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Artificial Intelligence, Human Agency and the Educational Leader

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For all my teachers, professional and personal, but especially those who were both.
For David. If we are stuck in a simulation, I'm glad I'm dreaming of you. KMJ
For
Anna Mae
Jessica
Josephine
Margaret
Giselle
Nick
Nolan
Ethan
Dylan
Sophia
Dominic
Portia
And Ric, my lighthouse. RP

Foreword

How much do humans want to cede to the machine? Once the grist for science fiction books and movies, the question takes on greater meaning as artificial intelligence (AI) and the related algorithms become ubiquitous in our daily lives. The issues addressed in this book consider various aspects of AI and its effect on education and schooling into the year 2051.

The intent of this book was to tie literature in AI and data collected regarding the influence of AI in the future to learning and teaching to discern ethical considerations that define the ties. To collect data, the authors put out a call for participants from an interdisciplinary spectrum interested in learners and learning through three organizations, Educational Leaders Without Borders (ELWB), International Council for Professors of Educational Leadership (ICPEL), and various Divisions and Special Interest Groups from the American Educational Research Association (AERA). Twenty-two ($n = 22$) respondents from the Humanities, Computer Science, and Social Sciences agreed to draft a "vignette" envisioning a future classroom in 2051 using six prompts. The overarching question posed was: How do we merge our learning and leadership theories to technologies and the algorithmic biases that may maintain the social injustices of today into our future? While this method of data collection limits the generalizability of the results, it does provide information on how educational leaders and social science researchers who are invested in the topic of AI in education currently view challenges and future directions.

Results using a rubric developed for the vignettes revealed two primary categories. The first category included vignettes focused on AI with a humanistic perspective on social justice concerns in the future. These writings looked beyond the practical and technical role of AI and intelligent learning systems as tools in the school to questions of ethics and how educational systems, including the use of new technologies, are products of the social system.

The second category included vignettes that centered on developing practical, data-driven approaches to the utilization of technology in the classrooms of the future. These writings were focused loosely on data collection and assessments driven by a model utilizing the teacher as a classroom manager. Concerns were expressed mostly around uneven implementation and differential access leading to disparate outcomes.

In terms of learning theories, four major foci were found in the vignette sets. As many of the writers were educational administrators or leaders, several educational leadership theories were discussed. These focused on management concerns, as well as styles of leadership. Working with teachers and other stakeholders who were the users of products was a concern, but the authors were most concerned with providing equity and opportunity for the students through their leadership. This concern was echoed in the second set of theories that centered on culturally proficient educational practices. With overarching concerns for student opportunity, providing material and technology that was culturally specific and culturally relevant was often discussed. There were concerns not only with how student data was treated but also how the student was seen and heard by the technology, how interactions were structured, and how the technology could respond to individual needs.

The third set of theories could be subsumed under the traditional educational learning, teaching, and motivation theories that are prominent in the education field. Socio-cultural theory and social learning theory were both invoked when discussing scaffolding of lessons to provide increasingly harder problems; the identification of a student's zone of proximal development, or material that is just at the cusp of the student's ability; and discussion on the necessity of social interactions for learning.

The final set of theories referenced by the authors sought to combine aspects of educational theories with technology and theories of technology-mediated instruction that explain how learning in the present and in the future was impacted by novel tools. Many of these referenced theories, including the social presence model and collaborative learning theory, sought to explain how connections are made between learners through the mediation of technology. Other theories seek to explain how new tools are increasingly incorporated by learners in their learning processes, such as connectivism learning theory and convivial technology. At times these technology-mediated theories were placed in opposition to the teacher-mediated theories described above. There was an understanding among the authors that what we are and will be seeing in education represents a fundamental shift from the teacher-centered classrooms of the past, matching with the literature on the disruption caused by AI agency across organizations. The pertinent question was if this future shift will be to a classroom centered on the student or centered on the computer. Many of the authors discussed more than one learning theory within their writings.

To summarize, the book tied work in AI to teaching and learning to discern ethical considerations that define those ties. Technology that serves student learning is often focused on efficiency and accuracy in relation to educational outcome measures. AI education often focuses on teaching efficient retrieval practices of content knowledge in academic situations. This situation may be viewed as a product of the reliance on cognitive learning theories that focus on the efficient processing of information. Programmers choose a rational approach, with a primary target (audience), for a product developed that is scalable. Efficiency is primary. It is rarely based on humanistic learning paradigms that focus on the overall value of education for the good of society. The curriculum is not based on human beings, emotions, and compassion. Those human characteristics lack the logic that is considered, or even possible, with our current algorithms. This drive to create efficient systems can also be viewed as a product of the neo-liberal paradigm that insists technology has the goal of producing profit through scalability, rather than producing a product that serves the societal good. Students become viewed as products of this system, or at least, their efficient cognitive functions are viewed as products. Within most educational spaces, however, efficiency is a secondary concern. The vignette writers, even those who focused on educational leadership and management theories, did not center concerns about efficiency as measured with educational assessments. As these educators were trained using a variety of learning theories, other goals, besides efficiency, were a foremost concern, pointing to an area of disconnect between current AI development and educators. The vignettes provided by educators showed much more reliance on humanistic and social learning theories that embraced the complexities of the student-teacher relationships. Even those who ventured into technological-mediated theories were concerned about how relationships were built through and around the technology, not how the technology increased test scores. Educators emphasize the social dimensions of the learning experience and emphasize outcomes beyond employment success. These various concerns were amplified by the knowledge that current human efforts to ensure the important outcome of educational equity have been inadequate.

To return to the main issue regarding humans and their machines, the book intends to acquaint the reader to the issues of human developing algorithms that may make education efficient and scalable. But, at what cost to humankind?

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Chapter 1
AI Transforms Twentieth-Century Learning

Rosemary Papa and Karen Moran Jackson

The transformational story this book proffers begins with the stunning disruption that artificial intelligence (AI) will thrust upon daily lives worldwide. The COVID-19 pandemic (Jean-Baptiste & Green, 2020) forced most students onto online platforms where software collected huge amounts of data from students. How much student data was being amassed is not yet known, and likely the software companies will keep that information proprietary. But the student data collected on these platforms will join the tsunami of data that now governs our technology. Some estimate that 90% of the world's data has been generated in the last 2 years with 80% of it unstructured, meaning that it is not easily categorized or searched (Rana, 2020). How will all this data be used in educational AI?

The involvement of teachers and education professors in the creation of new software and ongoing use of the product is fundamental and critical to the future of schooling. In this book, we consider why educators need to be active partners in the development of curriculum and assessment systems used in schools. By participating in the creation, as well as the ongoing tweaking required to update and revise systems as data grows, educators can ensure students are free from manipulation and that the systems are equitable to the diversity of students and school contexts. Educators should not stay passive with online curriculum development. Machine learning is now exploding in all social aspects of life worldwide. Keeping the large data sets bias-free is our role as educators. AI agents and the nature of AI *agency* depict how machines learn off the data they are fed and take actions in our world.

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In this book we connect AI agency to what it means for the intertextuality in online curricular that increasingly will redefine *human agency*. Who decides the how, what, for whom, and why with AI development for education controls the future of education.

More questions are raised in this book than are answered. The book strives to ensure understanding and offer actions for teachers, administrators, and the professors who prepare them to better deal with this revolution that will transform classrooms that have changed little over the last 100+ years. The curriculum we utilized was often built on the shoulders of research, but we now more clearly see how it is potentially biased through the lens of psychology and eugenics, along with the assessments that have been demanded of learners in schools and universities. We contend that educators willing to lead must become active participants in the AI revolution. They must question how teaching and learning are impacted, how curriculum through AI systems is being developed, and what is the potential for the continuance of social inequities in these systems. We weave this story going from the broader realities of what superintelligence and transhumanism mean to us as educators, to educators taking their place in AI development, all while wrestling with the ethical issues presented by the AI revolution. This book acknowledges that we are indeed in the middle of a revolution composed of automation, AI, and the COVID-19 pandemic, leading to an explosion of questions about teaching and learning structures, strategies, and philosophies. We begin with a seminal question, "How much does the human being want to cede to the machine?"

Heffernan (2020) agrees that we are in a historic revolution due to the automation resulting from AI "[And] revolutions have casualties—sometimes in unbearable numbers…But Leon Trotsky's observation that revolution is the locomotive of history still seems about right. At the very least, we would do well to notice that we're in the middle of one" (p. 6). The positive elements of new technologies were described by Tucker (2017) in an educational report from the New South Wales (NSW) Department of Education and Melbourne University, titled, *Future Frontiers: Education for an AI World* (2017). The piece presented a collection of research-based essays on possible futures in education and the potential implications for creative technology use in schools. The editors concluded from a collection of essays developed for the project that:

> […] successive revolutions in agriculture, industry and communications have created an ecology where human ingenuity and autonomy are augmented by artificial intelligence (AI) [and] each day, with every new breakthrough in science and technology, it is becoming clear that we are racing towards a future with immense potential to drive productivity and improve standards of living across our community. (p. v)

While there exists this "immense potential," educators continue to address age-old questions about how students learn, how teachers teach a curriculum embedded in new tools, and how school administrators ensure the well-being of all under their care. These debates underscore that the structures and software resulting from automation and AI might come from organizations that operate under different philosophies than educators. The driver for their work is often selling the product, delivering efficiency and scalability. This drive can lead to a one-size-fits-all view by which learning is measured, rather than concentrating on student needs.

The primary theme for this book was to produce a transparent and honest dialogic on the elements within societal and cultural contexts to place educators in their rightful place as partners in how AI is created for the diversity of students in schools. We seek to understand the relationship between educators, social scientists, engineers, and computer programmers related explicitly to AI development, learning, and ultimately social justice ethics.

> AI technology is used to derive important information about an online learning system, but the action taken is not by the system itself; the human intelligence that surrounds the system is supported and leveraged…However, learning theories that fail to take into account the evolutionary origins of human teaching and its nature as a fundamentally biocultural phenomenon are fundamentally incomplete, with consequently limited explanatory power. (Baker, 2016, p. 458, 461)

By identifying intersections between AI development and learning theories, by the end of the book, educational leaders will confidently interface with developers and content experts to establish optimal teaching skills and strategies for the learner's ethical "good" while attending to social justice parameters.

Learning and Leadership Theories

Learning, social cognition, personality, and leadership theories date back to antiquities where the research was noted in Chinese literature from the sixth century B.C. (Hieder, 1985 as cited in Zaccaro, Kemp and Bader, 2004), in the struggle to identify the qualities of leadership. Throughout history, examples are found in some form or another which have shaped our future. From the mid-1800s, extraordinary and heroic great men were written and described circa the 1840s by Thomas Carlyle and the 1880s by Francis Galton, who both espoused a eugenics effort to describe and justify superior intellect and courageous leadership as traits. These traits, one is born with, developed into the Great Man Theory. The Great Man Theory (Carlyle, 2012; Galton, 2001; 1883) espoused that one is born with traits of extraordinary leadership potential that non-leaders do not possess.

For the field of educational leadership for both teachers and school administrators, these traits were perceived to be passed down from one generation to another generation of one's bloodline. In subsequent research traced throughout the twentieth century emanating from the Great Man Theory, Stogdill (1948) analyzed 124+ trait studies conducted between 1904 and 1948, and another 163 studies between 1948 and 1970 which identified leadership traits across leaders in various groups. He identified "eight traits: intelligence, alertness, insight, responsibility, initiative, persistence, self-confidence and sociability" (1974; Northouse, n.d., p. 16). He also speculated on the situational aspects connected to these traits. This research line spans the twentieth century into the twenty-first century traced through the Great Man Theory and his/one's innate leadership abilities. Mann (1959) examined 1,400 findings on leadership and personality, though they had less emphasis on situational aspects, distinguishing leaders from non-leaders. His identifying six traits (intelligence, masculinity, adjustment, dominance, extraversion, and conservatism) were subsequently supported by Lord, DeVader, and Alliger (1986) through a meta-analysis found to support that personality traits and leadership perceptions define leaders as high in intelligence, masculinity, and dominance. Zaccaro, Kemp, and Bader (2004), through their research on social intelligence addressed how one's feelings are understood, reflect another important trait. Leaders tend to have higher intelligence, which, if it is innate, supports a bias to all who do not fit the Great Man Theory. Trait theories undergird personality and social leadership theories with conscious and unconscious biases. Leadership theories in the twenty-first century are linked to situational, servant leadership and other practices undergirded by biased lenses historically situated to give power to some and not to others. In a popular 1980s textbook, *The Professorship in Educational Administration*, edited by two noted giants in the field, Donald J. Willower and Jack Culbertson in 1964 wrote:

> Elsewhere I have suggested that in seeking talent for the professorship, we should look for men who are bright, who are young, who have dealt with the major ideas of Western culture, who have exhibited some independence and creativity, and who have a commitment to education. (Campbell, 1964, p. 19)

Another author in this book suggests that one of three ways to organize a leadership department is by using the Great Man Theory (Griffiths, 1964, p. 32). This textbook was still in use during a 1980s doctoral program focused on administration, curriculum, and instruction at a land grant university. This underscored the traditional views as "right" views and made second-class citizens of others.

Biases are all around us; biases are in our classrooms and universities. A *Los Angeles Times* news article, titled *California spells trouble for the SAT*, discusses the evolution of college admissions and standardized tests as being inherently unequitable. Citing the genesis, Dr. Rosner of the Princeton Review Foundation said,

> …he plans to begin raising another potentially explosive issue about the SAT: Its founder, Carl Brigham, was a Princeton professor and supporter of the eugenics movement—a racist ideology that sought to use science to improve the human race by promoting traits deemed superior and breeding out those judged undesirable. He believes the origins of the test cannot be dismissed. Amid the nation's racial justice movement, universities have removed the names of eugenics supporters from their building and honors…UC Berkeley last October disclosed it had discovered a $2.4-million eugenics research fund, frozen its use and launched a review into how the university could have accepted such a gift in 1975. (Watanabe & Agrawal, 2021, January 22, p. A12)

These biases permeate much of social science research in psychology, sociology, and education and not necessarily in obvious ways. Moving many of our standardized testing protocols and books on personality, social cognition, and other social sciences into leadership texts makes it difficult to see how we can ferret out the biases taught to teachers and school leaders by professors unaware.

Likewise, disruptions in schools are ubiquitous given geography on planet Earth. As extrapolated by the field of medicine and standardized testing, school leadership can make a dangerous situation even worse for people of color by an inherently biased system, as found in the COVID-19 pandemic affecting people of color more substantially. Before the COVID-19 pandemic, the environment impacted education in delivery methods. Hurricanes, earthquakes, fires, and other natural disasters contributed to disruptions in many students' schooling journey. Baytiyeh (2019) proposed a proactive strategy when face-to-face learning is disrupted using Bandura's (1997) social cognitive theory, which found that people's perceived self-efficacy is that one believes they can control their own behavior. The pandemic has put this to the test as students and teachers worldwide struggle within cyber connectivity learning and teaching. Education until the "new normal COVID-19" thrust upon educators the lack of connectivity for many students. Questions abound:

How are the learners coping?
In what ways is their self-efficacy affecting their academic performance?
How is their sense of self affected in an adverse dimension of pure online learning?
How are teachers coping with their learner's stress and possibly their depression?
What are educational leaders doing to prevent teacher stress and anxiety?

Will AIED (artificial intelligence in education) be programmed to harness our emotions into relationships with AI systems as part of student learning? This type of intentional design was explored by Walker and Ogan (2016) in the following scenario:

> A student stares at the scream. First day of geometry, but already wrong again. A message pops up: "Maybe we should think about the definition of isosceles triangle – do you remember what we said about the three sides?" The student relaxes. "Oh yeah, we learned about isosceles triangles already" she thinks, "and at least I'm not doing this alone." (p. 714)

Humans are social learners, and in this scenario, human emotions are being evoked by the program. This type of intentional design results when "an AIED system employs the type of polite language used by acquaintances…[P]ioneers in learning theory, suggest people respond to technology in similar ways as they respond to humans" (Reeves & Nass, 1996, p. 714). Are these the goals of AIED to create an efficient, productive learning environment (p. 715); socio-motivational relationships as part of the design (p. 717); or robotic learning companions (co-bots) to interact socially with human learners (p. 718)? Walker and Ogan (2016) described "a vision of the future where students form social relationships with their educational technology that are context-sensitive, evolve, and are carefully designed to enhance positive outcomes and avoid negative ones" (p. 725). They go on to ask, "Is it acceptable if technology lies to students if it is purposefully manipulative" (Walker & Ogan, 2016, p. 726)? The ethical issues raised by such a relationship need to be studied with questions that are based on the human agenda. The obvious questions relating to theory-driven and design-based research need to start with do no harm. This adage is the start of any teacher-student relationship. In the vignette by Jeremy Visone, *The Importance of the Teacher in Regulating Learning*, he emphasizes the teacher's importance utilizing Vygotsky's zone of proximal development and social cognitive theory.

Vignette: The Importance of the Teacher in Regulating Learning

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Scenario 1 As students enter their mathematics classroom at Marie Curie Technical High School[1] (Curie Tech), a culturally diverse high school of choice located in an impoverished northeastern US city, they exchange typical greetings with each other and their teacher. However, unlike in most classrooms, the teacher, Mr. Siber,[2] does not introduce the students to a lesson or learning activity. Rather, the students at Curie Tech log onto their laptops to find their individualized lesson for the day in the form of the cloud-based mathematics curriculum SUM.[3] Students know the drill: without much interaction with each other, they are to find the next skill in their progression of lessons in SUM. There is continuity from home, as students are to work in SUM at least 30 minutes per day, 7 days per week. Thus, there is no distinction between homework and classwork, other than the surroundings.

SUM had been touted as a self-paced, individualized system of math content delivery, skill development, and assessment. Students have proven that the promised individualization is, in part, realized; students are moving at varied paces. Some students, the most independent learners, are powering quickly through the lessons and levels, mastering skills on the first attempt. For some of these students, the challenge emerged that Curie Tech had exhausted math content and classes to offer these students. Whereas state regulations require a certain number of credits (as measured by years of seat time in math courses), these students had compacted multiple years of math into 1 year's worth of seat time, and there are no higher-level math courses to offer them.

At the opposite end of the spectrum, the majority of students in Mr. Siber's math class, many of whom are Spanish-speaking English learners, are lagging far behind the pacing guide. When they fail to grasp a concept after watching the initial demonstration video and/or taking the mastery quiz for the lesson, rather than raise their hand to ask Mr. Siber a question, students had been instructed to write for assistance within SUM's interface. SUM, which does offer its resources in Spanish, directs students to watch videos that re-explain the taught concepts. Students then retake the mastery quiz, which they frequently fail again. When the cycle of failure becomes sufficiently frustrating, students reach out to Mr. Siber for direct assistance. Since Mr. Siber has not been regularly instructing the students, and they are all in different places with respect to content, Mr. Siber, ever playing catch-up, is effectively reduced to

[1] Pseudonym.
[2] Pseudonym.
[3] Pseudonym.

a tutor role, assisting students with whatever random challenge they are encountering in the moment.

"This was such a disservice for the kids," shared Mrs. Edvice,[4] a school counselor, who has had many conversations with frustrated students and/or their parents. She explained how students at Curie Tech came from a middle school environment, where math instruction was more traditional and teacher-directed, and they have struggled greatly with a learning format that is so devoid of teacher interaction. Paradoxically, a program designed to be the penultimate method to personalize learning and differentiate for individual needs has negatively impacted the students most in need of differentiation—those who need more challenge and those who need more assistance. When students had questions, SUM did not understand the nuances of their inquiries and needs and, rather, provided one-size-fits-all videos to re-explain that which the students did not understand in the first place. So great were the challenges for many of the students at Curie Tech in acquiring math knowledge and skill from SUM that the students needed to enroll in two math courses during their senior year to remediate learning gaps. It is no surprise that, after 4 years of investment and commitment to SUM, the technical high school system to which Curie Tech belongs abandoned the program.

Scenario 2 In a math workshop environment at Rosa Parks Elementary School[5] about 10 miles from Curie Tech, first-grade teacher, Miss Prymerry,[6] holds court at her kidney-shaped table.

"I am done with my work," shared Felicia, proudly offering her completed worksheet of practice math word problems.

"Great work. You have done well to use our counting on strategy. However, you seem to have missed the number to start with." Miss Prymerry motioned to several incorrect steps in problems on Felicia's paper. She wrote out a sample practice problem, slowly talking through the steps and asking Felicia for her level of understanding throughout. Felicia asked some clarifying questions, and Miss Prymerry was able to answer them in real time. Then, based upon her diagnosis of Felicia's mistakes, Miss Prymerry asked Felicia to use her electronic tablet to access a particular application where she could practice her identification of key numbers in word problems.

Another student, Manuel, who is an English learner, shared his work next. He was correctly identifying the numbers to manipulate, but his calculations with these numbers were not correct. Analogously to Felicia's situation, Miss Prymerry wrote out an example of a correct calculation for Manuel, using the taught strategy of the day. She was able to demonstrate for Manuel why his

[4] Pseudonym.

[5] Pseudonym.

[6] Pseudonym.

application of counting on had not worked correctly, even though he did not fully understand her words. Simply, he had been counting the number he was starting with, rather than beginning with the next larger number. Then, Miss Prymerry sent him to his tablet to work on a different application, this time focused on calculation with the new strategy.

Analysis

In both of the situations described, technology played a central role in students' math learning. However, the situations presented quite different roles for the teacher. In the case of Curie Tech, one might argue that the "teacher" in the classroom was reduced to nothing more than a monitor of student work completion and, on occasion, a last-resort provider of remediation and support when students were maximally frustrated with their technological teacher. At Rosa Parks Elementary School, Miss Prymerry served as a mediating decision-maker between students and the technology applications, as she skillfully and strategically steered students to meet their individual needs. Whereas SUM could not adequately answer students' questions, Miss Prymerry was able to understand the nuance of her students' needs, show them how to perform the skills correctly relative to their mistakes, and recommend technology tools that specifically targeted what her students needed at that precise moment.

From a learning theory perspective, Miss Prymerry was able to help students access learning at their *zone of proximal development* (Vygotsky, 1978b), by precisely identifying students' mistakes. This was followed by practice with the specific skill that students needed, allowing them to move to the next logical rung of the figurative ladder of learning. A skilled teacher can make the connection for students to push them incrementally ahead each lesson. Conversely, SUM was not able to meet students where they were effectively, and, as a result, students "were stuck," in the words of Mrs. Edvice, unable to reach the next logical skill because their "teacher" was unable to help them bridge the gap in their understanding.

Bandura (1986) asserted through *social cognitive theory* the importance of learning from those with real or perceived authority and/or expertise, such as teachers. According to Bandura, for learning to occur through observation, the observer's (student's) connection to the model (teacher) is foundational to the amount of attention the observer will pay to the model. However, the observer must also have the prerequisite skills to perform the larger task. Whereas one could argue a technology-based "teacher" (i.e., SUM) could provide the motivation—say, through engaging videos and/or gamification approaches—required for students to attempt to learn the desired skills, the inability for the program to successfully attend to students' grasp of prerequisite skills left students who were struggling without a capable vehicle for assistance. They were, in effect, stranded in their learning progression.

This ineffective remediation for students with gaps raises equity issues. On the surface level, SUM seems to offer an advantage for English learners, as it offers its videos and instruction in students' native languages. However, without the expertise of a skilled teacher to help students past their sticking points, the English learners lag behind peers who are able to progress to more challenging content, thus resulting in a "lack of opportunity to learn" (Smith et al., 2017, p. 73).

For educational leaders, the use of SUM as a math content delivery, skill development, and assessment vehicle does not meet expectations. For example, the ISTE Standards for Educational Leaders (International Society for Technology in Education, 2020) call for educational leaders to "[e]nsure all students have skilled teachers who actively use technology to meet student learning needs" (p. 1). These standards continue to call for educational leaders to seek "innovations in pedagogy" (p. 1) through technology. However, the standards explain that these pedagogies are those that are improved by the inclusion of technology. Here is where SUM does not pass the test. The technology tool cannot outperform a skilled teacher at diagnosing and responding to specific student needs and questions.

More comprehensive standards for educational leaders (National Policy Board for Educational Administration, 2015, 2018b) also call for educational technology use to enhance the learning experience, but they also qualify the use of technology with adjectives such as *high-quality*, *equitable*, and *effective*. Given the poor outcomes for students with needs, and the widespread need for remediation following students' interfacing with SUM, it seems clear that SUM should not be described by any of these qualifiers.

Actions for the Field to Consider As we turn our gaze to the coming decades, recognizing the rapid advance of technology-based learning that was necessarily and instantly thrust upon educators, students, and families, alike, in the midst of the COVID-19 pandemic, we need to situate technology in its proper position in pedagogical repertoire. As distance learning under quarantine has shown, as had the failures of SUM, technology can, at best, serve as a support, an enhancement, a vehicle for engagement. However, it should not serve as the decision-maker for student learning. As yet, technology has not proven to be a match for a skilled teacher, who is able to recognize why a student is struggling, as well as understand the nuances of students' questions, resulting in a more focused, strategic response and plan for remediation. Particularly, for our students who struggle, the importance of the teacher in regulating learning cannot be overstated. Teachers need not worry that they are about to be replaced by adaptable, self-paced, individualized technologies. These technologies can serve to make the job of the teacher easier, but they cannot take the job of the teacher. Educational leaders must continue to hire teachers who can embrace the use of technology while still independently diagnosing student skill development.

