ProctorU: *Exam Security. Done Right*. Available at <https://www.proctoru.com>.
- Rai, Arun, et al.: "Editor's comments: next-generation digital platforms: toward human-AI hybrids." *MIS Quarterly* Vol. 43:1, 2019, iii-ix.
- Roos-Breines, Markus, and Michael Gallagher: "A return to Teacherbot: rethinking the development of educational technology at the University of Edinburgh." *Teaching in Higher Education* (2020): 1-15. Available at <https://doi.org/10.1080/13562517.2020.1825373>.
- Rubel, Alan, and Kyle ML Jones: "Student privacy in learning analytics: An information ethics perspective." *The information society* 32.2 (2016): 143-159.
- Selwyn, Neil: *Should robots replace teachers?: AI and the future of education*. John Wiley & Sons, 2019.
- Selwyn, Neil, et al.: "Digital Technologies and the Automation of Education—Key Questions and Concerns." *Postdigital Science and Education* (2021): 1-10. Available at <https://doi.org/10.1007/s42438-021-00263-3>
- Shen, Libi, and Anchi Su: "The Changing Roles of Teachers With AI." *Revolutionizing Education in the Age of AI and Machine Learning*. IGI Global, 2020. 1-25.
- Social Solutions*. Available at <https://www.socialsolutions.com>.
- Slade, Sharon, and Paul Prinsloo: "Learning analytics: Ethical issues and dilemmas." *American Behavioral Scientist* 57.10 (2013): 1510-1529.
- Squirrel AI Learning: First AI-adapted education provider in China*. Available at <http://squirrelai.com>.
- Stiegler, Bernard: "Artificial stupidity and artificial intelligence in the anthropocene." *Academia. edu*. [https://www.academia.edu/37849763/Bernard\\_Stiegler\\_Artificial\\_Stupidity\\_and\\_Artificial\\_Intelligence\\_in\\_the\\_Anthropocene\\_2018\\_](https://www.academia.edu/37849763/Bernard_Stiegler_Artificial_Stupidity_and_Artificial_Intelligence_in_the_Anthropocene_2018_) (2018).
- Tai, C: "Under AI's watchful eye, China wants to raise smarter students". *WSJ Video*, 2019. Available at <https://www.wsj.com/video/under-ais-watchful-eye-china-wants-to-raise-smarter-students/C4294BAB-A76B-4569-8D09-32E9F2B62D19.html>
- Teach to one 360*. Available at <https://teachtoone.org/teachtoone360>.
- Text2Art*. Accessed 2 November 2021. Available at [www.text2art.com](http://www.text2art.com).
- The Institute for Ethical AI in Education: "Developing a shared vision of ethical AI in education: An invitation to participate"*. University of Buckingham. Available at <https://fb77c667c4d6e21c1e06.b-cdn.net/wp-content/uploads/2020/09/Developing-a-Shared-Vision-of-Ethical-AI-in-Education-An-Invitation-to-Participate.pdf>.
- Thinkster*: Available at <https://hellotinker.com>.
- Thompson, Greg, and Ian Cook: "The logic of data-sense: Thinking through learning personalisation." *Discourse: Studies in the Cultural Politics of Education* 38.5 (2017): 740-754.

- Turing, Alan M: "Computing machinery and intelligence." *Parsing the turing test*. Springer, Dordrecht, 2009. 23-65. Available at <https://doi.org/10.1093/mind/LIX.236.433>.
- UNICEF: *Policy Guidance on AI for Children, 2020*. New York, NY. Retrieved January 28, 2021 at <https://www.unicef.org/globalinsight/media/1171/file/UNICEF-Global-Insight-policy-guidance-AI-children-draft-1.0-2020.pdf>
- United Nations Educational, Scientific and Cultural Organization: "Beijing Consensus on artificial intelligence and education". 2021. Available at UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000368303>.
- Vincent-Lancrin, Stéphan, and Reyer Van der Vlies: "Trustworthy artificial intelligence (AI) in education: Promises and challenges." (2020).
- Wang, Pei: "On defining artificial intelligence." *Journal of Artificial General Intelligence* 10.2 (2019): 1-37.
- Weissenbacher, Alan: "Rights and guidelines for protecting cognitive liberty in the age of neuro-engineering." *Spiritualities, ethics, and implications of human enhancement and artificial intelligence* (2020): 269.
- Williamson, Ben: "Governing software: Networks, databases and algorithmic power in the digital governance of public education." *Learning, Media and Technology* 40.1 (2015): 83-105.
- Williamson, Ben: "Digital education governance: data visualization, predictive analytics, and 'real-time' policy instruments." *Journal of Education Policy* 31.2 (2016): 123-141.
- Zawacki-Richter, Olaf, et al.: "Systematic review of research on artificial intelligence applications in higher education—where are the educators?." *International Journal of Educational Technology in Higher Education* 16.1 (2019): 1-27. Available at <https://doi.org/10.1186/s41239-019-0171-0>
- Zurth, Patrick" "Artificial Creativity? A Case Against Copyright Protection for AI Generated Works" *UCLA Journal of Law & Technology*, published at <https://uclajolt.com>, Available at <https://ssrn.com/abstract=3707651> Accessed 15 November 2021.