Ways of Knowing

As Dr. Visone noted in his vignette, Du Boulay and Luckin (2016) considered learning theories and AIED teaching strategies for the teacher and the learner. They reviewed epistemological and reflective theories with roots in the variability of teachers and communication competence. They described it (noted below) and acknowledged the difficulty of understanding learning and teaching:

> While there are some specialized tactics that human teachers apply effectively, good teaching derives from the conversational and social interactive skills used in everyday settings such as listening, eliciting, intriguing, motivating, cajoling, explaining, arguing, persuading, enthralling, leading, pleading and so on. Implicitly the message was that neither learners nor teachers are disembodied cognitive entities engaged in symbolic knowledge sharing but rather are feeling and thinking beings living and working in a particular educational, social, and cultural context. (du Boulay & Luckin, 2016, p. 401)

MOOC data (Peach, Yaliraki, Lefevre & Barahona, 2019) analyses on learner behavior identified differences among learners, such as early birds to crammers, that quantify all movements of the learner. Teachers' role is to remain in the loop, offload tasks, concentrate on what to work on, and continue to collect more data. Are teachers to be primarily interacting with the software data? Humans all have implicit bias, which is the fundamental ethical dilemma. AI algorithms are created using large data sets, which may be biased, coded by humans, which all have implicit biases. The resultant programs may target a particular audience with a prevalent focus on specific students to the detriment of other students.

In the vignette from Ginger Black, *Should We Get "Flipping" in Education? Blending into the Twenty-First Century with Online Learning*, she proposes educators must lead with a vital pedagogical purpose based on social cognitive theory and self-regulation.

Vignette: Should We Get "Flipping" in Education? Blending into the Twenty-First Century with Online Learning

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Much of the success of the traditional face-to-face educational setting is largely supported by the student's home environment. With the abrupt shift from the traditional classroom to an online learning environment due to the COVID-19 pandemic, much of our student's learning environment did a complete 180. Though parents and students waited for the first 2 weeks of transition to better understand exactly what their education would look like, many parents expressed concerns about how to support their children in the new learning environment—*home*. This vignette serves to share brief accounts of the parental perspective of their child's online learning experience, share ideas of how to better support families in the online environment based off parent and guardians' perspectives, and share thoughts regarding the future of online, blended, and/or flipped learning environments in our K–12 schools in America. Further, this vignette briefly explores education driven largely by technology versus the teacher 30 years into the future.

Introduction Parents and guardians of current school-aged children did not grow up in a world with the modern technologies students are accustomed to today. Schools have not mirrored the upgrades of technology our world has experienced. With the COVID-19 pandemic and drastic changes to everyday activities, schools had to make rapid decisions to protect society. These radical changes quickly reformed how education was conducted. Schools frantically determined their course of action to continue to educate learners using some form of online instruction. Schools were charged with transitioning learning, which mostly functioned in the traditional school setting, to an online learning environment. Learning became centralized to the student's home and supported remotely by teachers. The transition started with much uncertainty and created questions regarding the future of our students' learning process and progress for the current school year and beyond.

Allen and Seaman (2017) defined distance learning as "Education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously" (p. 6). E-learning became a term utilized as distance learning evolved and technologies improved (Sangra et al., 2012) and has become the fundamental delivery mode for distance education (Mayadas et al., 2015). New terminology exists to address particular teaching and learning methods using technology (Kahiigi et al., 2008), such as online learning, hybrid, or blended learning, flipped classrooms, and more.

Online courses can be differentiated based on characteristics such as "instructional delivery mode, time, and flexibility" (Mayadas et al., 2015, para. 6). Mayadas et al. (2015) explained that "online courses totally eliminate geography as a factor in the relationship between the student and the instruction" (para. 18). Blended or hybrid courses mix course activity in the traditional face-to-face classroom with online delivery (Mayadas et al., 2015). Flipped learning has emerged as a way to provide opportunities to best support student learning using online learning blended with activities that stimulate interactions between peers and instructors in the face-to-face learning environment (Lee et al., 2016).

The lack of forward thinking in many of our K–12 school systems became a harsh reality for many families and school faculty as the uncertainty of our student's education faced unparalleled adversity. As a parent and educator, I was concerned about the current state of education and felt that we had done an injustice to our students. Why had we not more diligently invested in online education earlier? Why were we perplexed by the unforeseen future of our students' current educational needs during this time? We live in a global society driven by the latest and greatest technologies, and yet we were taken aback by the concept of online learning. Like deer in the headlights, we were seeking our plan of action.

I collected perspectives from 33 parents/guardians from 2 school systems in North Carolina with children in elementary, middle, and/or high school to determine the benefits and challenges of transitioning to online learning. I also gathered opinions regarding the future of online, blended, and/or flipped learning and how this learning environment could be more effectively supported. Further, using parent perspectives I considered the future of education and how this wake-up call could be imagined for K–12 schools.

Benefits and Challenges of Online Learning Parents shared benefits provided by the online learning environment such as the opportunity for students to continue their education despite this pandemic, students became more familiar with technology, and it helped develop better time management and organizational skills. Others believed that the online learning environment was less distracting, the pressure of time limits was more relaxed, and students could work when it was convenient. The greatest benefit discussed was the ability for students to be self-paced through online learning.

The transition to online learning also included challenges for many families. Several were concerned with the structure and organization of the online environment. Others believed that major challenges in the online classroom were the lack of student motivation, attentiveness, and engagement. One parent felt this new learning environment was "not as engaging" compared to the traditional classroom. Parents also believed that there needed to be more clear and consistent communication in the online learning environment.

Furthermore, families found that technology and internet service were problematic for children to function effectively in the online environment, while others explained that the lack of knowledge students and families had regarding learning platforms or technologies impacted learning.

Actions for the Field to Consider Due to the pandemic, school systems contemplated how to execute "school," scrambled to implement online learning, and debated on how or if new information should be taught to students. Unfortunately, many stakeholders were not prepared for this drastic shift in education due to the lack of teacher training, student practice with digital learning platforms, and limited resources.

Fortunately, the capabilities of the internet and various technologies create possibilities for educating students. Additionally, this generation of learners are digital natives and have grown up with various devices and technologies. In this technology-driven society, it is peculiar why schools across America do not better embrace these opportunities to guide and support instruction and learning (Cuban & Jandric, 2015). So why have schools not yet adapted to the society in which they exist? Will we return to the traditional school setting and forget the lessons learned during this unprecedented time in our nation's history?

The fact is we have now broken ground to this new learning landscape. We need to persist with these changes and continue to implement online instruction and learning. We should consider what has worked during this transition to online learning, what needs improvement to ensure success for all involved stakeholders, and how we can use technology to our advantage.

Parents and guardians felt consistency was an essential component needed to support students in the online classroom. As many parents and guardians indicated, clear decisions, directions, and strong communication between home and school are imperative for the successful implementation of online learning. Gurley (2018) noted that effective and continuous communication is essential for students participating in online education. Therefore, school districts should determine an online learning management system that could be utilized to establish consistency, leverage student engagement, and provide effective ways to communicate.

Anderson (2011) believed that online learning provided learning experiences that were “more flexible in time and in space” (p. 53) and considering the emergency closing of school during the pandemic, we must consider options that allow learning to continue efficiently. Picciano’s *Blending with Pedagogical Purpose Model* provides a framework to help educators most effectively balance instruction using multiple modalities to teach and support various students in online courses. Picciano (2017) stated “the most important feature of this model is that pedagogy drives the approaches that will work best to support student learning” (p. 178). Utilizing an appropriate framework to design and implement courses is important when considering the future of K–12 online, blended, or flipped learning to ensure student success. As parents expressed, it is important for students to learn new concept through instruction and learning activities in the online environment, to have opportunities to engage with their peers and the instructor, and to have consistency in their educational experience, no matter the learning platform.

Unquestionably, educators need opportunities to become better prepared for online instruction, in regard to not only designing and implementing online and/or blended classes but also using technology to promote instruction and learning. Most teachers have “learned on the job” how to appropriately integrate technology into their classrooms. With the continuous and rapid development of technology, this has not been easy. Indeed, educators need the tools and knowledge required to effectively facilitate learning in the online environment.

Since time management and confidence in the online classroom were presented as both benefits and challenges, it is valuable to promote self-regulation skills in this learning environment. According to Bandura (1991), “In social cognitive theory human behavior is extensively motivated and regulated by the ongoing exercise of self-influence” (p. 248). He claimed that self-regulation occurs through three subfunctions: “self-monitoring of one’s behavior, its determinants, and its effects; judgement of one's behavior in relation to personal standards and environmental circumstances; and affective self-reaction" (Bandura, 1991, p. 248). Since many online courses, whether fully online or those that operate using a blended model, rely heavily on the ability of participants to learn independently, manage tasks, and set goals to complete coursework, self-regulation skills are imperative for a student's success in the online environment. In many twenty-first-century classrooms, teachers facilitate learning for students and encourage various ways to learn. However, much learning in K–12 classrooms is dependent upon the teacher's direction, guidance, and much of the time students being told when and how to learn. Educators must model how to regulate learning to help students reflect on their own understandings and set goals for continuous improvement. We need to shift the mindsets of our K–12 students to take ownership of their learning and practice self-regulation in order to be successful in online and hybrid classes.

In a world full of uncertainty, many things are still certain: students must be educated, technology continues to improve, and learning can exist outside of the traditional classroom. Our K–12 school systems could operate globally to educate students; however, traditional mindsets and notions of remaining in the past continue to flatten our educational systems. I envision the extinction of the traditional classroom and teachers being replaced with a master teacher digitally instructing students. Not only would this ensure that students receive common pedagogy, but this could provide financial benefits for state and national budgets. Moreover, when we consider school safety, operating in the online environment could theoretically protect our children from potential risks. I am aware of internet dangers; however, when you consider the dangers that schools face, such as school shootings and threats of pandemic virus outbreaks, I believe this opportunity outweighs the potential risk factors school campuses encounter today.

Looking into the future, students will connect virtually to complete K–12 requirements. Obviously, this transition will likely come with resistance from families, communities, and schools. With time and better understanding of how online learning functions, these pushbacks will decline. This transition will gain more buy-in if school systems, administrators, and educators do their homework on how to design and implement effective online courses. Parents will be less resistant if they understand the dynamics of this learning environment and observe its function with efficacy and if the framework used to design and implement the course focuses on student engagement and learning goals.

In the future, students will participate in online classes that will engage them in learning activities we can only imagine due to the ever evolving and impressive technologies of the twenty-first century. In this learning environment, timeframes for completing coursework could be determined by the individual learner, which will allow families to better balance busy lives. In addition, students will become self-regulated individuals due to the nature of online learning which will better prepare students to reflect and make decisions for their future.

Traditional schools need a makeover to become more current, support the future lives and careers of students they are teaching (Friedman & Mandelbaum, 2011), and break free from the modern mold they remain. School systems need to focus on providing online, blended, and/or flipped learning environments which foster self-regulated learners, create a more economic-friendly education system, protect our students from the dangers that threaten our school campuses, and provide an education that is relevant to the world we live in today. Further, educators, administrators, and policymakers need to change their mindsets regarding what is taught and how it is taught (Costa, 2010). Since online learning was the trend many schools shifted to during the pandemic, why would we consider closing the door to this type of learning environment? Rather, we should recognize the opportunity it provided, learn from this unplanned transition, and continue to support the use of online, blended, and/or flipped learning models to teach K–12 students.

AI Focus on the Individual Learner

As the new normal of 2020 has shown through #BLM and the COVID-19 pandemic, critical questions face all educational institutions (pre-K-12—tertiary), which result from aspects of humanity such as poverty, race, special needs, and gender and are evidence of human frailties and bias. Some people look to AI as an objective answer to these questions. However, the research discourse is framed by the role of learning theories, AI, and the algorithmic biases that may and likely will continue the social injustices of today into the future unless educational leaders assert themselves into AI development.

AI in education, according to Benedict du Boulay (2020), is at the present moment primarily concerned with data mining and machine learning. He suggests three significant roles for AI in education: assisting the individual learner within a tutoring systems, assisting the teacher in their management of the classroom of learners, and managing the tracking and data analysis of multi-cohorts of learners and teachers. In describing an AI tutoring system aimed at the individual learner, du Boulay gave the example of a program named "Betty's Brain" in which students must teach a female avatar named Betty different science concepts (Leelawong & Biswas, 2008). The use of a non-gender-neutral name for such a program is problematic. If AI systems have bias consciously, what happens when rationality-driven tools speed into a place where we convince ourselves that human beings are too messy and complicated to include humanistic levers?

In the vignette by Dixie Abernathy, *Artificial Imagination: Entrusting Our Students' Creativity to Educational AI Technologies*, she explores the importance of constructivist learning theories to think through schools' choices about access, pedagogy, and the needs of individual students.

Vignette: Artificial Imagination: Entrusting Our Students' Creativity to Educational AI Technologies

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I recently had the pleasure of visiting several elementary classrooms in northern California, classrooms that were part of a school that restricted technology use from the elementary programs. When first hearing of the school, I must admit that I was curious. As a Professor of Educational Leadership and one who touts the importance of technological tools in the modern educator's pedagogical skill set, I wondered how any educator could shun the advancements of our century.

After all, consider for a moment the full gamut of educational technological advancements. I'm referring to the reading programs that assess students' reading levels, assign appropriate texts, and then monitor progress on an almost hourly basis. I'm talking about advanced math programs that can intuitively provide just the perfect modifications and interventions to propel students to improved mathematical understanding. I'm thinking about the classroom behavior management systems that can "remember" students' names, assign or remove points for behaviors, and even reward students with humanlike expressions and praise.

These were the tools and presumed advantages on my mind as my Uber driver, Jack, corrected our route from an incorrect direction (one that had been provided by his navigation app). He finally let me out in front of the non-technology school, and I braved the chilly northern California breeze to enter through the front door. I was halfway expecting to be transported way back … back to the twentieth century. And, in a way, I was.

Return to the Twentieth Century … Entering the kindergarten classroom, I noted that most of the students were not even in the room itself. This was the early morning block—that exact, perfect time of day for letter recognition games on iPads, interactive videos on Smartboards, and fun math drills on cell phones (why not? … they are 5, after all). Instead, I found that the kindergarten students were all outside, playing, exploring, and singing, even as I was wrapping my scarf tighter around my neck to shield me from the wind.

I would soon learn that the first 2 hours of their day was always spent in this way—playing, exploring, and singing. The few students that were left in the room were busy turning their chairs upside down to create makeshift castles and role-playing fairy tales. The smell of soup, made by the children with their garden's vegetables and warming in a Crock-Pot, was wafting through the room, reaching my nose, and causing my stomach to growl. The chalk drawings on the chalkboard were holding my eyes. Yet, even so, a funny feeling was inching its way up my spine. Something was missing—something that my psyche must have assumed was extremely important.

Reluctantly leaving behind the kindergarteners and entering the first-grade classroom, I was sure I would see some relinquishing to technological assessments or computer intervention programs on Chromebooks or other devices. But, again, I was surprised. Or disappointed? Or amazed? The children were using just pencils and lined spiral pads. The teacher was writing simple math equations on the chalkboard. The décor of the classroom was scant. I watched the teacher teach and then wondered if I might grow bored as a student in her class.

Visiting the library of the school a short while later, I enjoyed a look around the small space, which housed hundreds of books and nothing else—no desktop computers or other devices, no indication that the library was designed to act as the "technology hub" of the school. A staff member willingly shared her outlook on the quaint reading space. She wondered at the ability, or lack thereof, of a child who has seen something on a computer to generate an original image. The example she used was that of a princess. She preferred for her students to decide on their own what a princess looks like, using experiences from their world and their own imagination.

Her simple example illustrated a larger and growing anxiety over the advancements of educational AI. For the many parents who send their young children to these non-technology schools, the concerns associated with a true twenty-first-century education are real. As Robin Raskin, founder of *Living in Digital Times*, shares, "Even though parents understand high tech skills will be essential to a secure job future, there's a growing nervousness that we're raising a 'swipe and you shall receive' generation" (2017, p. 1). This anxiety can grow even more focused when considering the creative abilities of our youngest generation. Richard Rende, psychologist, and co-author of *Raising Can-Do Kids* (2015), challenges parents and teachers to consider a key question…

Where Have All the Daydreams Gone? As shared previously, as I stood in the non-technology classroom, I wondered to what degree I might grow bored. I found myself constantly checking my phone, that little device that I keep in my hand at all times, the one that provides me with music, pictures, and quick answers to all my questions. Rende and Prosek (2015) and others contend that boredom allows the space for daydreaming to exist and thrive and that when students find ways on their own to make boredom go away, they have essentially also trained themselves to think innovatively and to build creative skills (Holbrook, 2020; Rende & Prosek, 2015). Thus, despite our many efforts to keep ourselves and our students constantly stimulated, there are those who would suggest our approach is misguided. After all, the little children in our first-grade classrooms today are the inventers and musicians and artists of tomorrow.

However, and perhaps unfortunately for these future creators, an AI-created work of art, “Portrait of Edmond Belamy,” recently sold for over $400,000 at Christie’s Auction House (Christies, 2018). Art industry professionals now wonder just how quickly AI will be capable of creating art and music that humans cannot (Joshi, 2019).

A Healthy Addition or a Crippling Addiction? There is no denying that the advancement of technology in all corners of our classrooms and in all aspects of our lives has affected, in some way, the creative flow of ideas for students and educators alike. In turning over the “original production” of that which has never been imagined, we entrust a certain, and sometimes significant, part of our life into the hands, or wires, of the technological device (Varghese & Laprince-Ringuet, 2018). As shared by Hannah Fry, Associate Professor at University College London’s Centre for Advanced Spatial Analysis, and author of *Hello World: Being Human in the Age of Algorithms* (2019), many of us have issues with placing too much trust in technology, a trust that is even more tested when the object of our confidence, the technology, lets us down. We often assume that our AI buddies will always come through, but Dr. Fry assures us they will not (2019).

Perhaps, at the end of the day, the teachers, parents, and students who reject technology as part of elementary schooling are simply anticipating the inevitable—the eventual letdown of an algorithmic report gone wrong, the eventual disappointment of an AI application that simply doesn’t deliver. Perhaps they are simply skipping that step and doing the work of creating, exploring, and evaluating themselves so as not to put their full trust behind applications that may eventually err.

In rejecting the potential downside of AI educational tools, however, are these same decision-makers ignoring the plethora of creativity-building opportunities now available through technology? Christina Miller, President of Cartoon Network, has pushed the envelope in making the viewing of cartoons more creative for the child consumer, working with other AI partners, such as MIT’s Scratch language, to allow the viewer to build CN characters (Richmond, 2017). Maker Movement, an online architectural and construction exercise, is now available to schools and used to encourage students to create and build, and Microsoft has now added rigor to Minecraft in order to encourage deep mastery for their two million plus Minecraft players (Raskin, 2017). Is building a castle on Maker Movement really that different from building a castle with wooden chairs in a classroom?

Preparing for Tomorrow … In preparing our young students for the challenges of tomorrow, perhaps we may happen upon a comfortable middle ground. Devorah Heitner, author of *Screenwise: Helping Kids Thrive (and Survive) in Their Digital World* (2016), asserts that parents and educators must accept that children can indeed be creative in front of a screen. Pippa Sanderson of Intelligent Tech Channels agrees. “Technology and creativity go hand in hand,” Sanderson shares, “enabling us to be more creative and productive” (Sanderson, 2017). Accepting that consumption of technology does not necessarily include or preclude creativity may help us all in supporting our young learners, even as they observe their world both with and without technology.

In reality, our own understanding of constructivist learning theories may actually support the inclusion of technology even further. In many cases, educational technology adds to the contextual background of learning, thus complementing the constructivist’s emphasis on *contexts* (Gilakjani, Leong, & Ismail, 2013; Juniu, 2006). As students use technology to explore ideas and meanings, technology becomes a “dynamic part of the constructivist learning environment” (Allsop, 2016, p. 2). As one research team explained, “Technology is the designs and environments that engage learners. The focus of both constructivism and technology is on the creation of learning environments” (Gilakjani, Leong, & Ismail, 2013, p. 1).

And so, our current infusion of technology into elementary classrooms will most likely continue. Despite our worries, research indicates that a significant advantage can be realized by young students with the integration of AI supplements into their learning (Biancarosa & Griffiths, 2012; James, 2014; Reed, 2018). Our children will continue to spend their young lives waiting for a program to tell them if they’re great at math or reading, hopefully with a simulated clapping sound and a giant yellow hand with a thumb pressed upward. The congratulatory notification from their AI teachers may even become so meaningful that that they will readily share it with their closest human or nonhuman friends, all 2,376 of them.

Yet, despite the reservations, I must confess that I envy the learners of today. They are preparing for the challenges and the jobs of tomorrow, and many of them are doing so with the full spectrum of tools and capabilities available. For example, I rejoiced when my youngest child earned her Microsoft Office Master’s certification, made possible through a magnet school she attends that has “School of Technology” in its name.

Does my daughter know what a princess looks like? I believe she does, and perhaps that image is one that is a hybrid, made up of her own experiences, both technological and not, in this ever-changing world. Perhaps the image was first formed when I read her a picture book as a toddler. And then, perhaps, the image morphed as she played fashion games on her iPad as a first grader. Perhaps then, as she woke up early to watch the royal wedding on television, it morphed again. And then, as she researched the internet and read her Instagram posts and watched her TikTok videos with her Chromebook, her Apple watch, and her iPhone, perhaps it morphed even further.

There are many questions I will continue to ponder as I reflect on my visit to the non-technology school that day and my ongoing work as an educator. And I will ponder them still, as I relax this evening and watch a movie while enjoying a cup of warm soup. I believe the movie's title is "The Princess Bride."

Actions for the field to consider would include analysis and ongoing discussions involving the following questions:

- In what ways is the availability of technology enhancing or restricting student cognitive development in creative thinking and imagination?
- Are there certain grades or phases in the learning continuum that should remain "off-limits" to the use of technology in the teaching and learning process?
- In what ways might technology be most effective in supporting the imaginative play of young students in the social presence of the classroom?
- What does the future hold for AI inclusion in the K-12 classroom setting, and how might educators and families get ahead of these advancements in providing the most meaningful educational experience for children?

Teaching and Learning Transformed

Humans are social learners. Online instruction is somewhat a misnomer in that teachers use the medium to reach students whose primary humanity demands that we show connectivity through care and compassion. This need for care and compassion is necessary whether an achieving student or a student requiring specific interventions is on the other side of the screen. However, the use of technology can deflate and make more challenging this key goal to education through reliance on software programs that cannot show empathy to the student.

How we learn and help others learn is seminal to understanding adult andragogy and pedagogy strategies and practices (Dereshiwsky, Papa, & Brown, 2017; Papa, 2015; Papa & Papa, 2011). Teaching requires skills at "chunking" the known curriculum into what Clarke (2019) called rich and complex tasks that electronic devices manage at the risk of diminishing subject-specific content without pedagogy that can take advantage of incidental learning teachers manage all the logistical issues. Morrison and Miller's central claim is that "human pedagogy is at once a cultural and biological behavior, fundamentally enabled by language and resulting from millions of years of the coevolution of genes and culture" (2018, p. 439). They believe that sociocultural-cognition theories of learning can shape the social dimensions of teaching and learning.

> …the new biocultural account of human teaching and learning for the most part support and are largely consistent with the 20th-century sociocultural-cognitive theories of learning that have helped shaped AIED research from the beginning—including Vygotsky's social development theories (1978a), social learning theory from Bandura (1977a), cognitive appren-

ticeship (Collins, Brown & Holum, 1991), situated learning (Lave & Wenger, 1991), and social constructivism (Palincsar, 1998). (Morrison & Miller, 2018, p. 441)

In the vignette by Mary Dereshiwsky, *Adult Learning and Diversity of Perspectives Through Technology-Mediated Instruction*, she contends that resiliency and adult learning theories are necessary to understand and help shape lifelong learning patterns in students.

Vignette: Adult Learning and Diversity of Perspectives Through Technology-Mediated Instruction

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We will be learning new ideas throughout our lifetimes. So, why not enjoy the journey? This advice is particularly relevant to teachers, principals, and superintendents who directly serve as role models to their own students in the value of lifelong learning.

Technology has revolutionized convenient access to such ongoing learning for busy educational professionals. Preparation of teachers, principals, and superintendents to lead twenty-first-century schools in an Arizona university via technology-mediated instruction has yielded the following benefits:

1. **It levels the playing field for those students located at a distance**. The educational professionals enrolled at this university are located in dispersed cities and towns throughout Arizona. In many cases, travel to the brick-and-mortar campus in the northern part of the state would result in a multiple-hour commute.

   In contrast, current widely available access to a notebook computer, tablet, and wireless connectivity means that the classroom is conveniently located wherever the student happens to be. The hours of commute time, exacerbated during late-afternoon or evening rush hour as well as weekends, are replaced by the ability to focus and concentrate on the learning material itself.
2. **It allows for balancing of multiple responsibilities**. Related to the above point, the busy principal, teacher, or superintendent is not removed from their work site where they may need to be on call to take care of pressing problems. Likewise, those with families can trade in-class seat time at preset days and times (often long stretches of time on evenings and weekends) for valuable family time while more flexibly accommodating their study activities around that family time. Likewise, work or recreational family travel is no longer a barrier to continuing with one's education. The educational professional can meet travel obligations without ever "missing class" because of the ability to literally pack up and take their classroom with them. Despite increased prevalence of connectivity, the digital divide

still exists. Rural and/or remote internet connectivity can still be spotty, such as on the Navajo reservation. Northern Arizona University (NAU) has responded to this access limitation by creating additional hotspots for its students who are geographically dispersed throughout the state (https://louie.maps.arcgis.com/apps/presentation/index.html?webmap=d18fde8df5cd4379840637133e580b90). An additional number of hotspots have been created for Navajo and Hopi students. They include extended access to parking lots of designated buildings so that students can connect to the internet while also practicing social distancing (www.nau.edu/access). According to Northern Arizona University College of Education Dean, Dr. Ramona Mellott, the college has made arrangements to provide laptops on loan to students who may have experienced financial hardships due to COVID-19 and can't afford them, as well as offers to make copies of learning materials and send them to students to work through with their professors on an individual basis if they are unable to connect to technology-facilitated instructional sessions (R. Mellott, personal communication, September 16, 2020).

3. **It allows for richer sharing of ideas and experiences with a broader cross-section of students** *enrolled in the same class*. Prior to the advent of technology-mediated instruction, given our geographically dispersed students throughout Arizona, the curriculum primarily consisted of live-and-in-person classes held for those students in each given location. This arrangement inhibited broader exchange of perspectives of educational leaders in other, more distant locations. For example, a superintendent in a rural school district in the southern part of Arizona might benefit from finding common ground in communicating with a rural superintendent in northern Arizona. Technology has now removed this geographic barrier, enabling our educational leaders from throughout the state to all be part of the same classroom. As a result, students are exposed to a greater variety of diverse perspectives, as well as discovering commonalities shared with geographically distant classmates, that would not otherwise be possible in the traditional face-to-face classroom. As a result, they can maximize the benefits of adult learning theory related to blending their real-world experiences with their classroom learning (Merriam & Bierema, 2013).
4. **It levels the playing field for students with disabilities.** Educational professionals who are physically challenged no longer have to worry about any inconvenience of commuting to class and possibly facing noncompliant (or inconvenient) physical disability barriers in a brick-and-mortar classroom. Students who are hearing-impaired no longer have to make arrangements for their disability office to assign them a signer to attend a physical class with them, with the primarily text-based format of online instructional communication. Even those with visual disabilities are not left out, given the prevalence of text-enlarging computing equipment that

allows them to view the course content. The university disability office can also fully accommodate requests for audio and video transcripts for students with both of these disabilities (Roberts, Crittenden, & Crittenden, 2011; Basham, Stahl, Ortiz, Rice, & Smith, 2015).

Students with anxiety-related disorders can formulate their thoughts before "speaking" in the form of an asynchronous discussion post without the stress of "being called on" as in the live-and-in-person classroom. Instead, they can draft and revise their thoughts in private, before posting in a more quiet, comfortable, familiar physical setting (ASU Prep Digital, 2019) https://www.asuprepdigital.org/how-can-online-high-school-benefit-students-who-suffer-from-anxiety/.

Actions for Creating Beneficial Learning Experiences for Students

All of the above benefits have been realized for our teachers, principals, and superintendents in the technologically mediated educational leadership curriculum in Arizona. Recommended action steps to continue to create maximally beneficial learning experiences for them include the following:

1. Continue to leverage current technology developments to further enhance access and connectivity for geographically distant students. For example, explore ways to resolve slow file uploads and downloads, disruptive buffering of classroom videos, and connectivity issues to live sessions (e.g., abrupt disconnects during live sessions), for those students located in remote rural areas.
2. Expand access to technology help desk services. The recent COVID-19 pandemic and lockdown have taken a toll on college campus budgets. University administration has responded with cost-cutting, including layoffs and furloughs of personnel. Ironically, though, the related need to transition all teaching online has increased the need for support services. The increased number of students now online means a commensurate need for access to reliable 24/7 toll-free or live online chat help desk personnel. It also means expanding the total number of such personnel to reduce wait times for students who contact them to request help with urgent technology problems.
3. Improve preparedness of university-level instructors to effectively teach online. The COVID-19 pandemic required massive entry into the online classroom environment of many university professors who, up until now, had only taught in the traditional face-to-face environment. This abrupt shift naturally caused some disorientation and stress for them in having to suddenly transition all of their real-time teaching materials online.

However, even prior to the sudden online influx necessitated by COVID-19, preparation of effective online instructors had been piecemeal at best. Technology departments at universities typically offered workshops and trainings in how to teach online, with attendance by faculty often voluntary.

Similarly, university professors preparing to teach their first online course might at best be handed a preexisting course shell with content loaded into it, but not otherwise offered much in the way of coaching in how to use it. (The lucky ones might be allowed to shadow a current online faculty member to observe how this colleague teaches online.)

Such catch-as-catch-can, patchwork approaches to preparing instructional professionals to teach online need to be replaced with more systematic planned instructional approaches. Ideally an entire course in teacher preparation curriculum should be devoted to effective online instruction. Topics to be covered should include navigating the technology (and preparing one's students to do so); developing online course syllabi with additional explanatory detail that may not be needed in a traditional face-to-face course syllabus; creating or locating optimal online learning materials including instructor-created videos and PowerPoint files in addition to text-only materials; designing engaging asynchronous discussion topics and encouraging student participation; planning and conducting live sessions that will benefit students; planning and supervising group work in online courses; and resolving commonly encountered student issues (e.g., nonparticipating students; discussion posts by students that don't go beyond "Good job" or "I agree").

The expanded popularity of online instruction during the past couple of decades, including the most recent surge in prevalence due to the COVID-19 lockdown, necessitates an urgent focus on preparing instructional professionals for the unique challenges of the online classroom setting. It can no longer be left to chance, but rather, it should be explicitly built into teacher preparation curricula. An added bonus in the case of teachers, principals, and superintendents learning online themselves is that they will become equipped to be role models and change agents in initiating similar online instructional initiatives in their own K-12 classroom settings.

According to Nelson Mandela, "Education is the most powerful weapon which you can use to change the world" (https://www.goodreads.com/quotes/tag/change). Our teachers, principals, and superintendents are at the forefront of leading the exciting changes in learning that the technology-mediated classroom has made possible. We owe them a maximally beneficial and rewarding learning experience of their own using technology, in order to inspire them with the possibilities of infusing the best of what twenty-first-century technology can offer to their own students.

We can support them in doing this by (1) continuing to scan the rapidly changing technology horizon for latest developments in potentially useful techno-tools (e.g., novel audio-visual curricular enhancements); (2) letting them see us bravely experiment with these new technologies by adding them to our online classrooms, including pushing past initial fear or resistance to the new and unknown; (3) empowering them as our partners in their technologically mediated learning process by asking them "What's working for you?

What isn't working so well?" and "What can we do together to help improve what's not working?"; (4) continuing to seek novel work-arounds to either temporary or permanent inequities in access to connectivity, such as those mentioned above that Northern Arizona University is implementing to level the accessibility playing field for underserved student populations; and above all else (5) refusing to allow technologically mediated instruction to become "canned" instruction of a one-size-fits-all model and instead continuing to seek ways to let the individual personality of both teacher and each student to shine brightly through the technology itself.

Technology is not intended as a substitute for individuality, or for personality, of both instructor and students. It is at best a means to an end, intended to bring together these two key stakeholder partners of the learning process.

Actions for the Field

What do the above goals imply for the technologically mediated classroom of 2051? Past history of rapid technology development implies that technologies not yet even imagined today will be standard operating procedure in 2051. Rather than speculate on specific technology, I would like to focus my predictions on the above two key stakeholder groups to the education process. The primary relevant theory in my opinion is not learning theory, but rather resiliency theory (American Psychological Association, n.d.). This is because it speaks to the dedication, drive, and determination of those who use the technology for learning purposes, rather than the specific learning material itself.

I predict the following will characterize the online classroom of 2051: (1) educators who welcome technology as an instructional facilitator instead of a source of fear or anxiety; (2) educators who welcome the chance to learn new technologies as they become available; (3) educators who ask themselves, "How can this technology help me make my online classroom even more engaging to my students?"; (4) as a result, educators who welcome the opportunity to keep retooling their online classrooms to be as creative, relevant, and inviting to their students as possible; (5) educators who infuse their communications with their online students with warmth and welcoming as well as (content-related) wisdom; (6) educators who continually and proactively model for their students that change is to be welcomed instead of automatically resisted; (7) as a result, students who feel welcomed, included, and empowered in their learning process, instead of feeling marginalized; (8) students who envision the potential of technology to make connections with their professors and peers as part of an empowered and engaged learning community in their online course; (9) students who will also scan their personal and professional horizons to actively seek ways to use technology as a bridge to lifelong learning; and (10) students who will be the dreamers in committing to surpass the technology of 2051 to develop even more novel ways to infuse the educational experiences of the classrooms of 2101 with creative and engaging technology.

AI algorithms that attempt to predict the future are built from large data sets that rely on historical information. O'Neil (2016) stated that whoever owns the code now has the power over humanity. Algorithmic harm is done when blind faith translates data into algorithms. In O'Neil's book, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*, she contends that systemic bias shifts into authoritarianism. For example, facial recognition today on city streets worldwide to anticipate criminal behavior is the latest form of mass surveillance. Biometric facial recognition provides the same information as DNA, which should be given optimal privacy supports within a society. Algorithms through large data sets discover patterns. Often humans cannot explain how the algorithm works, similar to a black box. AI developers know what they want to build but admit to not knowing how the algorithm does it, which presents a myriad of ethical issues. The results of AI algorithms are not neutral when we see their applications for hiring, firing, getting loans, college admission, and other social systems. Does this lead to a new way of branding kids, another form of conscious bias, embracing the notion that numbers do not lie? AI may well serve us as another gatekeeper, invisible and unwelcome.

Coded Bias, a documentary directed by Shalini Kantayya on bias developed through facial recognition, showed the illogic of our thinking that AI is forward-looking. Again, this raises issues about using historical data to create AI systems, as Joy Buolamwini, an MIT media specialist, noted in the documentary. Kantayya explored how machine learning algorithms perpetuate existing gender-race-class inequities. It was noted that the rapid adoption of AI in a variety of fields, including education, has few safeguards. This documentary told the story of a value-added model used to fire teachers and override observation by the principal in some northeast and southwest school districts.

The ethical ills of facial recognition are now well documented. "In the wake of protests around the death of George Floyd, IBM, Microsoft, and Amazon are now denying police departments access to their facial recognition technology" (Magid, 2020, para. 1).

> IBM was first out the gate with an announcement on June 8th that it's getting out of the facial recognition business and, in a letter to several members of congress that it "firmly opposes and will not condone uses of any technology, including facial recognition technology offered by other vendors, for mass surveillance, racial profiling, violations of basic human rights and freedoms, or any purpose which is not consistent with our values and Principles of Trust and Transparency." (Magid, 2020, para. 6)

In contrast to popular belief, van Otterlo (2017) knows algorithms are not objective simply because they are mathematical. The logic used here is described:

> …Algorithms are heavily biased by political views, design processes and many other factors (Bozdag, 2013; van Otterlo, 2013). Characterizing the ethics of algorithms is hard since algorithms and potential consequences are so diverse, and situations may change over time. Mittelstadt et al. (2016) define[d] concerns about how algorithms transform data into decisions. Evidence can be inconclusive, inscrutable, or misguided and this can cause many ethical consequences of actions, relating to fairness, opacity, unjustified actions, and discrimination. Overall, algorithms have impact on privacy and can have transformative effects on autonomy, i.e., the ability for humans to make their own choices. Another way to struc-

> ture the space of algorithms and ethical impact, is by looking at agency, i.e., what they are capable of, which results in a taxonomy with five broad classes of algorithms. The first type consists of algorithms that reason, infer and search. They employ data as it is. The more complex they are, the more information they can extract from that data. Examples include translation, language understanding, and image recognition. Ethical concerns about such algorithms are typically about privacy since more ways become available to interpret and link more kinds of data. A second class learns and finds generalized patterns in data. They are typically adaptive versions of the first type, e.g., a scene recognition algorithm that is trained on an image stream. They introduce ethical challenges simply because they learn (outcomes are not stable), because they can statistically predict new information (privacy), and they may severely impact users' autonomy by profiling and personalization. The third type are algorithms that optimize to find the "best" actions. These typically employ reward functions that represent what are good outcomes and generally rank things ("the best pizza around") or people (e.g., on Tinder). (p. 3)

There is value in thinking through how these rules pertain to education and their impacts on students and teachers. There is also value in understanding how these rules are normed based on data from how students are assessed. Whereas autonomous cars and the ethical dilemmas they poise are tangible, complex problems in education are difficult to uncover as the bias can hide within the data values. If these data continue to be collected and related to each other without transparency, resulting rules may be very harmful to the individual. van Otterlo (2017) proposed utilizing decision-theoretic logic programming to solve ethical problems and insert a code of ethics to counter bias using machine ethics. He contended, "by saying that the code of ethics functions as a moral contract between human and machine, thereby unifying the two approaches in the first half of the paper …Value alignment can be obtained by formalizing existing human values and norms into flexible but expressive formalisms" (p. 6). He concludes that this approach is a more rigorous thought activity that includes ethical norms and values.

The Bay Area News Group (2020) cited CEO Sundar Pichai as saying, "there is no question that artificial intelligence needs more regulation to prevent the potential negative effects of the use of technologies in a variety of mediums" (Bay Area News Group, 2020, p. A11), including useful regulatory frameworks that are explainable. Tucker (2017) stated that in analyzing a key report, *Leading Educational Systems and Schools in Times of Disruption and Exponential Change: A Call for Courage, Commitment and Collaboration*, students will need stronger cognitive skills earned in more sophisticated ways. He urged with cautions:

> …educators and educational leaders to transform schooling in ways that will prepare students for a world that is constantly and rapidly changing and assist them to better understand and appreciate the emerging nature of work that is being influenced, even transformed, before their eyes by intelligent technology. [… that] if we fail at this task, it may only be a matter of time before the machines and a very small technological elite are deciding these issues, and we are not likely to be happy with their decisions. (p. 35)

The result of AI in education could lead to a much more personalized educational experience. But does it? How we embed one's passions and talents into "product-oriented learning experiences" (p. 134) has the potential to do more harm than good to the learner. Educators do not want to be regulated to teacher spectators. If schooling exists solely for work, as its focus has been over the last 40 years under the political, economic, and societal neoliberal philosophy, then learning approaches' transformation needs to change. Professional development will require teachers to adopt new teaching models and construct new strategies that interface with the technology in support of learners.

Burleson and Lewis (2016) envisioned integrated learning and living environment in 2041. They envisioned "society and technology co-evolved to embrace cyberlearning as an essential tool for envisioning and refining utopias–non-existent societies" (p. 796). This utopia deeply engages the learner to reach their full potential. This utopia they further described as:

> …Artificial Intelligence in Education (AIED) has transitioned from what was primarily a research endeavour, with educational impact involving millions of user/learners, to serving, now, as a core contributor to democratizing learning (Dewey, 2004; 1938) and active citizenship for all (billions of learners throughout their lives). An expansive *experiential supercomputing* cyberlearning environment, we affectionately call the "Holodeck," supports transdisciplinary collaboration and integrated education, research, and innovation, providing a networked software/hardware infrastructure that synthesizes visual, audio, physical, social, and societal components. The Holodeck's large-scale integration of learning, research, and innovation, through real-world problem solving and teaching others what you have learned, effectively creates a global meritocratic network with the potential to resolve society's wicked challenges while empowering every citizen to realize her or his full potential. (p. 796)

The Holodeck is seen as an "…expansive experiential supercomputing cyberlearning environment" (p. 798). This future holds that 75–100% of the life-wide learning will be "integrated, virtual, acoustic, physical, robotic, physiological, co-located, and distributed individual and team experiences…" (p. 798).

> Expanding on this, in the context of the Holodeck, we have found that when individuals and teams of learners actively engage in hands-on collaborative activities, they begin to understand things from multiple perspectives–they begin to become experts (Burleson, 2005; Kay, 1991). In these environments, key elements of Amabile's componential model of creativity: intrinsic motivation; domain expertise; creative style (Creativity Support Tools (Resnick et al., 2005) and tools for reflective engagement); and actualizing resources, coalesce to advance individual and team creative processes and outcomes (Amabile, 1983). By definition, creativity – anything new, non-obvious, and useful – is responsible for *all* societal advancement (Burleson, 2005). Thus, with creative exploration and ever more sophisticated expertise, the goals of cyberlearning, AIED, and the Holodeck are to facilitate learning to live, learning to be, and living in and evolving utopia. (p. 800)

Burleson and Lewis's (2016) utopian conclusions consider that the learner develops and possesses personalized stories, open reality streaming, contributions that are both individual and done cooperatively with others and that through the discovery of learning continue to spark creativity and innovations. Their vision by 2030 is noted in Table 1.1.

As shown in Table 1.1, this vision denies the educator's role. The educator is not the numerator to be defined by the technology and adapt solely to a program's curricula, as this reverses for whom technology serves. The technology should adapt to the student and the educators. The table defines the possible development of AI in a joyous, perceptive superhero role. This line of thinking continues in the book *Origin*

Table 1.1 The CCC, CRA, and NSF 2010 GROE Workshop Roadmap for Education Technology circa 2030[a]

Interface capabilities	2030 vision
Affect and emotion recognition	Strong recognition, fluent expression highly personalized
Embodied interactions	Full body capture everywhere; mirroring behavior
Learning companions	Virtual + robotic companions that seamlessly switch between virtual and physical settings
Brain-computer interfaces	Continuous wearable, fMRI-like capability, and EEG/near-infrared signals
Physiological	In-body monitoring and transmission—oxygen, glucose, and cortisol indicators; HR/breath
Augmented reality	Seamless, natural, ubiquitous, recognition
Haptic	Enhanced mobility, superhero capability, high-power haptic capabilities

[a]CCC, Computing Community Consortium; CRA, Computing Research Association; NSF, National Science Foundation; GROE, Global Resources for Online Education

(2017) in which Brown asked how the patterns of the past could guide us to an enlightened future that includes a nonliving species created by humans. Brown reminds us of a history seen through a lens of cellular automation, as in Conway's Game of Life (p. 357), a simulated game of species growth. The history becomes a Darwinian analysis which combines codes and patterns where "computers establish patterns that can lead us to the future…the evolution of a species [that] is linked to its environment and the codes being written ask, what will human intellect look like 30 years from now? Where are we going?" (p. 369). Brown continued: "each new technology creates more innovation and begs us to ask if we are engineering an enhanced version of ourselves?" (p. 409). Moreover, if this is true, it will not erase the *haves* and *have-nots* as we create a future that at lightning speed robots free up workers "…on assembly lines, provide clean energy, nutritious foods and clean water for all" (p. 409). This is the potential AI holds, as well as the dangers that may further encourage greed for some, ensuring naught for all.

The growth of AI systems into an AI species will undoubtably be tested with the Turing Test, a test named after the famed mathematician Alan Turing who examined how we could determine if a machine could think. When describing the Turing Test, the Stanford Encyclopedia of Philosophy (2016) stated Turing believed that machines could think in certain kinds of purely behavioral and logical conditions to indicate the presence of thoughts or intellect. In *Minds, Brains, and Programs*, John Searle argued against the claim that "appropriately programmed computers have cognitive states" (1980, p. 64). Searle disagreed with Turing's claim that an appropriately programmed computer could think. The controversy with Searle's position is in considering there is only *one* way of understanding what he is arguing for.

Following this line of inquiry for meaning in the field of education, the next vignette grounds learning theories in AI. In the vignette by Patrice D. Petroff, *Metacognitive Strategies and Educational Growth in a Virtual World*, she offers several learning theories to support the learner of the twenty-first century: behaviorist learning theory, constructivist learning theory, connectivism theory, and orativist learning theory (online collaborative learning).

Vignette: Metacognitive Strategies and Educational Growth in a Virtual World

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There are unknowns that are making seasoned educators and administrators uncomfortable and forcing a growth mindset that is unprecedented in the educational world. Learning decisions, ranging from online platform adoptions through successful student results, now more than ever require an approach that will benefit all stakeholders to continue to grow now and in the future. How do we tackle these challenges and through metacognitive strategies track, address, and change behaviors as related to online learning? Online learning growth is not easily determined through just measurable and observable data as we have learned in years past through behaviorist learning theory (Harasim, 2017).

There are more aspects that influence the learner other than just the material and what they do with that material. All parties involved in learning have backgrounds and experiences that help to shape and define the learning path that they take as well as what they share with others. If we approach learning from solely a constructivist learning theory, "The primary responsibility of the teacher is to create a collaborative problem-solving environment where students become active participants in their own learning. From this perspective, a teacher acts as a facilitator of learning rather than an instructor" (McLeod, 2019, para. 12). This theory is applied and used to develop virtual learning coursework both asynchronous and synchronous to have the students become active participants in the learning process.

In the wake of sudden change due to demands outside the physical classroom, educators were asked to develop coursework on a platform that allowed students to participate in class work at their own pace and dive into their learning mostly asynchronously. Educators were underprepared for the transition and did a fantastic job of making the adjustment in the timeframe given, but we are tasked with learning from this experience in order to grow for our future in digital learning and design.

Leadership must support growth strategies for success in a virtual world (Seppälä, 2014). We must explore ways in which we can support all participants to grow in a virtual environment. There must be ways to identify a "lack of understanding" (Price-Mitchell, 2015) for leadership to follow without negative consequences for admitting a lack of understanding in order to promote self-reflection. This will be an extremely important and difficult task for leadership to undertake. As leaders and employees, we are often taught to keep a distance and project a certain image, an image of confidence, competence, and authority (Seppälä, 2014). We are not naturally programmed to admit a lack of understanding, especially when it comes to our field of expertise. There will need to be a shift in vulnerability to acknowledge the lack of understanding and address and put in place strategies to build on this lack of knowledge for future success.

Leadership will need to showcase their own vulnerabilities in order to gain valuable understanding from their peers and those around them, thereby setting the stage for growth to occur. Leadership and facilitators must reflect on their journey both as a facilitator and as learner and return to that reflection to make adjustments (Price-Mitchell, 2015). During their reflection, they will be able to build on vulnerabilities and develop ideas on how to incorporate more information and connections into their work. As we grow and reflect on what we do not know, we will need to explore through the connections we have made through the development of technological advances. When exploring for ourselves, we are really exploring the connectivism learning theory (Siemens, 2005b).

The connectivism theory explains how internet technologies have created new opportunities for people to learn and share information across the World Wide Web and among themselves. These technologies include Web browsers, email, wikis, online discussion forums, social networks, YouTube, and any other tool that enables the users to learn and share information with other people (Harasim, 2017). The development of virtual courses and coursework must contain usage of the tools and technologies available but still connect expertly to the course content and material that is being covered for educational growth. Diversity in learning is key to developing our world changing views and learners. We must include and reference all experiences to make learning authentic and applicable to future endeavors.

It is through this process we would begin to see reflexivity emerge. Reflexivity is the metacognitive process of becoming aware of our biases—prejudices that get in the way of healthy development (Price-Mitchell, 2015). Leadership is obligated to explore these biases with themselves and faculty by keeping open dialogue and discussion as well as reflection of the process while developing virtual coursework. Which tools and technologies are we using and why? How would some of these tools and technologies potentially be biased toward different groups? What are some ways as a team we can address these potential biases prior to engaging in learning? Using these questions during the reflection process of development of work will help to further dialogue to promote everyone's success in the process. Exploring all of these questions and application of theory will allow growth in an online world. To further growth and engage all students with an even deeper understanding of learning and of each other, we must explore application of the collaborativist learning theory. The learning "is a process by which students interact in dyads or small groups of no more than six members with intent to solicit and respect the abilities and contributions of individual members" (Udvari-Solner, 2012, para. 1).

Actions for the Field As facilitators build virtual communities to support the learning, it will undoubtedly support infusion of different ideas, cultures, and prior learning experiences all part of the learning process and learning theories explored previously. We want our learners to be able to set the stage for organization of thoughts, collaboration on decision-making, and incorporation of ideas from all parties to be active participants in a global community. Understanding and using the collaborativist learning theory in a virtual environment will promote these characteristics for learners and make it impossible to not learn from others and gain new insights and understanding for those around us. Teachers will need to set the stage "as a facilitator of learning rather than an instructor" (McLeod, 2019, para. 12). Leadership vulnerability, the ability for all to seek knowledge without judgment, reflection on experiences, and application of theory will shape the outcomes of learners in a virtual environment. As Price-Mitchell (2015) stated, a safe way for identifying lack of understanding is the critical next step to growth. Without this, the unknowns will continue to remain unknowns and all parties will suffer the negative consequences.

In this chapter we have offered a range of issues educators are facing in classrooms now and will in a quickening pace over the next three decades and beyond. To be proactive requires educators to redefine what is teaching, what does the learner need, and how do learners *feel* in this ongoing revolution. In Chap. 2 we delve more deeply into an AI understanding that is essential for the twenty-first-century teacher as we move into a world that includes both human and AI agency.

Chapter 2
Artificial Intelligence and Computer Design

Rosemary Papa and Karen Moran Jackson

John McCarthy, writing in the 1940s first used the phrase "artificial intelligence" (Simon, 1995), although fascination with human replicas can be traced back several centuries. The famed automaton of a monk created by Juanelo Turriano in 1560 could walk, move its mouth, raise its hands, and roll its eyes, all through mechanical springs and gears (Abumrad & Nasser, 2018). While a marvel of its time, humans can easily recognize that the penitent figure is not intelligent but follows internal mechanisms that duplicate human actions. Most of our current computer programs operate under similar constraints, limited by programming and hardware capabilities. Even in the best computer games that brandish explosive visuals and respond to novel human direction, everything we see is based on a program initially designed by human hands. However, we are entering a new computer development phase where the results are due not to human guidance but computer initiative and even computer agency.

This chapter first discusses the current transition we are undergoing in computer science and software development, termed as moving from Software 1.0 to Software 2.0 by Karpathy (2017). A new view of data is the foundation for this change. While the discussion of these changes becomes technical, the implications for educational communities require a basic familiarity with the terminology and design of these new systems. Then we discuss how learning theories are adapting to the changes, finishing with a brief highlight of some ethical implications of these changes, a theme further elaborated on in Chap. 3.

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Computer Science and Software Development

Most of our children, if they take a coding class, are learning Software 1.0. Using programming languages such as C++, Java, or Scratch, students learn fundamental software skills such as conditional (if/then) statements and loops. They create programs that gather input from users, run the input through a prewritten set of instructions, and create output for the user. The word processing program on which this chapter is being written, for example, employs Software 1.0. In a simple example, when the user pushes the "e" key on the keyboard, the program places an "e" on the screen corresponding to the cursor's placement. The computer takes this action after accessing the software code stored in its memory about what should happen on the screen when a particular key is pushed.

There are limits to Software 1.0, although they may not seem evident to the casual user (Karpathy, 2017). These programs cannot recognize visual or audio information that has not already been programmed into their systems. For example, the alphabetic symbols recognized and produced by the programs must already be part of the program. In another example, without specific software, someone cannot scan a picture of a classroom into their computer and have the computer recognize the scan as a picture of a classroom. This type of image recognition is very difficult to do with Software 1.0. Software 1.0 will automatically assign only technical information to the new file, such as size and file type, while the user must input narrative information and how the file relates to other files.

Another significant limitation is that Software 1.0 is restricted by the programmer's imagination and skill. A programmer for Software 1.0 must conceptualize all possible rules and scenarios to create the code for a complete program. While Software 1.0 is often built by a team of programmers, the design is limited by their combination of skills, with potentially a long delay between code updates. These limitations have contributed to the growth of another computer software design approach termed Software 2.0 (Karpathy, 2017). While aspects of this approach were proposed in the mid-twentieth century (Simon, 1995), the hardware capabilities to enact these programs have only become available within the last few decades. Software 2.0 allows for a dynamic program that changes based on updated data, while Software 1.0 can only do so with handwritten lines of code. Additionally, the design parameters of Software 2.0 applications allow for and need large data sets. Developers in Software 2.0 are concerned with applying and analyzing how a model fits a collection of data, rather than concerned with covering all eventualities with lines of code. For Software 2.0, fundamentally the rules are inferred from the data, not created by the programmers.

Two computer design developments form the basis of Software 2.0: neural networks and machine learning (LeCun et al., 2015). Bhadra defines a neural network as "a set of algorithms, modeled loosely after the human brain, that is designed to recognize patterns" (2019, para. 1). Machine learning refers to the construction of algorithms, or statistical computations based on data, within the neural network that allows for changes which optimize predictions (Machine Learning, n.d.). In machine learning, developers establish a goal that the algorithm must achieve within a given set of parameters. Then, rather than be given pre-determined stepwise code to follow as in traditional programming, the computer chooses weights in an iterative fashion to successfully produce the desired outcome.

While the developers may specify the goal and type of algorithm, decisions over which internal paths to follow in the neural network are primarily based on probability weights calculated as the algorithm is trained. As algorithms are refined through training and testing on data, they are called models. If the models are built into real-world systems that have the ability to sense the environment, such as through a camera or learner input, and then act on the environment, such as providing a response or question, the program is called an agent.

Machine learning algorithms are specific to the goal they are being asked to accomplish and the type of data they are using (Dilhara et al., 2021). Text data, audio data, numerical data, and visual data require different processes and, thus, different algorithms. Common types of data might be analyzed in similar ways, however. For example, a program to recognize pictures of cats on the internet would be similar to a program to recognize dogs' pictures on the internet, but translation of text from English to Japanese requires an entirely different algorithm. To aid in advancing these programs, developers have created open libraries to share their machine learning programs and algorithms, such as GitHub (Dilhara et al., 2021).

For a simplified example of a neural network, consider the diagram below (Fig. 2.1), and imagine that the original input is a spreadsheet of demographic and academic information on a set of high school students. The goal is to predict students at risk of dropping out of school to provide recommendations for a dropout prevention program. In a traditional research conceptualization, we might recognize that some variables interact in somewhat predictable ways, with various weights, to influence the outcome.

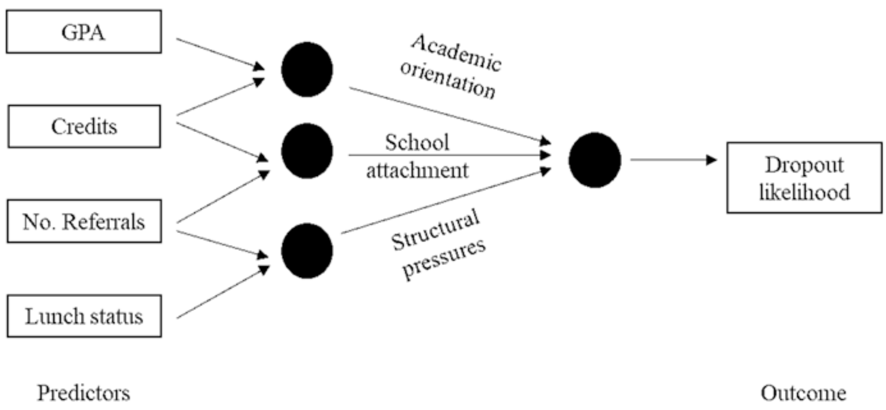

Fig. 2.1 A conceptualization of how various predictor variables may interact to predict an educational outcome

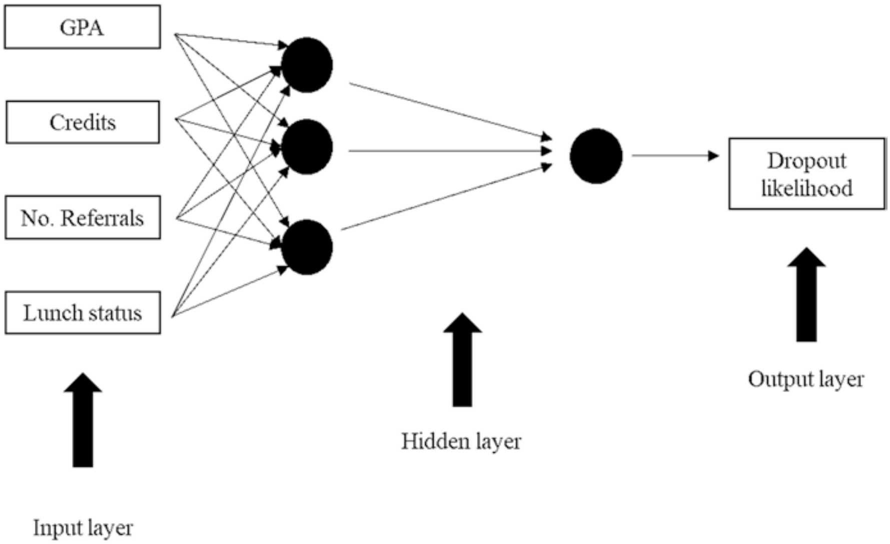

Fig. 2.2 A simple neural net diagram of how the input variables are weighed to predict an output based on version published by Bhadra (2019) on the Towards Data Science website. https://towardsdatascience.com/what-is-a-neural-network-a02b3c2fe3fa

As opposed to the pre-created structure diagrammed above, a neural network attempts to compute how all the input data are related to each other and related to the outcome in various ways (Fig. 2.2). In this example, a student's dropout risk is related to their GPA and the number of credits they have received, and the interaction of these two factors together. These interactions, calculated by the program, are part of the *hidden layer* of the neural network. They were not pre-determined by the programmer but are calculated by the computer. The decision to more highly weigh one interaction over another would be made based on the data used to train the program and not based on theory, with the goal to minimize the error between the algorithmic predictions and the actual outcome. The machine would learn that assigning weights in particular combinations leads to the best estimation of the targeted outcome—this is machine learning.

Karpathy notes that "Neural networks are not just another classifier, they represent the beginning of a fundamental shift in how we write software" (2017, para. 1). Sophisticated Software 1.0 programs can offer similar predictions, but the predictions are pre-determined by a calculation written into the code. The prediction was not dynamic and requires weights to be established either by the programmer or a content expert. Driving Software 2.0, neural networks, and machine learning can uncover hidden relations between variables and allow for dynamic change based on new data. This discovery of the relationships occurs within the neural net's hidden layers, where the interactions between variable combinations are calculated. Current applications such as facial recognition software employ neural nets hundreds and thousands of times greater than the four inputs and one hidden layer diagrammed above. For example, GPT-3, an AI language processing model, is built on 175 billion parameters (Heaven, 2020).

The important takeaway from this discussion is that Software 2.0 moves programming away from creating text-based directions to establishing data and parameters used by the computer to calculate probabilities. What do all these mean for educational leaders? This shift will impact educational leaders as Software 2.0 designs are the basis of current AI models and will likely be the basis of AI programs of the future. As they differ fundamentally from the Software 1.0, there are different ethical concerns with their use in schools. Simon in 1995 correctly predicted that AI programs would initially be designed to "perform tasks that are regarded as requiring intelligence when they are performed by human beings" (1995, p. 947). Just as educators in the real world divide classes into reading groups and provide differentiated instruction, computer programs are trained through AI models to do similar tasks. In education, programs such as Quizlet Learn® and Thinkster Math® provide students with problem sets based on their demonstrated knowledge through assessment activities.

Another task usually performed by educators now moving to AI programs includes versions of AI recommender models. Like the recommendation models that suggest movies or podcasts someone might be interested in based on previous viewers, these education programs make recommendations to administrators and educators about current students based on similarities to prior students. For example, the AI model described above for a dropout prevention program would fall within this category. Answering admission questions, posting class reminders, and even beginning second language tutoring are other examples of conversational educational tasks that are being increasingly done by AI-driven chat box or text agents (Haristiani, 2019; Yang & Evans, 2019).

The applications for Software 2.0 are already being tested in education. For example, educational software programs may offer students different activity options based on their previous performance. Answering a question correctly or incorrectly changes the weights assigned to possible future options, leading to alternative activities based on how students work through the material. Student paths are dependent on the weights assigned, and the paths change as new information is taken into the program.

Districts and schools are beginning to implement these types of programs, and with advances in technology, the impact of Software 2.0 on education will only grow. An AI agent can work within novel situations, like a classroom, because it can infer rules and relations from previous data, hence self-driving cars' ability to respond predictably even when driving on a new street for the first time. In the vignette below, Dr. Michael Timms shares a vision of a classroom filled with technology employing Software 2.0 in various guises and discusses the various potential AI applications in educational spaces beyond a desktop program.

Vignette: Will the Real Teacher Please Stand Up!

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Mia looked forward to the days she came to the school building for group lessons because she got to see her friends in person and work on team projects. Mia and her group were arguing about what they were supposed to do next in the chemical titration procedure they had just learned about.

Ms. Lin scanned the lab and noticed Mia's group seemed to be off task.

As she approached Mia's workbench, Ms. Lin asked, "How's it going over here?"

The heated discussion in the group subsided.

"We're a bit stuck," replied Mia.

"Let me have a look at your setup first," said Ms. Lin.

Mia watched as Ms. Lin checked their equipment setup.

"You've got all the right equipment and chemicals, and you've set up the burette correctly, so what's the problem?"

"We've done the first estimate titration, and we've got this pink liquid. But we don't know what to do next," said Mia.

"Did you record the starting volume of the titrant?"

"Yes."

"And the final volume?"

"Yes."

"Did you subtract the final volume from the starting volume?" asked Ms. Lin.

"Yes, it's 9.57 mL."

"So, 9.57 mL is the estimated volume of titrant that you need for this titration."

"But what does that mean?" asked Mia.

"When you added the titrant, what happened?" said Ms. Lin, showing no signs of impatience with the question.

"The liquid changed color. Well, it did after we added quite a lot of it."

"Exactly. What do you think happened when you added that final amount?"

"It sort of saturated it?" ventured Mia.

"Right. It changed color because an excess amount of titrant was added," said Ms. Lin, "So, what would we need to do if we wanted the final color to be just a hint of pink?"

"Add less titrant?" ventured one of Mia's team members.

"Right. We need to add a bit less than the amount that turned it totally pink. Usually, we subtract 5mL from the amount to add. Let me watch you do that."

Mia and the team cleaned off the equipment, topped up the burette, and repeated the titration.

As they approached the target volume, Ms. Lin said, “Now, add the titrant slowly. No, that’s too fast. We don’t want to pass the end point. Here, let me show you.”

Ms. Lin held the flask and set the stopcock on the burette so that the titrant just dripped into the flask. She swirled the liquid in the flask around. “See it’s still clear but with a hint of pink.”

She turned off the stopcock quickly and put down the flask. “Now you need to record the final volume. Then you can do another titration and take the average result.”

“Oh, now I get it,” said Mia.

Ms. Lin hesitated, “I’m sorry students, but I need to go and recharge my battery. You can continue to work with the other Ms. Lin using your augmented reality glasses. Of course, she won’t be able to demonstrate on the actual equipment, but she has a pretty good simulation she can show you. Or I can ask the real Ms. Lin to come over and work with you if you need it.”

Mia said, “I think we understand how to do it now. We’ll use our AR glasses if we need more help. Thanks for your help.”

“You’re welcome.”

As Ms. Lin walked over to her charging station, Mia quipped, “You’d think a robot as smart as that would remember to charge her battery before she came to class.” Her teammates chuckled.

None of us knows exactly what teaching and learning will be like in 2051, but we do know that technological advances are increasingly changing the way that we live and work, so they will certainly impact education too. The scenario above imagines what might result from the confluence of three advances that are happening right now in artificial intelligence in education (AIED), social robotics, and augmented reality (AR). Bringing these together would allow the creation of educational cobots—robots designed to work alongside humans and support them in their work. The scenario imagines a physical robot but also refers to a virtual robot that would be viewed via AR, but the purpose of both would be to have an entity that extends the capacity of the teacher as she or he works with a class. The scenario addresses how educational cobots could allow a teacher to work with multiple groups in a classroom setting, thereby allowing differentiation of instruction and greater personalization for the learners. To understand how the technologies might come together, let’s look at the state of each field and how it might develop in future.

Artificial Intelligence in Education

In its early days, the field of AIED concentrated on developing tutoring systems that could coach students in one-on-one sessions through guided practice. Researchers tended to focus on modeling domains and learners (Roll & Wylie, 2016). The early AI methods applied expert knowledge using formal reasoning, and while that took the field a long way initially, it ignored that learning has social dimensions too. So AIED research expanded into exploring how tutorial dialogues unfold, how we learn in groups, and what role emotions play in learning to name but a few directions. This involved not just keyboard/mouse input from the learner, but using sensors to capture gaze, facial expression, and physiological conditions (Dillenbourg, 2016). AI methods have also expanded to encompass machine learning, neural networks, and deep learning. Researching and building intelligent learning environments over four decades has led to a much deeper understanding of human cognition and how people learn.

Up until now many AIED systems were designed for learning particular topics in defined domains. Although there has been some attempt to create general tutoring systems such as AutoTutor, which helps students learn by holding a conversation in natural language (Graesser, 2016), this still is not the general approach in the field. Recently, natural language processing has made huge progress through deep learning and large data sets. Many of us now have applications on our phones, in our homes, and in our cars that can listen to us and understand instructions. However, there is still a way to go to have a general AI that can hold a conversation with us, but it will come and probably well before 2051. Once AI can actually understand us and link that to domain areas, it will clear a path to developing a general AIED pedagogical system that mimics how the best teachers teach and "knows" how humans learn. This broad pedagogical AIED can be linked to pedagogical content knowledge for particular domains and then applied in both hard and soft robots as described next.

Physical ("Hard") Robots

There are physical robots now assisting humans at work on the production line, in warehouses, delivering mail, and also helping at home with cooking, shopping, and even rehabilitation after injury. Although early two-legged robots were clunky and prone to falling over, Boston Dynamics Atlas robot can walk, run, jump, and land on its feet (https://www.bostondynamics.com/atlas). By 2051 we can assume that humanoid robots will be able to do most of the physical tasks we do daily and probably be able to do things we cannot. Currently, most robots are not humanoid in appearance. Factory robots are like arms and some mobile robots have wheels or four legs like an animal. For some tasks, robots do not need to be humanoid, but would this be true of the classroom? There is evidence from neuroscience that our acceptance of intelligent technology is influenced by how human-like it appears. Krach et al. (2008) used functional magnetic resonance imaging (fMRI) to compare the brain activity of study participants who played a game against four different kinds of opponent: a computer, a functional robot, a human-like robot, and a human. Unbeknown to the participants, all their opponents were just playing randomly. However, participants showed activation in the areas of the brain associated with “theory of mind” (i.e., attribution of human intention) in an order of increasing human-like features (computer < functional robot < human-like robot < human). So, embedding AIED in human-like hard robots would enhance their acceptance by the learner.

Augmented Reality (“Soft”) Robots
While hard robots have the advantage of being able to manipulate things in the physical world, soft robots in the form of augmented reality have the advantage of being able to be deployed anywhere, at any time. Unlike hard robots they can also change form and shape, say to match a learner’s preference for a teacher of an ethnicity that matches their own. Augmented reality as a field has also been developing over five decades although it is only in recent times, as miniaturization of electronics and cameras, together with increases in computing power, that it has really begun to advance rapidly. You can now use AR on your phone to try on shoes by pointing the camera at your foot and seeing how the shoe would look when you wear it, or you can arrange 3-D virtual furniture in your living room before you buy it. Up until now AR imaging has required large, expensive studio setups to create 3-D video of people, but start-up companies like Blinxel (https://www.blinxel.com/) have figured out how to make 3-D video cheaply, opening up the possibility of generating 3-D AR video implementations for use in education. As with humanoid robots, humans seem to pay better attention to 3-D rather than 2-D video (Andrew, 2018). At the moment, AR headsets such as the top-end Microsoft HoloLens 2 and Magic Leap are expensive and aimed at the business world rather than education. However, we are already seeing a growth of applications that use AR on mobile devices like tablets and smartphones aimed at broader use, for example, the latest Apple iPad Pro featuring a LiDAR scanner to facilitate AR applications. Between now and 2051, AR devices will get much cheaper, and we will likely be wearing glasses that allow us to project AR images onto our real world. Software, such as Unity, that is used to develop video games can also be used to create scenes, objects, and characters for AR software, so it is already possible to create a soft educational cobot character. If that were then imbued with the advanced AIED pedagogy described earlier, a virtual teacher could be projected onto the learner’s mobile AR device.

Actions for the Field
Even experienced teachers find it challenging to differentiate their instruction for a large class so that students can work on different tasks at different paces. We can work to create technologies that use hard and soft cobots that can move around the classroom as students are working on projects; recognizing students and their current emotions, being able to point or gesture, and being capable of employing AI-driven pedagogy can extend the teacher’s reach and support them in this task. This will involve forging new links with robotics researchers and creating new research centers to pursue these ideas. An exciting future lies ahead!

AI agents in education are being built on machine learning. Moreover, while machine learning has drawn some ideas from human learning, there remain significant differences in the process of how a human evaluates information and how a computer, even an AI agent, does so. Machine learning itself is data-dependent, not context-dependent—the algorithms work the same across the globe. Machine learning depends on and is maintained by data created as part of a social system; but not all data is appropriate for all contexts. This leads to a dichotomy between machine learning as objective and unbiased but seeing actual disparate results from algorithms.

A recent article in *The New England Journal of Medicine* gave 13 examples of algorithms that use race as a factor, resulting in potential harm to patients who identify as non-White, with Black, Latinx, Asian, and Native American people affected to various degrees by different calculations. It continued:

> These "correlations" (algorithm) are presumably based on the long-debunked premise that there are innate biological differences among races—a social construct—is not a reliable proxy for genetics…A recent study in *Science* examined a study…based on individual medical records, white patients were actually healthier than Black patients with the same risk score. This is because the algorithm used health costs as a proxy for health needs—but systemic racial inequality means that health care expenditures are higher for white people overall, so the needs of Black people were underestimated. An analysis of these findings, sociologist Ruha Benjamin, who studies race, technology, and medicine, observes that "today coded inequity is perpetuated precisely because those who design and adopt such tools are not thinking carefully about systemic racism"…The algorithms that are harming people of color could easily be made more equitable, either by correcting the racially biased assumptions that inform them [transparency] or by removing race as a factor altogether, when it does not help with the diagnose or care. (Editors, 2020, p. 12)

Dr. Ric Brown's vignette, *Taking the Magic Out of Algorithms*, views a future that must look to an unethical past of eugenics and how that history can lead to search engine and algorithmic biases. This statistician raises concerns about how, what, when, and why coding must be as transparent and honest as possible.

Vignette: Taking the Magic Out of Algorithms

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"Any sufficiently advanced technology is indistinguishable from magic" is a quote attributed to the British science fiction writer Arthur C. Clarke in 1961 (Jones, 2017). As you might recall, he also co-wrote the 1962 movie "2001: A Space Odyssey" with Stanley Kubrick. The quote is said to come from his book (a compendium of essays from his past) *Profiles of the Future*.

In 2020 as technology continues to advance at an exponential pace, artificial intelligence and its related algorithms gain more and more prominence in everyday life. The point of this vignette is to promulgate the understanding of algorithms that are becoming ubiquitous in the ongoing discussions of AI (artificial intelligence). It is not enough to "understand the definition of algorithms" (or simply just learn to spell the word!); one needs to understand what they do, can do, or should do. At this point, algorithms are mostly developer made (and thus are affected by its developer), although there is some discussion of algorithms writing their own algorithms. This phenomenon has been referred as "superintelligence" by Bostrom (2017b).

What is an algorithm? In a very basic sense, it is a mathematical formula. A good example of which everyone has knowledge is the division algorithm for dividing one number into another. Math teachers today use a variety of derivations of steps to teach division. The first statistical algorithms are said to have occurred in the eleventh century with the "Trial of the Pix" (p. 3) with the linear extrapolation from a sample to maintain the integrity of coinage (Stigler, 2003). For another example, in basic statistics, think of a mean (average); add up the numbers you have; and divide that amount by how many numbers you added together. In general, algorithms are directions or instructions on how to solve a problem. The fact that they do their work behind the scenes with increasing complexity does not make them magic. In fact, if you want to develop basic algorithmic literacy, you can learn some common algorithmic (Golbeck, 2016) components, recognize common algorithmic challenges, and try creating some algorithms yourself at https://slate.com/technology/2016/02/how-to-teach-yourself-about-algorithms.html.

The most prominent algorithms in use today involve what are called "search engines" (Hardwick, 2020): you type in a word, term, or phrase, and a SERP (Search Engine Results Page) is generated, not only based on the search term but also may consider physical location, browsing history, social setting, etc. SERP results appear in at least two forms: organic and transactional. Organic refers to information on the topic that exists, while transactional refers to commercial use in which an entity (business) pays to have its information made available and often prioritized. The movie streaming services use algorithms to identify movies of interest based on movies already watched by the subscriber. A good example to do as you read this vignette is to search for the author and/or quote at the beginning of this article. Insert "Arthur Clark" or the quote itself in the search space. It is likely that the first websites that come up are transactional in that they highlight his books for sale. You will also get websites that are organic regarding his life and work.

When I teach basic, applied statistics in the social sciences, my intent is to show how formulas (ideas) are utilized in the real world rather than simply the math and the influence they may have. This is an assignment in a statistics class that covers the idea of algorithms, the complexity of some algorithms and a touch of ethics. In a hybrid course, this is done in one of the live sessions but also accomplished fully online via assignments and/or live distant learning options such as Zoom, Webex, etc. Before getting into the calculations, examples, and interpretation, I ask them to do a search for "Pearson's r" (Huck, 2012). This begins the discussion of the purpose of algorithms in search engines. (see the information previously on regarding organic and transactional). The search leads to biographies of Karl Pearson, the correlation formula, and software packages on sale that do the calculations for you (these are of particular interest to the students). Then I ask them to do a search on Sir Francis Galton; one gets the same types of outcomes but also the facts of "regression to the mean" and eugenics. Eugenics (History.com, 2020) is a set of beliefs and practices that aim to improve the genetic quality of a human population, typically by excluding people and groups judged to be inferior and promoting those judged to be superior. It was promulgated by the Nazis in the 1930s–1940s to justify their treatment of Jews, disabled people, and other minority groups.

While knowledge, facts, and information on any topic are of importance, as educators we must take it upon ourselves to examine the issue of our time in the context of the subject matter. In the case with data analysis, AI and algorithms make sense to try to explicate. Back to the touch of ethics, if I told the students that the developer of the formula for the correlation coefficient was a eugenicist, does that make the technique invalid?

Sir Francis Galton (the cousin of Charles Darwin) is credited with the creation of the statistical concept of correlation and regression and widely promulgated the idea of "regression to the mean" which he sometimes called "regression to mediocrity." He meant the pejorative sense of mediocrity. His protégé, Karl Pearson, had the coefficient named after him well after its development (Edwards, 1993). Regression to the mean is both an observable phenomenon and a by-product of the correlation/regression formula. In the observable sense, if a golfer normally shoots in the low 90s, but one day shoots an 86, it is likely, not guaranteed, that in subsequent rounds, without direct intervention (lessons), scores will return toward the low 90s (the mean). What led to the lower score on that one occasion? Was the golfer more rested? Was the air less humid? Were the greens mowed differently? In other words, conditions may have been more conducive that day to a lower-than-average score. It will not always be that way and scores closer to the average will most likely return.

In the statistical sense, if a prediction equation is developed (utilizing Pearson's r), scores predicted will "regress to the mean" of the population from which they were drawn. An early example of the regression to the mean is found in the work of Galton on the heritability of height. He observed that tall parents tended to have somewhat shorter children than would be expected given their parents' extreme height. Seeking a mathematical answer, Galton measured the height of 930 adult children and their parents and calculated the average height of the parents. He noted that when the average height of the parents was greater than the mean of the population, the children were likely tall but shorter than their parents and closer to the mean of the population. Likewise, when the average height of the parents was shorter than the population mean, the children, while were taller than their parents, were closer to the population mean. Galton called this phenomenon regression toward mediocrity.

I demonstrate this effect by taking scores from the first two tests student take and calculating a correlation coefficient. That coefficient is not perfect. In the example, if I take a student who did very well on the first test (and I have the second test score to validate) to predict the second test and use the prediction equation, the student's predicted second test score would be closer to the mean of the second test, most likely lower than the student actually scored on the second test! It is the prediction algorithm at work, regression to the mean. In this example, while it may not be the algorithm that is the problem, it is certainly in the interpretation. Did Galton's fixation with eugenics evolve from his correlation algorithm?

Actions for the Field

It is incumbent on instructors, especially in areas that involve math, to work with students to build their sense of efficacy, that is, both the belief that they can do the work and also that they have the skills to realize that effort. Bandura (1995) describes self-efficacy as "*The belief in one's capabilities to organize and execute the courses of action required to manage prospective situations*" (p. 2). Especially in statistics, many students enter with an apprehension that they do not have the skills required to calculate complex algorithms. When shown that even the rather messy formula for a correlation coefficient involves only addition, subtraction, multiplication, and division, they begin to realize that complexity is nothing to be feared. Outside of math-related courses, any instructor in any course that employs searches in their content would want to discuss "search engines" in general and what outcomes students might expect. Also, algorithms and their respective perspectives would certainly be fodder for any discussion of ethics in any course.

It is also important that the outcomes of algorithms be understood in a broader sense and that questions be raised in any context where algorithms are utilized. Who developed the algorithm? What was the original intent of the algorithm? In practice, what is the outcome of the algorithm? Is the outcome consistent with the original intent? Was developer bias, known and unknown, considered? Is the outcome an aberration of truth? These are questions that educational leaders today and, in the future, should actively engage and demand transparency of the developers as the authors of the algorithms. Most importantly, for the future, if some sense of efficacy or delving into the nature of algorithms is absent, then they may seem truly magic!

While developers and designers undoubtedly need to be concerned about algorithmic biases, the common notion is that a machine learning system is only as good as the data used to train it. Why this truism exists and the implications for educational programs using AI algorithms are covered in the section below.

Data, Large and Small

Data drives AI systems, and AI agents need access to large amounts of data. The volume of data stored in technology devices around the world has been growing exponentially. Data growth between 1999 and 2006 has been estimated at over 1000%, with some estimates that we will be using up to 175 zettabytes of data by 2025 (Chojecki, 2019; Press, 2020). To put that number in perspective, a library floor full of academic journals contains around 100 gigabytes of data, and there are a trillion gigabytes in 1 zettabyte (Puiu, 2017). We are making and collecting data at every increasing rate.

Education as a field is not immune to this growth in data, with data generated at all levels: individual level (student, teacher, administrator) and organization-wide (classes, schools, districts). However, the value of the AI system data is not seen at the single or individual level. Pinkwart states, "The value of data, as argued, lies in its aggregation and analysis, along with the possible insights gained from these processes" (2016, p. 773). For AIED to best function, it needs diverse and plentiful data, coded with numerous variables, and related to other data at other levels (Bowen & Hickin, 2020). For example, predictions that result from data collected from students alone are almost always less accurate and more biased than results using data that connect students to families, teachers, and districts. In this way, the data needed to make AI educational agents useful is not conceptually different from the data needed to make educators effective. Educators can better serve their students with an understanding of student context and family lives, and previous educational experiences. Educators share this need for knowledge with AI programs. The difference is in the amount and the structure of the data needed.

Developers need data to train and test the models. The more variability in the type and sources of data and the greater volume of data, the more effective it is. Just knowing students answered a problem correctly is not enough to build an AI agent. The programs work best with detailed information such as the time spent looking at a problem; if the student chooses one distractor and then changed their answer; or how demographics of the student compared to other students who previously completed the question. Most current programs also need the data entered to be structured—the information needs to be pre-organized in categories and types, often with pre-determined values (Bowen & Hickin, 2020). This is typical of the databases of student records and assessment information collected by many schools and districts.

Nevertheless, much of the growth and excitement over AI use has to do with its potential to work with unstructured data. Unstructured data, such as video recordings or social media posts, do not have a preset organization. Software 2.0, due to the vast computational powers available with neural networks and machine learning, can find structure in unstructured data. This human-like ability to recognize patterns in unstructured data is something that machines have not previously been able to do. For example, after only a few classes, many high school art students would be able to glance at a drawing done by another student, a novel, unstructured visual piece of data, and recognize it as being in Picasso's or Monet's style. Humans are easily trained to recognize differences in type, especially with visual data. Software 2.0 can be trained to do this same task; however, this requires systematic training with hundreds of examples of Picasso's and Monet's work. This training allows the model to learn how specific groups of pixels arranged in a particular configuration are indicative of each artists' style. Moreover, current iterations of these types of models for unstructured data do require some type of pre-processing to serve as training data. For example, while humans would still easily recognize a picture of a cat that had been rotated 90 degrees, many AI recognition models would have trouble with this simple variation, and the data needs to be cleaned of such variations before it can be used in training the model.

This distinction in the type of data needed by humans versus needed by AI agents points to one of the tenets of AI development. Known as Moravec's paradox (Kasparov & Greengard, 2017), it is the observation that activities that are easy for humans are hard for computers while what is hard for humans is easy for computers. We are just reaching a level where the most advanced robots can imitate the actions of 6-year-old humans, jumping and dancing (Machemer, 2021). Yet these robots are not around us—they currently reside only in high-tech labs. Conversely, our phones can perform advanced mathematical computations beyond most human ability. Building on this paradox, Simon (1995) noted that while humans naturally engage in nonlinear thinking, intuition or inspiration attempts are very difficult for computers. Human intuition usually happens quickly and without clear justifications. Teachers use intuition often in the classroom, based on previous experience. Many teachers can intuit when students are not grasping a concept and predict what new intervention might succeed in student learning the material. This intuition ability is somewhat analogous to AI agents making a prediction, based on modeling from data with several hidden processing layers in a neural network. Just as teachers may not be able to articulate why they believed a specific intervention would be more effective than another, an AI program's outcomes may be produced without precise accountings of what variables led to the predictions.

Of course, both humans and AI agents are subject to failures of data and lack of knowledge. When the original data set is biased or lacking students with specific characteristics, both educators' intuitive senses and the training models can fail. A critical aspect of intuitive actions is that people and computer models can adjust to that constraint when informed of bias or lack of data. When people know that they lack examples, they may exhibit more caution in their recommendations or make recommendations that will do less harm. Models can be trained to attach less certainty to outcomes based on less or erroneous data.

However, as AI programs begin to incorporate more data on more aspects of human activity, some believe that Moravec's paradox will become less relevant. Already, some argue we might be reaching a crossover point. For example, human masters of strategy games such as chess and Go have been bested by the power of dedicated, advanced AI agents (Kasparov & Greengard, 2017). Although these AI agents were designed with the specific goal of beating humans at a rules-based game, many are concerned with the development of agents in the future that have broader goals and greater general intelligence. The ethical implications of such superintelligence on an AI agent are discussed in each chapter.

Before we get to that point, though, the AI agent must be fed data—lots and lots of data. Kizilced and Lee (forthcoming) divide use and incorporation of data within these systems into three stages. In the first stage, *measurement*, programmers decide what data will be collected and fed into the system. For the second stage, *model learning*, the system is trained from the data. Modeling is often done by dividing data collected from the measurement component into training and testing sets. With the training set, the agent calculates the weights of parameters to predict the given outcomes. These weights are then verified on test sets to determine if the algorithm was correct or needs to be retrained. In the third stage, *action*, the agent will produce a prediction or a list of options that are acted upon either directly by the system or given to humans to act upon.

To make these steps more concrete, let us imagine a district that wants to create an AI agent that will identify students for a dropout prevention program. In the first measurement step, district administrators will need to decide what student data should be used to identify students. After deciding what data can be used, they divide the data they have collected on previous students into two sets. This is the model learning stage. The first set of data is used to train the system to identify the probability of leaving school by using past data in which the student outcome is known. The computer can learn what other variables, such as grades, family income, or bullying reports, correlate with dropout. The system can then generate an algorithm for prediction, which is tested by feeding the test set data into the system and validating the agent-predicted outcomes to the actual observed outcome. If the model does not perform well, it is retrained, where parameters in the algorithm are tweaked, and tested again until it reaches a pre-determined accuracy level.

Reaching this accuracy level leads to the last step, action. In our example, the program may assign students to the program or provide suggested names to administrators based on the prediction models. Depending upon the agent's design, administrators may see the reasons for the recommendations, specifically the variables weighted most significantly by the program. This component creates a transparent system, also known as *explainable AI* (Weller, 2019; Hansen & Rieger, 2019). Other agents are opaquer in their decision-making and may not provide oversight as to what it deemed significant variables. These systems are considered *black box AI*.

Of course, many procedural questions arise with even this relatively simple AI agent. Collating the data and training the system requires significant staff time. Administrators would need to consider what predictor variables should be included in the model. More variables usually increase accuracy but also require more time to process. Administrators would also have to decide if data already collected by the district would be enough to operate the agent or if new and different data would need to be collected.

Ethically, issues abound with using AI agents in education. How does using demographic data, such as race or gender, pose a risk of disparate treatment regarding recommendations to the program? How well can administrators explain the model output and decisions made based on model probabilities to parents who question why their child was placed in the program? What net benefit and risks exist for using an AI agent to make these decisions versus trained counselors and educators? What would be lost by using such a system?

While data use and access are often treated in technical terms, it has profound ethical implications for how our schools operate and the growth of human potentials. With technology increasingly dependent on data, access to data remains access to power. Dr. Concha Delgado Gaitan's following vignette reminds readers that current technologies contain data that can be translated into real-life power, especially by communities that have been traditionally marginalized from power structures by elites. Following this powerful example, social scientists, educational leaders, and developers need to consider how future technologies, such as AI agents, can use the data they gather for good.

Vignette: Mexican Women's March: A Movement in the Making

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On March 8, 2020, the world witnessed an estimated 80000 women wearing purple participated in a 2-day protest, and a national strike began in Mexico City (Sheridan, 2020). Sixty percent of women stopped work to join the march. Women set up altars filled with flowers. Pink high-heel shoes representing the women who have lost their lives to femicide lined some sidewalks. Women wore masks carrying signs condemning murders, police, politicians, and government troops for their complicit part in the crimes. One piece of technology that every woman held was a cell phone. The Association for Progressive Communications (2020) reports that in this event, one piece of technology that every woman held was a cell phone. Cell phones, along with computer use, women can connect, thus form extensive connections. They're tools for their freedom to communicate and network.

It's not surprising that the women's march appears as news to many around the globe since violence against Mexican women (femicide) has rarely received the level of attention that we saw this year. This year marked 20 years of concerted determination of Mexican women to bring justice to crimes against women and to expose the corruption that protects the perpetrators.

Juarez and Chihuahua became the epicenters of the violence against working women since 1993 when a specific group of girls was targeted. The victims came from impoverished families and worked in the maquiladoras as factory workers (Livingston, 2004). Typically, the women had slender physique, dark skin, and shoulder-length hair. When their bodies were discovered, the young women had been raped, tortured, and mutilated. This data was collected and stored with the help of new and more advanced apps that allowed for more extensive and safer storage capacity through various technological means by university activists in collaboration with legal experts who researched the crimes. Protecting the data was a high priority for women who presented the data as evidence in the courts when arguing for women's rights against femicide.

In 2005, Amnesty International reported that more than 370 young girls were murdered in Chihuahua and 270 had taken place in Ciudad Juárez. From the beginning of the murders, theories were advanced about why these women were targeted. Informally, communities circulated other possibilities, including the fact that law officials were complicit in the women's disappearance and murders. People were careful when accusing law enforcement because they could face severe to have such retributions against the community and their businesses.

This patriarchal backlash may be the result of a lack of employment opportunities for men and more women entering the workforce, which has altered traditional gender dynamics and created a situation of conflict between the sexes (Pantaleo, 2010). Some researchers attribute the murders to Mexico's structural crisis, including increasing poverty, unemployment, the peasant economy's disintegration, migration, and a dysfunctional justice system (Staudt & Mendez, 2015).

Other research shows differently. According to Monarrez Fragoso (2008), in the incidents of femicide in Ciudad Juárez from 1993 to 2007, 9.1% of the murders of women were attributed to organized crime and drug trafficking activities. Overall, in considering the potential motives for gendered violence against women, academic Mercedes Olivera (2006) has argued that femicide is a mechanism of domination, control, oppression, and power over women.

In March 2020, Mexican women commemorated almost two decades of sustained open, public, legal, and political demand for justice for women. From the initial stages of this movement, women leaders organized anti-femicide feminist groups to include their daughter, sisters, and women of all professional and social sectors.

Castañeda Salgado (2016) studied how women from different sectors of Mexican society worked in their capacity as academics, political activists, and artists devising approaches to address the femicide within their fields and interlinking their talents within the Mexican context. In Mexico City, new technologies like GPS and panic alarm buttons connected to the police are being made available to more than 100 women between the age of 30 and 40 who suffered domestic abuse and living with aggressors (Moloney & Ahedo, 2019). This experiment was the first initiative of this kind, small but a step.

Mobile technologies and lifesaving devices for protecting women from persecutors have proven to be indispensable. Men find ways to hack women's phones and computers. Men stalk and harass women in their attempt to regain control after women have been advised of their rights.

As women's groups have been organized during the past two decades, they have accomplished necessary legal actions on behalf of women. In the 1990s, the federal court recognized femicide as a crime against women. The courts also ruled that women were not to blame for walking at night (Mendez, 2020). These laws punished femicide in the courts. Researchers amassing research on femicide and the court decisions giving women rights in abuse prompted the UN Women and the Office of the United Nations High Commissioner of Human Rights (2017) to launch the Latin American Model Protocol for the investigation of gender-related killings of women. It was developed in a 2-year participatory process, consulting experts from the region and worldwide. The Model Protocol is a tool for the police, court officials in the justice systems, and forensic doctors to properly investigate femicide. It begins by defining hate crimes against women and how they need to be investigated and prosecuted.

Legal battles against femicide made it into international courts when the maquiladoras came to Ciudad Juárez. The Campo de Algodon (cotton field) case represented 15 young women found murdered and buried in a rural area near the maquiladoras. The maquiladora owned international companies from Germany, the United States, Russia, and China. In the interview with Dr. Mendez, she updated the matter of femicide to the present time. The global pandemic virus, COVID-19, has complicated the femicide problem, especially in Juarez around the maquiladoras. The death rate among women has risen as the various international factories failed to protect women with masks and gloves. The violence against women continues in the maquiladoras with a different weapon, neglecting to protect them from a deadly weapon for financial profit.

Actions for the Field

The complex and deep roots of femicide in Mexico, as is the case in other countries around the world, have been exposed. Women's resilience, tenacity, and intelligent persistence in organizing all women have led to women developing methods of investigating. By staying focused on the goal, to unite and inform women while documenting and amassing research data to support court cases, women have won their safety and independence.

Twenty-First-Century Learning Theories

Extending AI agents' abilities to engage with humans in realistic, complex situations has been the driver of creating AI agents such as Deep Blue that compete with humans in trivia and strategy games (Kasparov & Greengard, 2017). These agents' success in imitating and surpassing humans in these games, though, took place due to the extensive skill of the developers and training by human chess masters, coupled with the resources of major corporations. For the majority of the systems we discuss and can envision for the immediate future, humans remain in control. With this control, we need to consider what it is we want to teach these agents about human learning.

Researchers continue to develop new theories to understand the role of technology in mediating learning and teaching. The inclusion of technology in more educational systems entails creating twenty-first-century learning theories. Often these theories place technology in the role of a mediator between two humans, such as between student and teacher (Bower, 2019). Others view technology as a mediator between the student's outward expression and inward knowledge (Papert, 1993; 1994 revised ed). This mediation role compares to twentieth-century learning theories that have the student and teacher in direct contact. How do relationships develop when there is a technological interface versus face-to-face? The following vignette by Christopher Benedetti demonstrates how experiential learning theories, role congruity, and connectivism can describe the process of developing virtual learning simulations. Benedetti also discusses how both developers and educators serve different roles in the process.

Vignette: Promoting Responsible Connectivism in Virtual Learning Simulations

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As societal demands push the boundaries of experiential learning beyond traditional, physical spaces, artificial intelligence applications, such as virtual reality, have the potential for recreating synchronous experiential learning experiences for those who are unable to access or be physically present in a learning space in real time. The current generation of virtual reality games demonstrate how human behavior can be simulated, even with complexity and emotion (Persky & Blascovich, 2006). Virtual learning simulations, a form of virtual reality, attempt to model typical behaviors of an experience (Baker, 2007; Van Lehn, Jones & Chi, 1992) using predictive algorithms or programming code. Virtual learning simulations have already been used in the medical field (Lateef, 2010) to practice skills before working with live patients, indicating the potential to extend experiential learning beyond presence in physical spaces. Virtual learning simulations allow for authentic and deliberate practice to maximize learning, as well as provide exposure to uncommon and diverse perspectives not found in the students' immediate environment.

Experiential Learning in Virtual Spaces
Experiential learning is a key component of many contemporary learning theories, as it is commonly understood that our learning is enhanced through social interactions with others, and the space around us, in the formation of new knowledge. Connectivism extends the application of experiential learning to virtual learning spaces, with experiences now including our open, though systematic, interaction with digital knowledge (Siemens, 2005a) allowing for diverse perspectives to inform new, but well-rounded, knowledge. Connectivism seeks to shift beyond traditional forms of social learning into more virtual spaces, which allows for processing outside of the physical influence of others (Kop & Hill, 2008). Online learning, both synchronous and asynchronous, is the most visible demonstration of connectivism in action, as learners can interact with other learners through chats and discussions, while also accessing relevant content anywhere on the internet to increase the diversity of perspectives to limit biased or skewed learning. Connectivism encourages the learner to take control of their learning by allowing open access to vast amounts of available knowledge (Goldie, 2016).

Stereotypes and Learning
Role congruity theory, which focuses on the formation and use of stereotypes in the assessment of leaders, has been used to examine gender (Aziz et al., 2017; Eagly & Karau, 2002) and race stereotypes (Grappendorf et al., 2011), highlighting how stereotypes of those different than ourselves may distort how we view others. Role congruity uses the term leader broadly, referring to roles of high achievement, often markers of success, not commonly held by underrepresented populations. In other words, role congruity proposes that those who do not adhere to stereotypes developed by those outside of the underrepresented populations are not able reach roles of high achievement easily, if at all. Given that learning and achievement are commonly associated, role congruity can be used to understand the pitfalls of stereotypes in the learning process. In short, role congruity can create an inequitable learning experience for those from underrepresented populations.

A Model of Responsible Virtual Reality Connectivism
Figure 2.3 presents an author-created model to illustrate the challenges and opportunity of responsibility for the various stakeholders when developing a virtual learning simulation.

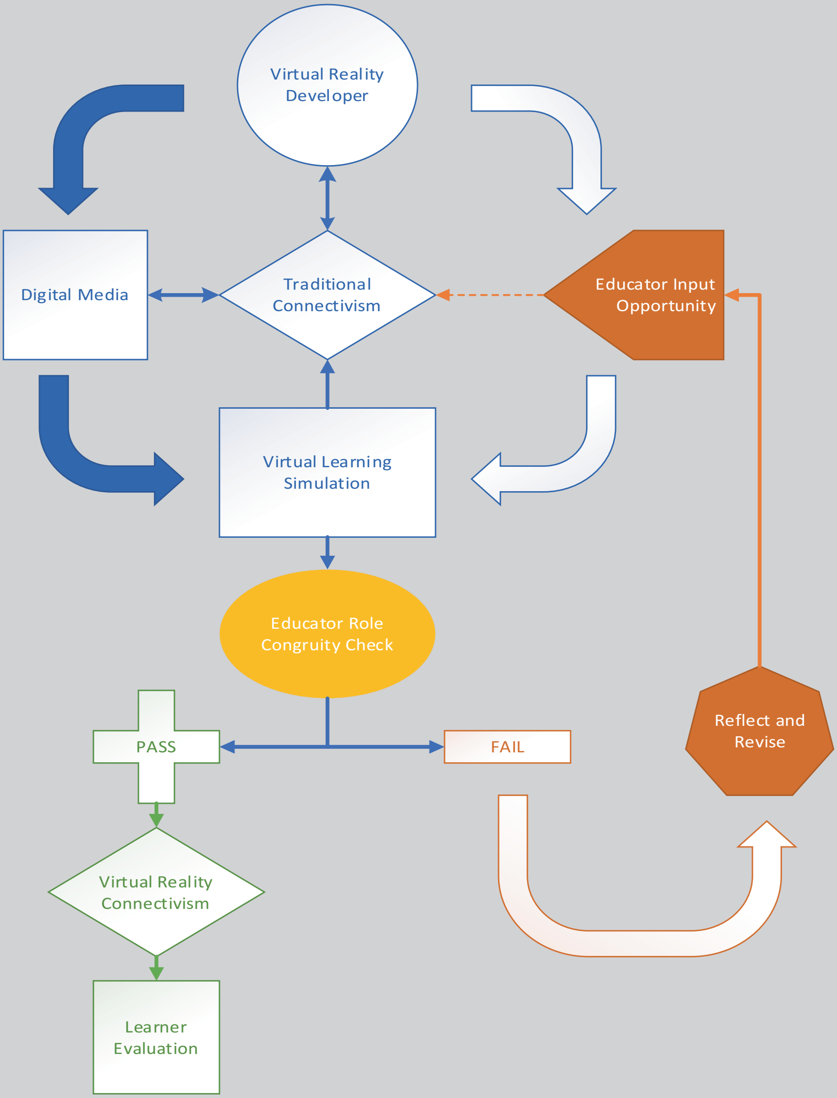

Fig. 2.3 Responsible virtual reality connectivism model. (*Note*. Author created)

The top portion of the model in Fig. 2.4 illustrates a simplified version of how a virtual learning simulation may be developed (Checa & Bustillo, 2019), which is captured as a cycle given the likelihood of revisions typical in software development. Developers are experts in software, not education, so they engage in traditional forms of connectivism, such as conducting internet searches, given their comfort and familiarity with the digital world to acquire

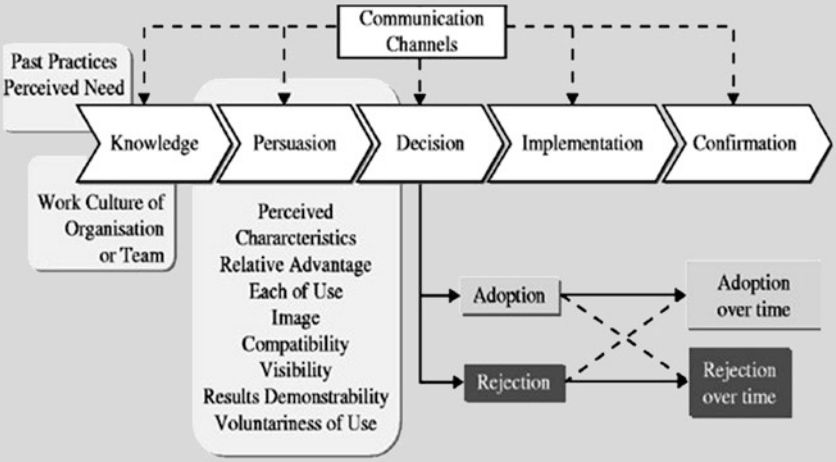

Fig. 2.4 Communication channels (Rogers, 2003, p. 171)

knowledge to build the simulation. Developers also make decisions about how people are portrayed in the simulation, both in physical appearance and behaviors. These decisions can be influenced by role congruity, which front-loads stereotypes into the simulation, embedding them in the software code. Once in the code, only the developer can make changes to the simulation. Outside educators are sometimes consulted in the development process and can guide and provide context for developers' connectivism efforts, but they are not able to review content until a working product is available.

Actions for the Field: Role Congruity and Connectivism
Educators play an important role in limiting learner access to role congruity in virtual learning simulations as noted in Fig. 2.1. Educators must be the gatekeepers in this process. Given their limited (if any) participation in the development of the simulation, educators must be the first to experience the simulation prior to release to learners. This evaluative step is referred to as the role congruity check, which includes the author-created framework, the three "A"s: accuracy, action, and authenticity.

- Accuracy—Simulated people are reflective of a diverse society.
- Action—Learners engage with a diverse range of simulated people.
- Authenticity—Simulated interactions vary based on knowledge and skills, not stereotyped behavior.

To ensure a balanced review of the simulation, multiple educators representing diverse backgrounds should participate in the evaluation. Otherwise, the check could result in a false positive, potentially sending a biased simulation to learners. Failing any part of the role congruity check is problematic, prompting reflection to generate suggestions for revision. Since failing the check is likely connected with the software code, the suggestions must be delivered to the developer. Educators should insist for increased involvement in the development process as part of the suggestions to ensure any role congruity issues are resolved before the simulation is released to learners.

Once the simulation has passed the role congruity check, educators can begin to integrate virtual reality into their existing connectivism paradigms. While the simulation is designed to recreate reality, it is still digital, which means the constraints of physical social experiences, such as thinking and behaving according to group norms, are not present. This allows learners to understand and inform experiences within the simulation with information from other digital sources, increasing the uninhibited learning that is desirable in connectivism. Learners can pause the simulation to allow for contemplation and investigation and should be allowed to do so. Learning is more important than any social pressure of the simulated experience. This also allows for learners to further evaluate role congruity in the simulation using the three "A"s, as well as their own perceptions of stereotypes related to those in their community.

As a final note of action, educators and learners must work together to understand, identify, and ultimately overcome role congruity so that all learners have the same opportunities to achieve. The model in Fig. 2.1 attempts to capture this shared responsibility at different stages of the process. A well-designed virtual learning simulation can model behaviors that challenge preexisting stereotypes, but it is the work beyond the simulation that helps to move beyond issues of role congruity. There must be a shared belief between educators and learners that everyone can learn, regardless of their personal characteristics, which is used to inform future learning. The power of connectivism is that it is ongoing and lifelong, and lessons learned through a simulation free of role congruity can positively shape learner behavior for years to come as they continue to navigate the digital world for new information.

Messy Human Issues and Ethics

Pinkwart (2016), while imagining a dystopian future of AI in education, gave the following possible conversation between two students regarding an AI tutor:

> Dan:…So think about it, what happens with the stuff you say to your tutor?
> Eve: Well… it's… stored?
> Dan: Sort of. It all gets to this company who calculates if our solutions are OK or not. But they need to make money, so occasionally they seem to sell our data to whoever pays. And

> there were also all these hacks sometimes where people stole that data. My sister told me that one of her classmates did not get a job because of that. You know, things she said to this ethics learning machine. It sort of misinterpreted her words and not only gave silly feedback but profiled her as extreme and dangerous. Also, she played with the tutor a lot and was profiled as a "gamer". And then all that life-long profile data went to that employer somehow. So, no job offer for her. Nothing she could do. (2016, pp. 778–779)

In this example, Pinkwart points out several ethical issues with machine learning and data for AI in education spaces. First, who owns the data needs to be addressed when computer programs are implemented in educational systems. Companies that own data often sell the data they collect from users, something we currently see within social media platforms. Internet-connected and cloud-based programs increase access to student data, assessment data, and demographic and personal information. Companies can use this data for their profit unless there are legal understandings of how the data is to be used and who can grant permissions for use (Boninger et al., 2017).

As more data-hungry software programs enter the classroom, where this data should be stored also presents both practical and ethical dilemmas. The increasing use of online software during the 2020–2021 COVID-19 pandemic made many school districts vulnerable to hacking attempts that resulted in ransom demands (Marks & Riley, 2020). Districts were forced to pay money to hackers who threatened to release private information stored on district servers, such as employee social security numbers and student health records. School districts may be especially vulnerable to these attacks as they are dependent on public funds and do not always have the funding to upgrade aging computer infrastructure. In comparison, the private technology companies supplying educational software often can afford strong security measures. While keeping data under district control may prevent misuse by companies, it may also make it more vulnerable to hackers' attacks. Felicia Young describes these ideas around how vulnerable a system is to attack, both by those outside and inside the system, in the vignette below.

Vignette: To Cheat or Not to Cheat: Artificial Intelligence Potential Harm to Higher Education

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As technology evolves, the way students experience education will change as well. Academic integrity will be tested, as the moral and ethical limits will be pushed beyond current limits. Educators must determine if the effectiveness of artificial intelligence is worth the risk involved. The advancement in technology will occur, but at what cost?

> Every period of human development has had its own particular type of human conflict—its own variety of problem that, apparently, could be settled only by force.

> And each time, frustratingly enough, force never really settled the problem. Instead, it persisted through a series of conflicts, then vanished of itself—what's the expression—ah, yes, "not with a bang, but a whimper," as the economic and social environment changed. And then, new problems, and a new series of wars. (Isaac Asimov, 1950, p. 133)

This quote is a perfect analogy to be used regarding the progress toward artificial intelligence being integrated into higher education within the next 30 years. The amalgamation of higher education and artificial intelligence will ultimately solve a multitude of issues which plague today's universities—finding competent adjunct faculty to cover freshman and remedial courses, student to professor ratio, salary expectations, etc. But there is a great deal of room left for error for institutions of higher education. One must ponder the potential negative implications of artificial intelligence in higher education institutions of the future.

The field of education has been the subject of many research articles and reports tracking how artificial intelligence can enhance the field as we currently know it. Most recently the *Horizon Report 2019 Higher Education Edition* (Educause, 2019) forecasts that artificial intelligence related to teaching and learning are expected to grow even more than the applications applied to the educational technology systems. With this rapid growth, academic integrity will ultimately become an issue. Tracey Bretag created a notable definition for academic integrity:

> Academic integrity is an interdisciplinary concept that provides the foundation for every aspect and all levels of education. The term evokes strong emotions in teachers, researchers, and students—not least because it is usually associated with negative behaviors. When considering academic integrity, the discussion tends to revolve around cheating, plagiarism, dishonesty, fraud, and other academic malpractice and how best to prevent these behaviors. Academic integrity is much more than "a student issue" and requires commitment from all stakeholders in the academic community, including undergraduate and postgraduate students, teachers, established researchers, senior managers, policymakers, support staff, and administrators. (Bretag, 2018, p. 23)

Does the true nature of honesty in academia change when the new gatekeepers of knowledge are machines created by humans? Can these machines be manipulated to create alternate outcomes? Will students have access to hack these very important pieces of the puzzles that will change the face of higher education? Educators must consider the ways in which these issues can jeopardize the future of the profession.

A study constructed by Abdelaal, Mills, and Gamage (2019) discusses how state-of-the-art artificial intelligence offers a new platform for serious academic misconduct that cannot be easily detected and very hard to verify. The study focused on addressing academic integrity regarding concerns of using artificial intelligence tools associated with phony writing, ways to identify articles generated by these tools, and a multitude of solutions to alleviate the academic integrity issues. It was concluded from this study educators should attend and conduct trainings to ensure others are aware of existence of these AI tools and their potential to be used in an improper manner, as well as creating appropriate punishment measures for those who cheat. Another important conclusion of this study was "artificial intelligence software is powerful enough to collect the related critical information better than good researchers, therefore teaching and research institutions should improve their plagiarism and fabrication policies against AI tools" (2019). These concerns are valid and could be very problematic in the next decade or two. Although this study focuses specifically on student cheating, there is a good possibility an educator can be accused of cheating using artificial intelligence, as well. Students and academics alike must understand technology cannot and should not be used to defraud the very system created to educate and provide a consensus of a proper existence through avenues of knowledge. Cheating only undermines the very statutes institutions of higher education were built on.

Actions for the Field to Consider

It is important to note technological advances will propel education to new heights, but not without consequences. Academic integrity or truthfulness will be an issue as artificial intelligence is expanded from systems of technology into classrooms for everyday use. The creation of generated coursework submitted as original work potentially comprised computer systems due to student hacking and misuse of computer applications by faculty, staff, or students. New and updated standards must be created to monitor and stop this behavior before there is gross error of negligence. It will be interesting to see how universities and colleges will handle future problems. Will more programs be created to catch the errors created by humans by way of other intelligence programs? The journey to discovering these answers will be very interesting and definitely a journey to a new wave of academia. The answer to these questions lies in the preparation of educators and institutions to combat potential threats to academia leading to the year 2051. If no plan is enacted, the academic community will suffer greatly. However, this analysis may be an overstatement as I am sure many educators thought doom and disaster was possible with the introduction of the internet. Yet, the sanity of education was maintained through this transition. The education community has been resilient since the inception of formalized education, especially in the postsecondary sector. Transformation is something that should almost be expected as education rapidly changes. Artificial intelligence will ultimately change the landscape of higher education, but if the road map of the past is used to navigate this new technology, academia in 2051 will be just fine.

While the changes from Software 1.0 to Software 2.0 have taken place quickly in some industries, the pace of change has been slower in the educational system. This is not very surprising. Educational institutions have displayed remarkable stability for years in the face of profound technological and social change. Pedagogies such as *drill and kill* exercise are still mainly the same for students regardless of form and time. Killing student interest was done by oral recitation in the nineteenth century and by paper and pencil in the twentieth century, and the same is now done by point and click in the twenty-first century. However, the pace of organizational change and individual adoption varies both within and between systems. In education, as in all fields, some individuals choose to accept, adapt, and embrace technological changes quickly, while others adapt more slowly. Dr. Valerie Riggs's following vignette describes some of these individual differences in adoption to online learning at a historically Black university during the COVID-19 epidemic. The author reflects on how change was both encouraged and enforced and the professional development required for such changes.

Vignette: Reflections of a Faculty Learning Management Ambassador on the Observed Impact of COVID 19 on HBCU Faculty and Online Learning

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COVID-19 ravaged America beginning early spring of 2020. The national impact of the pandemic has resulted in over 60,000 American deaths. The economy was forced into a collapse due to nationwide curfews and demands for public businesses and spaces to close or move to digital spaces (Reals, 2020). Universities across the United States abruptly closed their physical doors in March 2020 and moved to various stages of online learning. For large universities, this transition merely expanded their already flourishing offering of online courses, of which students easily transitioned. Other universities, including HBCUs, struggled for various reasons to offer sound courses and quickly get up to speed with their online course offerings necessary for students to finish their spring semester. This writing is a personal reflection of a Faculty Learning Management Ambassador on the observed impact on faculty members after a forced innovation of 100% online learning at a Historically Black College and University (HBCU) in Maryland as a result of the global pandemic, COVID-19. Implications for future development in online learning for HBCUs and smaller institutions that experienced difficulties with technology will be explored. Rogers' (2003) Diffusion of Innovation Theory frames this reflection.

Diffusion of Innovation Theory

Rogers' (2003) Diffusion of Innovation Theory presents two concepts that are applicable to this discussion on innovativeness: (a) innovations diffuse through social organizations while traveling through a five-step process where members make decisions to accept the innovation and (b) accepting the innovation is related to the categories people fall into as they move through understanding the innovation and determining whether they will use it. Rogers (2003) identified these categories as Innovators, Early Adopters, Majority, Late Majority, and Laggards.

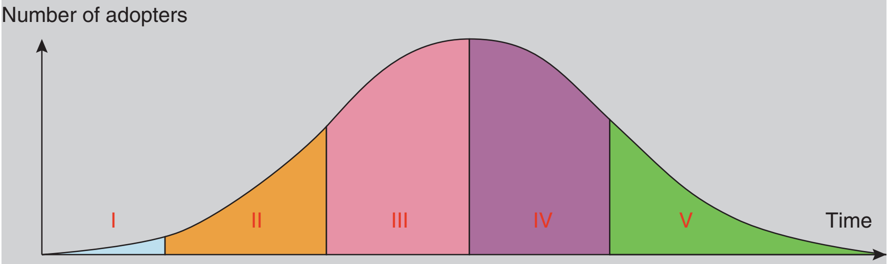
Five-Step Process for Making the Decision About Innovation

Rogers (2003) uncovered a phenomenon where he found innovations were diffused or communicated through channels over time to members of the particular social system. Rogers (2003) suggested members of a social system travel through a five-step process in order to make the decision to accept the innovation. The first step in the process is *Knowledge*, where the person learns of the innovation and has a general idea of how it works. The second step in the process is *Persuasion*, where the person forms a positive or negative attitude toward the innovation. The third step is the *Decision*, where the person engages in activities such as self-knowledge, training, or pressure that lead to the choice to adopt or reject the innovation. The fourth step is *Implementation*, where the person begins to use the innovation. The fifth and final step is *Confirmation*, where the person evaluates the results of the innovation decision that was made. Figure 2.4 summarizes the decision-making process of innovation.

The first concept from Rogers (2003) provides background on how an innovation such as online education may have previously moved through communication channels and come to be accepted by faculty members. In the case of COVID-19, it can be assumed that the channels of Persuasion and Decision were immediately removed from a personal choice and replaced with the mandate from the university that online learning would happen at a rate of 100% effective immediately.

Levels of Innovativeness

The second concept from Rogers' (2003) Diffusion of Innovation Theory is the discussion of the five categories of innovativeness faculty members may fall into as they begin to consider adopting a new technology. Rogers (2003) described the first and highest category as Innovator. Innovators tend to be interested in new concepts, are willing to take risks, and do not need much encouragement to adopt an innovation. The second category is Early Adopter. Early Adopters are comfortable with accepting new ideas but may perhaps need instructions and training. They do not need much encouragement to adopt an innovation. The third category is the Early Majority. *The Early Majority* are usually not leaders, but they will adapt to new ideas before the



Category	I. Innovators	II. Early adopters	III. Early majority	IV. Late majority	V. Laggards
Percentage	2.5%	13.5%	34%	34%	16%
Characteristics	Venturesome Interested in new ideas	Convey ideas of innovations to others. Greatest degree of opinion leadership	Deliberate adopt new innovations just before the average member of a system.	Skeptical Adopt new ideas just after the average member of a system.	Traditional Suspicious of innovations Last to adopt an innovation Not opinion leaders

Fig. 2.5 Adopter categorization on the basis of innovativeness. (Rogers, 2003, p. 281)

average person, and they like to see success stories with innovations and evidence the innovation is effective. The fourth category is the Late Majority. They are skeptical of change and tend to be slow with adopting an innovation. They prefer to wait until many others have tried it. The fifth and lowest category is Laggards. They are very traditional, conservative, and skeptical of change in general, and it is very hard to win them over to trying an innovation. People in this category often need statistics, pressure, and requirements to accept an innovation (Rogers, 2003) (see Fig. 2.5).

In my dissertation work, I performed a study and surveyed a representative sample of the faculty members reflected upon in this discussion. The faculty were employed at the HBCU in Maryland. My initial surveys explored level of innovativeness and found that 66.4% of faculty were Early Majority and 33.6% were Early Adopters (Riggs, 2019). These results were initially surprising due to the lack of strong online presence prior to the pandemic; I hypothesized that most faculty would have lower levels of innovativeness. It was a positive surprise to find that faculty at this HBCU were in fact innovative and interested in continuing to know more and develop online learning. One of the major implications discussed in my study was the importance of consistent and continuous training for faculty on using LMS and learning to teach online.

Reflections of an LMS Ambassador During COVID-19

During the summer of 2019, a new learning management system, Canvas, was implemented for use throughout the university. It was met with some resistance, but ultimately this was the new system that would be used. In order to ease the transition, LMS Ambassadors were assigned to each school. I was appointed as an ambassador during this time. My role was to provide training, individual help, course creation, and many other support roles for faculty that needed the help. This was pre-pandemic times and I would say that this job at that time was relatively easy. Faculty that had always taught face-to-face continued to do so. I would receive some calls and do trainings on the system but at a very manageable pace. These calls got slower and slower until March 2020. Distance learning and teaching online was optional, and faculty determined their desire to participate—ultimately, those that desired to be trained and create courses online taught in that manner fully voluntary.

In March of 2020, after the Governor of Maryland mandated universal closures, administrators alerted faculty and students that the university would transition into 100% online learning; it was decided that more LMS Ambassadors were needed and this support function would continue. LMS Ambassadors, who were faculty themselves, were offered stipends to dedicate themselves to supporting their faculty peers. Without knowing what would happen next, we agreed and were suddenly inundated with hundreds of calls from faculty with beginner to advanced-level operation skills on the LMS and with online pedagogy in general.

The previously mentioned research (Riggs, 2019) reported that most faculty at this particular HBCU were Early Adopters and Early Majority users of online learning and had positive attitudes toward online learning and technology. Surprisingly, the calls and types of questions that I received, in my opinion, reflected those of new users of technology, possibly Late Majority or even Laggards. I was not sure how these types of questions could be so common as I had just recently surveyed a representative sample, which showed support for distance learning at this HBCU. Questions ranged from complex on "How to implement various rubrics into the course management system" to simply "How do I reply to a thread?" and in some cases "What was a thread?" Questions would sometimes move beyond the LMS and more to their computer—how to download a document, problems with emailing, connectivity issues. From these types of interactions, I concluded that many faculty that I worked with were in fact Early Adopters and Early Majority in attitude and technology skill, but it was also emerging that there was a growing group of other faculty that might have been Early Adopters and Early Majority in attitude only and not technology skill consequently, and in many instances they lacked the necessary technical capability to transition easily into teaching online. My research surveyed for attitudes and perceptions of distance learning and technology; however it did not survey for skills in technology (Riggs, 2019). There is room for more research to compare attitudes and skill. As the faculty questions and issues came in, I found that my peers were nervous about their new modality but extremely enthusiastic and energetic about learning how to be successful with teaching online. Some were frustrated and just wanted things to return to normal so they could just simply teach and continue what they had always done as experts in their field. In meetings, other ambassadors and myself shared that we had received many calls and had performed many successful one-on-one trainings, course setup, and monitoring and held large workshops. In contrast to the semester before the pandemic, my job as an LMS Ambassador was greater than I had imagined, but I am sure that faculty members felt the same way about their jobs as we attempted to maintain excellence in the face of the unknown.

If asked, I would surmise that faculty members experienced much stress during this time. I had discussions with many that explained how they wanted to do more with their teaching and be more creative but were inundated with meetings and policy changes as the university continued to evolve daily because of the uncertainty surrounding the pandemic. Faculty wanted more time for the learning curve. They wanted to dive into the pedagogy of teaching online as well as understand the technical components of the LMS. Some didn't want to do either. They just simply wanted to teach and enjoy their students.

As the months went on, personal calls and emails were slower as the semester continued. They reignited again around grade submission time. Throughout, regardless of the tribulations and as a testament to the university, there was still the same positive energy and commitment to teaching online and meeting the needs of students. I often reflected and questioned the fact that many faculty members were not prepared although the technology was in place prior to the pandemic. Would mandatory training, workshops, and mandated use of the LMS for all faculty members prior to such a major forced transition such as COVID-19 have adequately prepared faculty members? Or would there still have been continued resistance or slow growth due to those with lesser technical capabilities?

Implications for HBCUs and Discussion of a New Model for Online Learning

Based on my previous research, I suggest that administrators consider that if Rogers' (2003) Diffusion of Innovation Theory offers valuable knowledge, then it is likely that the process of this theory has been disrupted as a result of the COVID-19 pandemic. For many HBCUs that were beginning to move toward embracing distance learning and were in the persuasion stage where faculty were beginning to express interest, excitement, and decision-making toward distance learning (Fig. 2.1), the pandemic and the resulting forced closures and immediate movement to online learning disrupted the opportunity for faculty members to move through the decision-making process, implementation, and confirmation of accepting the innovation (the use of distance learning).

Some faculty adjusted perhaps because they were Innovators and Early Adopters. Others who may have been Late Majority or Laggards did not adjust because of the disruption of the innovation adoption process. With this understanding in mind, how can university administration overcome these hurdles with the understanding that their faculty are experts in their field, whether or not they can embrace the latest technology? What could future classrooms look like for HBCUs and smaller institutions that still struggle with the technology but need to continue to engage their students seamlessly in a virtual environment? There are many additional conceptualizations of distance learning that could be implemented in conjunction with current models. The most frequently used model relies on the LMS as the holder of the class and where all information must be input in order for the student and teacher to access it. This learning is mostly two dimensional in that students and teachers view a screen and type back and forth as required by the teacher. There may be three-dimensional times where an online virtual time is set for a Zoom meeting or perhaps a video recording. But to think further, how can instruction be made easier for faculty that struggle with the technology but are experts in their field? Is quickly becoming a technology expert yet another task that they must learn and become experts in? How can faculty be expected to quickly learn the technology as well as the pedagogy and best practices for teaching online? Perhaps in the future, we can envision our classes as we would a new Netflix series—one in which students must subscribe to and visit for 15 weeks. The series would be interactive and live but could also be recorded for later use.

Given that this concept would be similar to a TV series, one would assume that a producer would be necessary to make the show run smoothly. The idea is that with a consistent class structure of Lecture, Q&A, Activity, Q&A, and Conclusion, a Course Producer could manage the technicalities of this all. The main components of their job would be to monitor activity, load presentations, admit students to the classroom, and man the chat room as well as other technical duties. As we imagine the future of teaching, the expert faculty member would be the star of this series, and perhaps through the use of a preset green screen or interactive white board, they would continue their work as if they are in a traditional face-to-face classroom. The university would provide equipment for home-based virtual faculty to include white boards, video cameras, and technical support for the setup of such. The idea is for the faculty member to be responsible for turning the equipment on, getting prepared to teach, and allowing the Course Producer to make sure that the session goes well. This concept suggests that Rogers' (2003) Diffusion of Innovation Theory be extended from the point of Decision with regard to teaching through distance learning. If the decision is yes, then the faculty member moves through the traditional communication channels and then implements the innovation of distance learning and commits to this innovation. If the decision is no, then the faculty member is assigned a Course Producer, and appropriate digital technology is provided by their university in order to create a

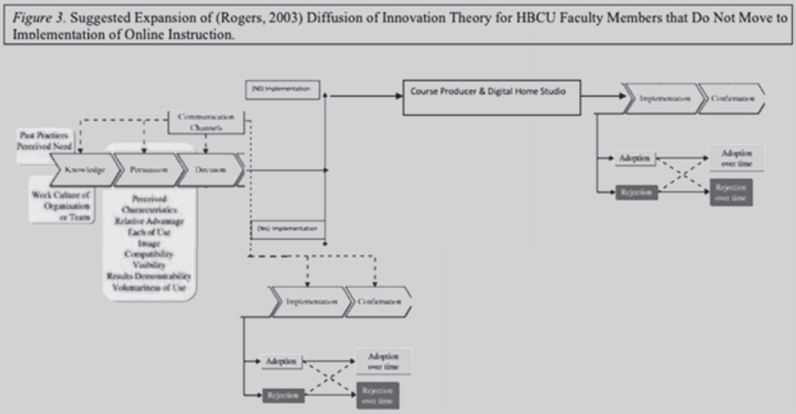


Fig. 2.6 Suggested expansion of Rogers' (2003) Diffusion of Innovation Theory for HBCU faculty members that do not move to implementation of online instruction (V-Lemke)

digital studio. Together with the Course Production and Digital Studio, the faculty member can move through implementation of distance learning and commitment to the innovation. See Fig. 2.6.

Thus far the university continues to support the idea of LMS Ambassadors for the upcoming semester, although the teaching modalities continue to be unknown as a result of the pandemic. My hope is that as we return for fall 2020, faculty members who were considered Early Adaptors and Early Majority have maintained this level or increased in *both* attitude and technical ability. I look forward to the continued positive energy and commitment to online learning from faculty for our beloved HBCU students.

Actions for the Field

One may wish to know what the future could hold for distance learning in future years, 2051 and forward. It is clear that this modality of learning is possible, yet we are not so sure how successful we may have been during this past year. Moving forward, as academics and scholars, we should continue to fine-tune a method of engaging students without having them in our physical presence. As previously discussed, varied options of a production-type model could contribute to the success of learning online, but we also need to continue to explore other methods that students currently use that keep them engaged with life. For example, social media outlets such as Instagram, Twitter, YouTube, Facebook, and TikTok could be methods that could be implemented into learning online. These platforms keep the engagement and people always return to them, sometimes for hours each day. How can we evolve our courses, so they become a social community with organic growth and explosion?

Although, by 2051, these social media examples may be obsolete, it is clear that a community and a gathering space of free ideas is cherished among those wanting to learn new things. As we work as facilitators of this learning, could we consider letting our students lead, develop, and produce viral ideas related to the coursework? The year 2051 and beyond should be the timeframe where we learn that it is okay to relinquish our control as instructors and instead guide and be equal contributors to the learning process. The COVID-19 pandemic of 2020 has taught us that we can be removed from each other and survive as individuals in our own spaces for long periods of time. However, we also are knowledgeable that we are social creatures and, therefore, found many ways to continue making communities even in times of quarantine. It is said that the world and socialization as we know it may never be the same. Thus, in the future it will be paramount as faculty leaders to allow social learning communities to grow within our classrooms. Our role should be to simply provide the space, resources, and knowledge for this to happen.

Describing both how we communicate the need for change and individual differences in how and when teachers adapt new technologies in the classroom, Dr. Riggs' vignette provides us with a view of what is happening in classrooms regarding technological change. The piece offers implications for those anticipating the changes that will undoubtedly happen again across educational systems as Software 2.0 and the resulting apps and technology become more prevalent. Hypothesizing into the future, we can ask if knowing that a neural network powers a program makes a difference. Should schools be the first place or the last place where we welcome AI technologies into our lives? How can we overcome the slow pace of change in educational systems? Furthermore, do we even want to speed up the pace of change? These questions about the adoption of technology are intertwined with questions about access and opportunity, covered in more detail in the next chapter.

Chapter 3
AI Disquiets

Rosemary Papa and Karen Moran Jackson

Online Teaching Learning 2.0

The Software 2.0 revolution raises questions about contemporary implementation in schools. These questions are tied to larger questions about AI in general and how the interplay between human and AI agency could impact education.

From a philosophical perspective, Sundvall asked, can machines become human beings (2019, p. 31)? Humans dream. Machines do not. As the boundaries of consciousness are pushed by AI development in all its potential, Sundvall contended that "AI has reached such a level of complexity and sophistication that they [AI researchers] can no longer fully understand why AI technologies make certain decisions" (Gershgorn, 2017 as cited in Sundvall, 2019, p. 33). Is AI already exceeding our ability to comprehend it? If so, how can we teach students to think critically about it? How do we prevent manipulation on social and emotional learning elements of students by algorithms? How are transformative technologies being implemented now in classrooms and school systems? COVID-19 has accelerated the use of technology in schools with students online. How can we both prepare students and teachers to work with transformative technologies, like AI, while also questioning their use and development? Educational theories have sought answers to fundamental questions about learning, but the pandemic has intensified the need to find answers.

Education until the new normal ensured connectivity for most, if not all, students, but how we answer these questions now will impact the development of

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future technologies. For example, what are the self-regulated cognitive strategies teachers use to ensure persistence and resilience in the learners? How are self-regulation strategies assumed to operate in AI learning systems? How do students develop self-efficacy and resilience when working with AI-driven learning programs that focus on cognitive skills? What metacognitive strategies are used by software and teachers to encourage student development in these situations? What happens if learner confidence is dimmed and grades drop? How do educators and the educational system respond to students who struggle with the change? Are struggling learners represented in the data?

The vignette by Dr. Melinda Lemke recounts part of this revolution through the impacts of the historic COVID-19 pandemic. The pandemic disrupted current schooling systems and caused educators to rethink how the system's inherent educational inequities can continue to be challenged. How we rethink about schools going forward is only limited by our imagination.

Vignette: A Critical Historical Rethinking of Online Learning in the Wake of COVID-19: The Unevenness of Pandemics and the Need for a Physical Place Called School

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A decade ago, I conducted a series of conversations with educational leaders to gain insight into different learning contexts across New York State (NYS). Each conversation focused on student income disparities, housing, and technology. These conversations, which were done over the phone and not recorded, were held with novice to veteran White, male and female educational leaders. These administrators worked in urban, suburban, and rural public, private, and nonprofit educational environments. Schooling contexts differed by demographics, median household income, and economic development. Differences also existed in the presence of charter, magnet, and other choice alternatives to public education, as well as the influence of community organizations on the everyday mechanics of school district policies and practices.

Despite these variations, two areas of commonality extended across our conversations. First, these educational leaders acknowledged that socioeconomic forces, such as industrial decline, were linked to shifting demographics, increased poverty, and family displacement across NYS. These administrators also pondered, aside from the *custodial function and responsibility of schools*, if there would be a *physical place called school in the future*, or if public schools, located in impoverished areas with declining populations, would slowly remove teachers and students from the classroom in order to create en masse online education.

Bringing the Past into Conversation with the Present

To rethink, re-interrogate, and reinterpret these conversations and the now decades-long push for online education, I turn to the process known as critical historical thinking (CHT) (Salinas, Blevins, & Sullivan, 2012). As history remains contested terrain both within and outside of classrooms, it is necessary that we re-examine historical persons, places, and established policies with the aim of challenging the selection and transmission of official narratives toward emancipatory ends (Apple, 2000; Banks, 1993; Darder, Baltodano, & Torres, 2003; Lemke, 2015). Through primary source documents or first-person accounts, CHT "creates an opportunity to include multiple perspectives and/or challenge traditional metanarratives. Ultimately the introduction of the *other* disrupts the official curricula typical to the teaching of history" (Salinas et al., 2012, p. 18).

Ostensibly, my examination of these conversations is not to introduce *othered* voices to thinking about educational concerns in 2010. These educational leaders, as do I, occupy an ontology shaped by White privilege—the reality of which, as I write, contributes to my public salary, benefits, and thus better healthcare and housing environment protection from the novel coronavirus or COVID-19 pandemic. Yet, as a former high school social studies teacher and central office administrator, I recognize CHT to be invaluable in rethinking established knowledge in meaningful and more critically authentic ways. On this point, Salinas and colleagues (2012) said:

> we mean that history is continuously interpreted and reinterpreted by individuals, communities, and nation states in undeniably different ways. By critical, we argue that historical narratives/texts should be created and recreated as inclusive of highly complex renditions of race, class, gender, sexuality, and so forth. (p. 18)

In light of the pandemic, these conversations need to be rethought and brought into dialogue with current concerns and visions of the future. The information shared by these administrators is not tangential to the present nor futurity. Rather, I would argue that the taken-for-granted ideological leanings embedded throughout their thinking are part and parcel of what maintains the kind of class-, race-, and gender-neutral technocratic and market-driven reforms discussed by research on neoliberal formulations within the United States and globally (Griffen, 2007; Lemke & Zhu, 2018; Lipman, 2011; Scott, 2005). The move to online learning under COVID-19 not only is part of a trajectory that must be troubled, but it is tied to broader equity concerns, the implications of which must be considered in any educational policy or programmatic shifts for the 2020–2021 school year and beyond.

The Unevenness of a Pandemic

As I write the pandemic continues. Furthermore, according to analysis of data compiled by Johns Hopkins University, though in some parts of the United States, coronavirus cases have stabilized or are on the decline, in other areas with limited closure or loosely regulated opening measures, cases have surged, e.g., Arizona, Florida, California, South Carolina, and Texas (Higgens-Dunn & Ratner, 2020). Ostensibly there is much we continue to learn about virus transmission and treatment. Still, historical documentation not only exists regarding public health official negligence during pandemics, but how such (in)action can intensify existent socioeconomic and political inequities—for example, documented in previous national health crises (e.g., 1899 bubonic plague, Honolulu, Hawaii) (Shah, 2001). Research also evidences how politicizing such crises can prompt more exclusionary attitudes toward immigrant groups and those constructed as the foreign *other* (Adida, Dionne, & Platas, 2020).

To begin, media commentators and federal leaders, including the 45th President [Trump], have racialized COVID-19 to the extent of helping increase nativist anti-Asian sentiment and specifically anti-Chinese, hate incidents (Hong, 2020; Tavernise & Oppel Jr., 2020). Though underreported by the news, *indigenous communities have experienced the highest infection rates in the nation* (Mineo, 2020), with Navajo Nation numbers surpassing that of New York State and laying bare overall federal neglect of treaty obligations (Doshi, Jordan, Kelly, & Solomon, 2020). Similarly tied to systemic disparities in income, medical treatment, housing, and maltreatment by law enforcement, Black individuals also have experienced disproportionate rates of coronavirus infection and death (Kendi, 2020; Nawaz, 2020).

Tied to the high level of overall domestic and caring profession labor (e.g., nursing) done by women, research evidences long-term negative consequences of the pandemic for female economic well-being (Chemaly, 2020) and health (CDC COVID-19 Response Team, 2020), which among other effects include increased hotline calls concerning domestic violence (Sandoiu, 2020). Though nonresident migrant farmers were deemed critical to the food-supply chain by the US Department of Homeland Security, these same "essential" workers only have experienced temporary political reprieve from the White House and remain socially isolated often in cramped living quarters without basic healthcare, unemployment insurance, and other public provisions (Jordan, 2020; Tzalain, 2020). Finally, chronic health problems coupled with food and housing insecurity have put the working poor and homeless, many of whom were deemed "essential," at higher risk for contracting COVID-19 (Brogan, 2020; DeParle, 2020).

Education-Specific Inequities

All of the previously named issues affect and are shaped by the US educational system and its employees, as well as its students, families, and surrounding communities. In an unprecedented and varied manner, entire districts shut down across the United States in spring 2020. By mid-March, in addition to a host of public and private business entities, 35 US states mandated school closures to slow the spread of COVID-19 (Einhorn, 2020). Early on, the US Centers for Disease Control and Prevention (USCDC) recommended that school closures follow available science, international reporting guidelines (e.g., World Health Organization), and school health expert consultation. It also developed contingency plans in anticipation of closures that underscored mitigating negative unintended effects for economically and physically vulnerable students and families (e.g., food insecurity, mental health, technology gaps), as well as healthcare workers (Rasberry, 2020). Still, in a political environment where the 45th President downplays the seriousness of the pandemic (Qiu, Marsh, & Huang, 2020) and there is limited science-based guidance for reopening (Weingarten, 2020), states and districts created and continue to move forward with their own road maps.

The extent to which these negative educational effects did or did not occur, for who, and level of CDC guidance effectiveness will be researched and written about for decades. Still similar to the aforementioned broad social inequities intensified under the pandemic, clarity exists about how policy actor (non) responses and the coronavirus itself exacerbated already existent educational inequities. Chief among these include lacking thorough and efficient communication between schools, students, and families as the result of systemic racial, economic, and health disparities (Goldstein, Popescu & Hannah-Jones, 2020), ongoing food delivery and insecurity concerns (Chan & Taylor, 2020), and increased emotional, physical, and sexual abuse of minors quarantining with familial or guardian perpetrators (Kamenetz, 2020).

Bringing the Past and Present into Conversation with the Future

In the short term of the coronavirus pandemic, technological and online learning concerns have ranged from digital divides in urban (Watson, 2020) and rural communities (Gaudiano, 2020), to how best meet the needs of students with disabilities (F. Hill, 2020) and address social-emotional issues with fidelity and respect for privacy while online (Will, 2020). Districts also have witnessed the hacking of online classrooms and educational meetings with hate language and pornography (Strauss, 2020). There also is concern about the increase in online commercial child sexual exploitation (Solon, 2020) and, as relayed to me anecdotally by practitioners, gaps in knowledge regarding how mandated reporter laws apply to online learning environments.

These issues demonstrate the infeasibility of and problems wedded to the kind of thinking espoused by the administrators I spoke with who indicated we were, *beyond the physical school as a place of learning*. Clearly these leaders did not envision a scenario like COVID-19, but their thinking cannot be written off as simply myopic. Rather, such reasoning is bound up with those discourses, policies, and practices that embrace what is discussed as a 24/7 educational work culture (Jabbar, Sun, Lemke, & Germain, 2018), which aims to alienate and isolate workers from the physical fruits of their labor. Such judgment cares little for the lived realities of the most marginal student groups who experienced a forced transition to all online learning during spring 2020. Having conversed with P-20 educators across the United States, such thinking also cares little for our well-being as evidenced by neoliberal work creep in the form of unpaid and invisible labor (e.g., email increases, conversion of seated to online learning, and the *expected* “participation welcome, but not required” Zoom meeting). Rather, omnipresent discussions about the budgetary bottom line hint at some of the performativity of administrative messaging about physical and mental health.

Yet, despite these obstacles, many educators who I studied under and currently work alongside are ethically minded and transformative individuals. They work to infuse culturally responsive practices and model healthy boundaries within their institutions toward the improvement of overall student and community health equity. Thus, if we are to learn anything from COVID-19, which we carry into the future, it is to identify and replicate their actions. An additional learning should be the unequivocal importance of the *custodial*, or caring, and *physical building* function of public schools in the everyday life worlds of students, educators, and the wider commons.

Actions for the Field

In weighing the significance of in-person synergies and transformation that occurs within physical school environments, it can be argued that online learning is by no means a panacea for the educational equity concerns of today. Though technology is here to stay, it also is not a replacement for the physical building, which is responsible for buttressing the communal democratic spirit of tomorrow. If educational leaders and policymakers seek to uphold an egalitarian and humanistic spirit, then consideration must be given to the inequities previously described and in a manner that does not permit new technologic modalities of reproduced inequality to come into formation.

In reimagining what public school learning environments might look like post-COVID and beyond, put simply, we must invest in public school students, educators, facilities, and wider community infrastructure. This does not simply mean throwing money at educational problems, though addressing fiscal inequity clearly is part of this equation. Rather, this means going beyond mere acknowledgment of those historically rooted and systemically present socioeconomic and political forces that create inequality toward a radical rethinking and agitating around such material and temporal conditions.

At a most basic level, from birth through postsecondary years, this would include developing a national agenda for a whole-child, ecological model of learning that accounts for public health and well-being. It would involve providing public school educators with the salaries, benefits, resources, and professional dignity they deserve, as well as increasing the number of nurses, psychologists, and social workers in public schools. It would include investment in public school facilities, which, for many traditionally underserved students and communities, means updates to unsafe and unhealthy learning conditions. Finally, it would mean wholesale institution of community asset-mapping and schooling models so to build bridges between schools and multisector community resources. Properly heeded and in spite of immense loss to human life, the pandemic offers a portal into past wrongs, tribulations of the present, and future opportunities for critical transformation.

Human Bias

Implicit biases are commonly understood to be part of the human experience. Chabria (2019) confronted implicit bias and the reason for certain fields, such as medical and legal workers, as "the result of subconscious attitudes and beliefs rather than explicit racism…many continuing education offerings for medical and legal professionals already include some implicit bias training, but new laws would set stricter requirements" (Chabria, 2019, p. B4). People, especially those employed in relationally dependent jobs, such as doctors and educators, need to be trained to recognize their biases.

Without an understanding of human bias's ubiquity, machine learning decisions may be flawed from the very beginning. Humans are flawed, so it follows that programmers who may be unaware of their biases may continue to promote social inequities. The biases in US society are evidenced by the experiences of the #BLM-Black Lives Matter movement. White privilege and Black subjugation have been revealed through differences in algorithms and police actions surrounding the June 2020 march in support of Black lives and the January 6, 2021, attempted coup on the US capital buildings (Brantley-Jones et al., 2021; Greenberg & Kim, 2021). White people at the attempted coup were treated delicately, even as they destroyed the offices and halls of Congress. Whereas only a few months previous, protesters marching for #BLM were treated harshly and subjected to police intimidation, arrests, tear gas, and unprovoked use of force. How can we safeguard against algorithms that produce biased results? Khan questions if computer scientists can develop algorithms that weed out biases on race, gender, special needs, and other human differences, especially when the bias exists in the data being used to generate the algorithm.

> For example, an algorithm used to determine prison sentences predicted higher recidivism rates for black defendants found guilty of crimes and a lower risk for white ones. Those predictions turned out to be wrong, according to a ProPublica analysis. Biases like this often originate in the real world. (Khan, 2019, p. 2)

Even in unbiased data sets (if this is possible), algorithms can have poor outcomes. Khan cited MIT Professor Celi who argued:

> the best way to avoid bias and other problems is to keep machine learning experts in the loop throughout the entire process rather than limiting their input to the initial design stages. That way they can see if an algorithm is behaving badly and make any necessary fixes. (Khan, 2019, p. 5)

Humans are the progenitors of deep learning systems and are the point of origin for developing AI systems (Manjoo, 2020). Manjoo contends machines mimic the mathematical structure of the neural networks as found in human brains. Machines "learn about the world by working out patterns in very large sets of data" (p. 5). Manjoo continues,

> And AI will act in humanity's image. AI systems will absorb their creators' ethics and incentives, their blind spots and biases- and, if we are not careful, they may end up automating and amplifying the darkest edges of human society into a new kind of digital dystopia. (p. 5)

Thus, the inherent bias that humans all have and exhibit is most likely being built into the algorithm, creating bias. For example, when embedded into detecting breast cancer or heart irregularities, human biases might permit us to conceal "the inequalities that already pervade society" inside the algorithm (Manjoo, 2020, p. 5).

Machine Bias

Through the lens of social justice, software and technology use should be guided by rules and ethics. For example, maximizing human engagement on social media can undermine individual mental health without more controls (Abi-Jaoude et al., 2020; Fardouly et al., 2018). What would happen if similar uncontrolled access was encouraged in educational systems? The concern with unfettered AI in education arises from seeing some of the effects of machine learning algorithms in other social systems. As algorithms rely on large historical data sets, they are inherently subject to the human biases that influence aspects of the data collection, including intentionally manipulated data.

For example, in 2019, Apple Card and Goldman Sachs were accused of gender bias when extending higher credit lines to men than women. Though Goldman Sachs maintained that creditworthiness—not gender—was the driving factor in credit decisions, the fact that women have historically had fewer opportunities to build credit likely meant that the algorithm favored men (Shapiro & Blackman, 2020). At the federal level, Magnuson raises concerns relating AI to financial markets in the United States. "These threats mirror the problems that created the last financial crisis –when complex derivatives and poorly understood subprime mortgages sent the world into a deep depression…AI could lead to financial bubbles growing bigger or lasting longer…[called] irrational exuberance" (2019, p. A13). In the financial markers, resulting predictions about investments could misfire and have consequential impacts on social order.

Facial recognition software is another application of an AI agent that has integrated human bias into the machine. As noted in Chap. 1, increasingly governments are employing facial recognition for a variety of reasons, some of which can threaten civil liberties (Chinoy, 2020). As eugenics led to White supremacy and political colonization, facial recognition which relies facial structure and head shape can be used to falsely assess a human's character and even mental capacity.

> A 1902 phrenology book showed how to distinguish a "genuine husband" from an "unreliable" one based on the shape of the head; today an Israeli start-up called Faception uses machine learning to score facial images using personality types such as "academic researcher", "brand promoter", "terrorist" and "pedophile" …By the late 1900s, algorithms could automatically map facial features-and super charged by computers, they could scan videos in real time. (Chinoy, 2020, pp. 36–37)

Likewise, MIT Media Lab's Joy Buolamwini wrote her MIT master's thesis on *Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification*, in collaboration with Timnit Gebru from Microsoft Research. The pair found that gender classification systems based on facial recognition "performed best for lighter individuals and males overall" and "worst for darker females" (para. 7). Bias errors in Amazon's Rekognition software are, Buolamwini argued, "among the most concerning uses of facial analysis technology involve the bolstering of mass surveillance, the weaponization of AI, and harmful discrimination in law enforcement contexts" (Magid, 2020, para. 8).

In another example, the social media platform Facebook's civil rights and First Amendment interpretations have been faulted. In May 2018, the American Civil Liberties Union (ACLU) performed an audit of social media. Regarding social issues performance, the ACLU distributed a "100-page report [which] outlines a 'seesaw of progress and setbacks' at the company on issues such as content moderation, bias in its algorithms, advertising practices and treatment of voter suppression" (Magnuson, 2019, p. A9). As McNamee argues, maximizing human engagement on social media undermines individual mental health and collectively democracy.

> Facebook, Instagram, YouTube, Twitter and others derive their economic value primarily from advertising. They compete for your attention. In the guise of giving consumers what they want, these platforms employ surveillance to identify the hot buttons for every consumer and algorithms to amplify content most likely to engage each user emotionally. Thanks to the fight-or-flight instinct wired into each of us, some forms of content force us to pay attention as a matter of self-preservation. Targeted harassment, disinformation and conspiracy theories are particularly engaging, so the algorithms of Internet platforms amplify them. (McNamee, 2020, p. 21)

Rules and ethics should guide algorithms. Yet, this truism begs the question of whose rules and ethics are primary in the design? We have seen social media feeds target us with dehumanizing disinformation and conspiracy theories. What has led to this manipulation? McNamee places the blame on algorithms in social media that are amplifying "emotionally dangerous content [a]s a choice made to maximize profits" (McNamee, 2020, p. 21). The Center for Humane Technology additionally argues that social media harm mainly lies in monetizing time spent on the Web. They caution parents to understand:

> While, of course, social media has its benefits, it has also taken over young people's relationships and is constructing their daily reality—homework, weekend plans, flirting, friendship, their sense of self and belonging—all within a system that is designed to capture and monetize our attention. (Center for Humane Technology, n.d.-a, p. 1)

The companies, and their resultant algorithms, are not driven by an attitude of what is best for the human agenda. This attitude is antithetical to an educational system. To prevent such a development, educators need to question what steps would lead to a similar free-for-all in educational systems? In education, due to the pandemic and the reliance on online learning, the programs now serving students are amassing large amounts of data. This data is often collected silently, with educators and parents unaware of the type of data collected. While most people would not be surprised that an educational services company would collect data on the number of incorrect versus correct answers, they may not realize that some programs also collect information on time to answer, on digital notes, and even on eye-tracking. For companies, this type of data can be used to support student learning in the program but also serves to engender scalability and profits for the companies creating the software. There is a need to merge our learning and leadership theories to technologies so that algorithmic biases can be challenged and that today's social injustices are not maintained into the AI future. When AI software is used in classrooms, educators must participate in the design of that learning process (Papa, 2021).

AI-Generated Books Current AI agents are concentrated mainly in recommendation models, language processing, visual processing, and high-performance computing for scientific pursuits. While much of our discussion has been broad in scope, it might help to more precisely examine how text processing is currently impacting publishing and the implications for education, which is such a text-dependent system. The first computer-generated book was published by Springer Publishing (Beta Writer, 2019) and was sent to experts around the world to review. The text focused on lithium-ion batteries, and the preface was the only piece not created by the AI algorithm.

The preface, written by content and machine learning experts, noted the details of its creation:

> The Beta Writer book is a cross-corpora auto-summarization of current texts from Springer Nature's content platform "SpringerLink", organized by means of a similarity-based clustering routine in coherent chapters and sections. It automatically condenses a large set of papers into a reasonably short book. This method allows for readers to speed up the literature digestion process of a given field of research instead of reading through hundreds of published articles. (Beta Writer, 2019, p. v-vi)

The developers collaborated with "Springer Nature and researchers from Goethe University Frankfurt, Germany" (p. vi). The book's directive was to efficiently manage information overload by providing a literature survey of existing content in Chemistry and Materials Science. The preface also describes the many decisions made to compile the algorithm (e.g., clustering methods, tree structures). Computer scientists, engineers, and editorial subject matter experts contributed to how the algorithm was developed in:

> balancing the collation of the 53,000 articles and the creative automation writing that produced the book. Natural Language Processing and Machine Learning techniques were used. The workflow was based on: 1. document clustering and ordering; 2. extractive summarization; and 3. paraphrasing of the generated extracts. (p. xi)

The collaborative intended to explore the limits, as well the opportunities, of machine-generated content. Of interest to the publisher was the question, what will the impacts be brought on by AI in the publishing industry? Other questions raised were:

> Who is the originator of machine-generated content?
> Can developers of the algorithms be seen as authors?
> Or is it the person who starts with the initial input (such as "Lithium-Ion Batteries" as a term) and tunes the various parameters?
> Is there a designated originator at all?
> Who decides what a machine is supposed to generate in the first place?
> Who is accountable for machine-generated content from an ethical point of view?
> (Beta Writer, 2019, p. vii)

To develop this type of book using AI algorithms required the use of full transparency, acceptance of failure, and encouragement of criticism to increase efficiency in research. The preface writers described how the original text, based on a massive database of information, produced work with many imperfections found in syntax and phrase association. An analysis of findings pointed to the crucial role of peer review. The collaborators noted that "we still think that for the foreseeable future we will need a robust human review process for machine-generated text" (p. ix). While on a topic with relatively little controversy, the creation of machine-generated research text required a new type of review process to the typical peer-review methods used in research. The term *peer* itself indicates a certain inadequacy for machine-generated research content. Who are the peers in this context? Would human readers consider themselves as peer to a machine? What role do experts in a specific research field play as collaborators with experts on neural networks and natural language processing? Who is best able to evaluate the quality of the text and the research upon which it was based?

The processes described in the creation of the machine-generated book required peripheral humans. As the author of books in the social science field, eliminating the human equation and using a machine to serve as the arbiter of knowledge is unsettling. The author's title of Beta Writer is to express its virtual creation. Among the humans involved, it was discovered that editors of the subject matter experts wanted to "maintain a certain level of control" (p. xxii).

> Another technical challenge that they identified during the creation of this book was that human users aim to remain in control. While an automatically generated book may be a dream come true for providers and consumers of scientific publications (and a nightmare to peer review), advanced interfaces to help users to guide the algorithm, to adjust parameters

> and to compare their outcomes seem to be necessary to ensure both standards of scientific quality and correctness. (Beta Writer, 2019, p. xxiii)

Publisher concerns about who are the authors of original research may not impact the creation of such a machine-generated book. Human authorship of many works will continue, but more machine-generated texts will also be created. The dilemma becomes blended human-machine text generation versus full machine-generated content. As Ross Goodwin puts it: "When we teach computers to write, the computers don't replace us any more than pianos replace pianists—in a certain way, they become our pens, and we become more than writers. We become writers of writers" (Beta Writer, 2019, p. ix). Publishing houses may decrease the numbers of writers they employ, but an increase of text designers may take hold.

Ethical Coding Ethical issues derive from human beings and their fact-based or irrational interpretations of moral life or absence thereof. In education, ethical issues are found in decisions teachers make in their classrooms, administrators make in their offices, and parents make in their homes. One research area on AI and ethics that have received much attention concerns the ethics around self-driving cars and the algorithms that drive the vehicles' decisions on the road. Sütfeld, König, and Pipa specifically researched automation in self-driving cars and their ethical dilemmas. They found that:

> Any tangible solution for automated ethics needs to reconcile fundamental law, technical feasibility, and the moral values of society. The goal must be to not allow the cars to be as fair and safe as possible…and guard the manufacturers from legal liability with respect to the ethical programming of their cars, but also to foster public trust in automated driving technology and facilitate its adoption. (Sütfeld, König, & Pipa, 2019 p. 20)

Simonite (2019) equates the extreme expansion of AI in our lives as "the dog has caught the car" (p. 1), seeing deep learning as being unresponsive to the realities of the spectrum of human intelligence. Current AI models, for the most part, are not concerned with ethical reasoning and social equities. In an interview with Wired.com, Simonite described AI models at present as mostly concerned with passing a test or winning a game. This presents a very narrow rubric and a low bar for humans to operate from. Bostrom (2014) raised these ethical issues surrounding AI almost 10 years ago:

> Imagine, in the near future, a bank using a machine learning algorithm to recommend mortgage applications for approval. A rejected applicant brings a lawsuit against the bank, alleging that the algorithm is discriminating racially against mortgage applicants. Finding an answer may not be easy. If the machine learning algorithm is based on a complicated neural network, or a genetic algorithm produced by directed evolution, then it may prove nearly impossible to understand why, or even how, the algorithm is judging applicants based on their race. On the other hand, a machine learner based on decision trees or Bayesian networks is much more transparent to programmer. (Bostrom, 2014, p. 1)

Developers working in the industry often have a primary private interest: scalability. When the goal is to create the best predictive models of consumption or marketability, the assumption of economic interests prevails. Social justice considerations, such as transparent policies and ethical guidelines to guide decision-making, are less prevalent. Bostrom contends that when AI algorithms "take on cognitive work with social dimensions—cognitive tasks previously performed by humans—the AI algorithm inherits the social requirements" (2014; 2011, p. 2). He continues that as laws in a country are predictable to maximize citizens' lives, laws do not necessarily optimize the society. He warns:

> Responsibility, transparency, auditability, incorruptibility, predictability, and a tendency to not make innocent victims scream with helpless frustration: all criteria that apply to humans performing social functions; all criteria that must be considered in an algorithm intended to replace human judgment of social functions; all criteria that may not appear in a journal of machine learning considering how an algorithm scales up to more computers. (2014; 2011, p. 2–4)

Part of taking on human responsibilities is recognizing the emotional well-being of other humans with whom we interact. A vital part of the human equation is emotions, especially empathy. Humans are called upon each day to make decisions on a myriad of emotional levels and cognitive awareness. Decisions that AI agents undertake, such as in self-driving cars, need to be safe across thousands of contexts: some envisioned by the programmer, and some cannot be anticipated when used broadly in multiple contexts.

AI as Human As discussed in Chap. 1, Brown discussed in his book *Origin* (2017) that a new Seventh Kingdom called Technium was being created that may create "an enhanced version of ourselves" (p. 409). Prior to this book, in 1993 Vinge wrote of a coming technological singularity that humans might not survive. He believed that in 30 years, AI would create superhuman intelligence, which also forecasts the end of the human era. We are 2 years+ away from this prediction. What has come to pass has been the increasingly rapid growth of "greater-than-human intelligence" with nonhuman driving cars, algorithms that sort our news, expand our credit card capability, and other tasks. His prediction of the post-human era is founded in the evolutionary past.

> Animals can adapt to problems and make inventions, but often no faster than natural selection can do its work -- the world acts as its own simulator in the case of natural selection. We humans have the ability to internalize the world and conduct "what if's" in our heads; we can solve many problems thousands of times faster than natural selection. Now, by creating the means to execute those simulations at much higher speeds, we are entering a regime as radically different from our human past as we humans are from the lower animals. (Vinge, 1993, p. 2)

Vinge (1993), in his prediction, believed that "minds can exist on nonbiological substrates and that algorithms are of central importance to the existence of minds…organic brains" (p. 4). Rules, Asimov's Laws, can be built into the mind of the superhuman entity.

> Still, the Asimov dream is a wonderful one: Imagine a willing slave, who has 1000 times your capabilities in every way. Imagine a creature who could satisfy your every safe wish (whatever that means) and still have 99.9% of its time free for other activities. There would be a new universe we never really understood but filled with benevolent gods (though one of my wishes might be to become one of them) …. such kindness in this universe…human's

> natural competitiveness and the possibilities inherent in technology. And yet…we are the initiators. (Vinge, 1993, p. 5)

He believed that a symmetrical decision model could be created in AI. He also presumed that the advantage of humans' intuition may be available in the computer hardware. He believed that pieces of this singularity could be quite scary, initially.

> We humans have millions of years of evolutionary baggage that makes us regard competition in a deadly light. Much of that deadliness may not be necessary in today's world, one where losers take on the winners' tricks and are coopted into the winners' enterprises. A creature that was built de novo might possibly be a much more benign entity than one with a kernel based on fang and talon. And even the egalitarian view of an Internet that wakes up along with all mankind can be viewed as a nightmare (du Boulay & Luckin, 2016) The problem is not that the Singularity simply represents the passing of humankind from center stage, but that it contradicts some of our most deeply held notions of being. I think a closer look at the notion of strong super-humanity can show why that is. (Vinge, 1993, p. 9)
>
> A mind that stays at the same capacity cannot live forever; after a few thousand years it would look more like a repeating tape loop than a person…To live indefinitely long, the mind itself must grow … and when it becomes great enough, and looks back … what fellow-feeling can it have with the soul that it was originally? Certainly, the latter being would be everything the original was, but so much vastly more. And so even for the individual, the Cairns-Smith (or Lynn Margulis) notion of new life growing incrementally out of the old must still be valid. The new era is simply too different to fit into the classical frame of good and evil. That frame is based on the idea of isolated, immutable minds connected by tenuous, low band with links. But the post-Singularity world does fit with the larger tradition of change and cooperation that started long ago (perhaps even before the rise of biological life). (Vinge, 1993, pp. 9–10)

Vinge (1993) concludes that research into AI and ethics should be applied in this era we find ourselves today. In 1993, he saw inklings in "Good's Meta-Golden Rule, perhaps in rules for distinguishing self from others on the basis of bandwidth of connection" (p. 10). He concluded that "Freeman Dyson has it right when he says: *God is what mind becomes when it has passed beyond the scale of our comprehension*" (Freeman Dyson as cited in Vinge, 1993, p. 10).

Bostrom uses a rock analogy: rocks have no moral status; therefore, we can throw, crush, and otherwise destroy the rock as it has no moral or emotional status. While sustainability and climate change scientists would disagree with this rather cavalier human attitude that has led the planet Earth on a path of self-destruction, it is within that self-destruction that humans may be marching to extinction. Bostrom contends that it is "widely agreed" (2014; 2011, p. 7) that current AI systems have no moral status. He speculates that two criteria link to moral status, separate or combined, labeled as sentience and sapience. Sentience is "the capacity for phenomenal experience or qualia, such as the capacity to feel pain and suffer" (p. 7): many animals exhibit qualia, which have a lower level of moral status. Sapience, or personhood, thereby humans only have this capacity, is "a set of capacities associated with higher intelligence, such as self-awareness and being a reason-responsive agent" (p. 7). Given these definitions of sentience and sapience, he further contends down this rabbit hole that AI's ability is not similar to a child's teddy bear or a toy car, so, therefore, it must have some moral status as a *living animal.* Just as humans, through their inherent bias, favor some humans over other humans, they display morality in degrees of difference. If one has more money, does that reality mean a morality higher than those not privileged?

AI systems are artificially constructed through deliberate choices of the developer resulting from the data set utilized. Bostrom supports having "no moral difference whether a being is made of silicon or carbon, or whether its brain uses semi-conductors or neurotransmitters" (p. 8), what he terms the principal of substrate non-discrimination. Relatedly, under the Principal of Ontogeny Non-Discrimination, or non-discrimination based on how a being came into life, whether through deliberate design or biological reproduction, displays a reality in which a cloned human should be brought to term with the same moral status as any other baby. Just as parents have duties to their children, not another's child, the Principal of Ontogeny Non-Discrimination can imply that the human creator or company owner "may have special duties to their artificial mind which they do not have to another artificial mind" (p. 9). Bostrom further extends this reasoning to the following:

> If the principles of non-discrimination with regard to substrate and ontogeny are accepted, then many questions about how we ought to treat artificial minds can be answered by applying the same moral principles that we use to determine our duties in more familiar contexts. Insofar as moral duties stem from moral status considerations, we ought to treat an artificial mind in just the same way as we ought to treat a qualitatively identical natural human mind in a similar situation. This simplifies the problem of developing an ethics for the treatment of artificial minds. (Bostrom, 2014; 2011, p. 9)

Just as today we have self-driving cars and autonomous carpet vacuums, the morality in the decision-making of a clone car driver lacks qualia but must be programmed to understand the difference between running over a ball versus running over a person. Will AI be able to distinguish between objective and subjective phenomena?

If AI can replicate itself into rapid reproduction, it will acquire superintelligence (Good, 1965). Bostrom (2014; 2011) envisioned scenarios of such—that reproductive qualities "could redesign itself or create a successor system, more intelligent, which could then redesign itself yet again to become even more intelligent, and so on in a positive feedback cycle." Good called this the "intelligence explosion" (Bostrom, 2014; 2011, p. 14). As we continue to think about existential risks to the human from AI, the primary questions of good and evil in AI bear the understanding that where there is great potential, there is also a risk to human-like expansion.

> The ultimate challenge of machine ethic…How do you build an AI which, when it executes, becomes more ethical than you? Perhaps the question we should be considering, rather, is how an AI programmed by Archimedes, with no more moral expertise than Archimedes, could recognize (at least some of) our own civilization's ethics as moral progress as opposed to mere moral instability. This would require that we begin to comprehend the structure of ethical questions in the way that we have already comprehended the structure of chess… the prospect of AIs with superhuman intelligence and superhuman abilities presents us with the extraordinary challenge of stating an algorithm that outputs super-ethical behavior. (Bostrom, 2014; 2011, pp. 17–18)

Human Diversity

The ethical problems surrounding the field of education are a subset to all sorts of issues for educators: data privacy and algorithms that are written to engage the user in emotional ways. As discussed in Chap. 1, eugenics was supported in recent history as a dominant model which impacted the political, social, and economic fabric of countries across the globe. In the classroom, a student issued a tablet or phone can be manipulated to believe there is a "human relationship" with the hardware interface. Coenen wrote that "Learning to be human today means learning to be part of a complex and global techno-social system. The study of and exchange on the ethics of technology will thus be increasingly crucial for our common future" (Coenen, 2018, para. 7). The COVID-19 pandemic has put all to a trial by fire: students, teachers, administrators, and parents worldwide in a revolutionary struggle within cyber-connected learning and teaching.

Some believe that educators are less biased than those from other fields. However, this belief is not accurate as societal ills remain when ones' biases are unexplored. Starck, Riddle, Sinclair, and Warikoo (2020) further address teacher racial bias compared to non-teacher American adults, citing other researchers that found lower implicit bias in teachers over various measures. The results of their study indicated that "when all of the controls were included, there was a small but statistically significant tendency for teachers to have lower implicit bias and explicit bias than nonteachers" (p. 276). In a second study by Starck et al., they conclude that teacher bias levels are similar to those of the general population.

> Given that racial bias in general is thought to reflect ongoing societal influences and inequities and implicit racial bias has been relatively slow to change at a societal level (Charlesworth & Banaji, 2019; Payne et al., 2017), reducing racial bias in a way that is efficient and resistant to broad social influences is a challenging goal. Continued research to discover prejudice reduction techniques that will work for teachers is much needed and will have important implications for promoting racial equity in schools. (Starck et al., 2020, p. 282)

This research suggests that training pre-service teachers and school administrators is critically important to help future school educators learn about their own inherent bias and understand bias of which they may not have been aware. When examining aspects of personal bias, efficiency is not the goal, as it does not reflect the depth of knowledge teachers and school administrators need to have before entering the classroom. Pre-service training at all levels of educators requires a firm focus on ethics and ethical decision-making that is social justice focused. All educators must think about how they think about student differences. This metacognitive reflection is especially needed given the learner's increased interface with technology such as AI.

Two next two vignettes describe how bias continues to impact classrooms today. The authors encourage educators to push themselves to acknowledge their implicit biases and create structures that fight against these biases. The vignette by Dr. Shane, *Effectively Creating LGBT+ Inclusivity in Online Coursework*, presents the critical importance for a reimagined curriculum that is more inclusive to better serve all students.

Vignette: Effectively Creating LGBT+ Inclusivity in Online Coursework

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For educators who are not used to teaching full coursework online, it can be easy to assume that the online format removes some of the bonding, networking, and familiarity that is common in face-to-face education. However, when done effectively, this cannot be further from the truth. In actuality, transitioning a course from face-to-face to online formatting allows the educator the opportunity to make small but poignant changes in the curricula and in the teaching method that can best support the needs of LGBT+ learners.

Often, educators must use older curricula for coursework. Sometimes, this is because the school mandates the lesson planning, texts, and other materials. Other times, it is because the school has a different person create a course than the person who teaches it. Of course, most educators are overworked and underpaid, making it near impossible to rewrite a course, even if they are permitted to do so. As a result of each/all of these, many instructors are trapped by existing material. They are either stuck teaching something preapproved but that they know is not as inclusive as they would like, or their schedule is so full of other work that there simply is not time for them to create new or updated content. While an unexpected transfer from face-to-face to online learning can be a scramble, longer-term planning for online teaching can be an unexpected gift! This is because, when transitioning a course from face-to-face to online, there is an opportunity for some alterations. When making these changes, it is recommended that consideration occur for LGBT+ learners. This applies not only for those teaching the material but also for education administrators and curriculum evaluators.

Most coursework is not intended to differentiate between students' genders or sexualities. As a result, many think there is no differentiation needed for LGBT+ learners. However, even the format of online learning can be problematic. For example, does your platform allow a student to change their name in synchronous class meetings and wherever they submit discussion board or assignments? If so, it is important to offer step-by-step directions on how to do so. This can be phrased in a way that invites all students to change their name to reflect the name they use. You can use the example of "Elizabeth" being able to change her name to "Liz" or "Beth" as a sample of why some students may wish to utilize this option. You can also request or require that students add their pronouns into their name as it is displayed. This may look like "Liz Smith (she/her)" or "John Jones (they/them)." This shows transgender, gender nonconforming, and gender nonbinary students how to alter their name without singling them out, as this option can benefit anyone who uses a shortened version of their first name, goes by their middle name, etc. It also encourages everyone to give thought to pronouns and to assumptions about others' pronouns. If the platform that your school utilizes does not allow students to do this on their own, find out if/how this can be requested. This may be a question for the technology office, or it may require speaking with the company that holds the school's contract to let them know that you require an inclusive platform for all students in all ways. Without this option, transgender students may be forced to be referred to by a name that does not represent who they are (birth names are often called "dead names") and be called the wrong pronoun by you and by their peers. This can lead to feeling disconnected from your class to their absence from class, to depression, or even to increased risk of suicidality (Shane, 2020).

How you divide your students for group work can also be impacted. If you divide by gender (some choose all-male groups or two men, two women groups), this can lead to confusion or incorrect assumptions that your transgender student may not wish to have to deal with or correct in order to be a part of the group. Be mindful about choosing groups at random (and letting your class know this is how groups are assigned). You may also want to check in with group members individually to open the door to conversations with students who may be bullied within groups for their identity.

As you review your course for what to move to the online platform, also consider whether the authors of references and the examples given are diverse. In many cases, every book or journal article author happens to be a White man. In many lesson plans, every person shown as successful in that subject matter is a White man. This can be harmful to all students, as it prevents non-White non-male students from envisioning themselves as being successful in this field and it can reinforce to everyone that White men are superior and more valuable in society than everyone else. This does not have to mean redoing entire lesson plans or rewriting your entire curriculum. You can actually have the students do this work themselves as a part of an existing required assignment, as a discussion board post, or as extra credit work. Try asking them to research and share about someone who made a significant difference in the class' field of study that is a part of a marginalized group. For smaller classes, this can be done as a collective. For larger classes, this can happen within breakout groups (either in person or via technology that exists within all online platforms). In situations where there is AI-generated coursework, this can be done by creating an assignment where the instructor shares a study on the subject matter that was authored by a person/people in a marginalized group and includes questions about it on tests or quizzes. These can fit the multiple-choice format, if necessary, and can include questions specific to requiring the student to consider the impact of the person's marginalization on them during the time they completed the work you highlighted. You could also seek out some of these individuals and include their names along with the list of names you already provide to students. For example, if your subject matter includes Martin Luther King, Jr., you can include the contributions of Bayard Rustin from the same time period or Marsha P. Johnson as another civil rights leader from a different era.

Actions for the Field

Educators are people and as a result, there are inherent biases. Since those in education often complete coursework requiring them to be reflective, many of the remaining biases are inherent. This means that the educator has begun the process of reconsidering whether their personal beliefs are beneficial or detrimental to learners, but they may be unaware of some of the ways in which their own experiences and perspectives may impact what they teach or how they teach. It is incumbent and vital that every educator remain vigilant in their quest to minimize any perspective or belief that can harm the way students learn. This includes LGBT+ students who deserve to feel safe in the learning process. It also includes non-LGBT+ students who will become richer in their understanding of humanity and the benefits of all people when they are taught in ways that include and affirm LGBT+ people. Unconscious bias trainings; intentionally choosing reference materials created by a variety of people; reading books such as *The Educator's Guide to LGBT+ Inclusion*; asking team leaders, school leaders, and district leaders to bring diversity trainers in for staff education; and choosing continuing education courses that focus on inclusion are all great ways for an educator to maintain an ongoing program to limit their unintentional biases.

The goal of inclusion is not to create more work for educators. It is not to minimize the existing work you have already created. It is simply to be mindful of the ways that online learning platforms may not immediately be inclusive and the opportunity that educators have to make small but meaningful changes to curricula when transitioning materials from face-to-face to online platforms.

How will AI Software 2.0 approach gender pronouns? Visual conformity of gender norms renders a dichotomous male-female reality which is false and serves as a transgression to understanding the he/him/his and the she/her/hers dialogic. Awareness leads to LGBTQ inclusivity, both in schools, universities, and the workplace (Human Rights Campaign Foundation, n.d.). The vignette by Dr. Pooja Saxena, *Sociocultural and Material Aspects of Knowing and Doing Computing*, calls on science to become more inclusive, especially for women and girls—improving among STEM fields worldwide the cultural realities that inclusivity of diversity should be embraced now for a more equitable future.

Vignette: Sociocultural and Material Aspects of Knowing and Doing Computing

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The discourse on feminism and science portrays both the enriching and constraining nature of a variety of political, empirical, and conceptual perspectives that have impacted the beliefs, practices, and institutions of science (Harding, 1991). In the United States, both historical and contemporary data on women in science portray that women were not excluded from STEM fields because they lacked the ability to study sciences. Rather, they suffered exclusion and marginalization from the field because of the perception that STEM fields are masculine in nature and that it is hard for women to survive in these fields because of their feminine attributes (Margolis & Fisher, 2002; Rossiter, 1995). Research shows that such beliefs may have caused women to develop a fixed ability mindset, low self-concept, and a lack of sense of belonging in the field (Gayles & Ampaw, 2011, 2014; Murphy, Steele, & Gross, 2007; Sartorius, 2010).

In contrast to studies conducted in the United States, my ethnographic study of women in computer science (CS) programs in two elite technical institutions in India demonstrates that the women developed a growth mindset in middle school, which they attributed to their socializers' beliefs, including those of their parents, siblings, teachers, and private tutors. Their socializers helped them gain a growth mindset, which describes failure as an indicator of further efforts that would allow individuals to grow. In most cases (83%, 25 out of 30), women attributed their success to both ability and effort. Around 10% (3 out of 30) of the women mentioned that they were not good at math until middle school, and they did not work well with their schoolteacher. They either hired a good math tutor or their fathers encouraged them to study math. One of them changed their school, which changed their attitude toward math. Several women talked about the importance of hard work in life and the critical measures they took to achieve success. They talked about gaining a high self-concept and sense of belonging to the CS field and indicated the importance of social context in studying CS.

Theoretical frameworks on feminism and science have largely evolved in Western countries since the late 1960s and 1970s, and they represent the worldviews of heterosexual, White women in science. These conversations are fairly new and isolated from the international community. Harding (1991) argues that feminism and science conversations are mostly rooted in European descent, and, therefore, monolithic conceptions of nature, science, technology, and social relations may not include a variety of other concepts in the discussion. In the Indian context, Mukhopadhyay (2004) found through her empirical research that American individualistic models focused on "internal female deficits particularly in mathematics" (p. 459) are not shared by Indian women and that these individualistic models promote an essentialist Western view of science. Consistent with Mukhopadhyay's (2004) study, my study in India revealed that women do not experience the masculinity of STEM fields and makes the case for incorporating diverse social, cultural, and economic questions into the global discourse on women in science.

Haraway (1990) calls for "Earth-wide networks" of connection, which enable different ways of knowing and learning. This includes diverse ways of approaching work in the field. For example, Turkle and Papert (1990) argue that "the diversity of approaches to programming suggests that equal access to even the most basic elements of computation requires accepting the validity of multiple ways of knowing and thinking, an epistemological pluralism" (p. 129). For instance, when observing programmers, Turkle and Papert found that, in addition to abstract and formal approaches to programming, several programmers exhibited relationships with their material, which is indicative of attributes of a painter rather than a logician. This is consistent with my study, in which participant Kiran attributed her coding skills to playing chess:

> I played chess as a child, where I had to think ahead not only about my moves but also about what my opponent might do. That required a lot of thinking, and I believe that's what helped me when I started coding. It was logic, algorithm, and the result.

Seen here, Kiran connected her programming problems to how she played chess as a child, using the concrete moves in chess to understand the basic abstract concepts of programming. This is just one demonstration of a diverse approach to STEM work.

Actions for the Field

Historically, STEM learning environments have not taken into account the range of ways of knowing of a diverse sample of STEM aspirants and professionals and have even denied them legitimacy, reproducing the deficit model of nondominant students and communities (Barajas-López & Bang, 2018). To develop the technologies of the future, we must research outside-of-school contexts, work to increase inclusion of intergenerational women, and find ways of bringing non-Western ways of learning and knowing to the fore. For example, studies have shown that women's fiber crafts have immense potential to increase women's participation in STEM learning. Importantly, the epistemological use of the understanding of weaving in computing has a foundation in the contribution of the Jacquard loom to the first computer algorithm (Essinger, 2004). Similarly, Kafai, Searle, Martinez, and Brayboy (2014) show that a culturally responsive open design approach to ethnocomputing that incorporates e-textiles has the potential to provide a context that is both productive and challenging for American Indian youth, which, in turn, can broaden the range of choices of introductory computational activities available for everyone. Seymour Papert examined the practices of Brazilian samba schools that help support community-based activities, such as dancing and drumming clubs. These are used as means to prepare for participation in Rio de Janeiro's annual carnival parade. Using the idea of these communities of practice, Papert envisioned a mathland, which he imagined would have a flexible structure for mixed-age groups, to encourage math learning. From the samba schools, he explored the possibility of creating a computational samba school, "a place where people come to learn through and about technology in a self-motivated, community-supported fashion" (as cited in Zagal & Bruckman, 2005, p. 89). Sources like these, both Western and non-Western, have immense potential for providing insight into the humanistic spirit, technology, and design thinking in intersections across race, caste, class, sexual orientation, ability, and nationality in a cybernetic future. Excluding the skills and cultures of groups across the globe from computing and artificial intelligence classrooms runs the risk of exacerbating the preexisting deep chasms of injustice and inequality and reproducing the hegemony of Western ways of learning and knowing.

Educational Leadership Strategies for Algorithmic Transparency and Honesty

How can educational leaders use AI to prevent social injustices while also preventing social injustices in AI? As educators, we seek a broad range of critical thinking skills for students. As a basic level, school software programs should not provide disinformation or any type of manipulation that could impact student's emotional health. They should not be subject to the profit-driven greed of companies, made visible by the US attempted democratic coup on January 6, 2021. As educators, we have to ensure that the products we use, from our newsfeeds to the materials we use in classrooms, are screened *during development* for race, gender, sexual orientation, and special needs biases.

Subconscious and inherent biases present in teachers and administrators can only be diminished through professional training and skill development. In-person teaching can accomplish this within preparation programs and ongoing professional development. The teaching within the algorithm world dissects the teacher's role into one-on-one aggregate data scores and not much more. Theories such as contingency theories focus on the learner's "need for independence and agency within a scaffolded learning experience," somewhat based on the Vygotskian notion. How then are learners that are not within this learner definition treated? Du Boulay and Luckin (2016) describe this process and the role of the teacher in it. They describe:

> …good teaching derives from the conversational and social interactive skills used in everyday settings such as listening, eliciting, intriguing, motivating, cajoling, explaining, arguing, persuading, enthralling, leading, pleading and so on. Implicitly the message was that neither learners nor teachers are disembodied cognitive entities engaged in symbolic knowledge sharing but rather are feeling and thinking beings living and working in a particular educational, social and cultural context. A secondary contribution was to show how far there was still to go before we could reasonably designate any AIED (AI in Education) system as modeling expert teaching capability…Clearly there is a bit of a chicken and egg situation here in terms of the relative difficulty of understanding learning vs understanding teaching. (du Boulay & Luckin, 2016, p. 396; p. 401)

Human survival may well depend on how superintelligence is created. As it applies to teaching and learning in the PK–12 educational setting, a preexisting issue was student access to technology outside the schoolhouse, including access to the internet and devices. The recent epidemic forced school leaders to deeply examine this issue, also known as the technology gap, homework gap, digital divide, or access gap. This has led to a national effort and push for the Federal Communications Commission to approve funding to offer free internet access for students in PK–12 (Reardon, 2021).

Mirroring Human Fragilities The myriad of questions surrounding how AI can and does hurt humans is seminal to this book. The ethical compass asks of us: do no harm as educators, and reflexive thought requires how AI benefits all/most of a global society. The "do no harm" has been identified (Koonce & Kreassig, 2020) as the ethic of grace. People build algorithms that have various reasons: some for the good of all and others for efficiency and profits. The neoliberal agenda of scalability through efficiency and standards relegates educators again off to the side, in a place of absorbing without understanding the goals behind the developed software. Developers may see this as "not an issue for them" as they are there to create models based on the data. In education, we have been trained to think about the curriculum as cognitive skills to be taught and mastered. The hidden curriculum equally critical speaks to the climate and culture of the school and all its inhabitants. We know that human nature is more or less motivated in different settings, classrooms, and our ability as educators is to ensure a safe and equitable expression for all to succeed.

Even when made under the First Amendment, social media should be regulated when comments contain explicit bias and serve to maximize profits. Doing so would prevent the amplification of nativist tendencies and hostilities in advertising with conscious intent to bifurcate human beings. Implicit bias exists in all human beings, and without a cognitive understanding, as we exploit large data sets, it requires responsible usage that is ethically focused on human agency "-isms." AI, at this time, is unable to handle human emotions. Emotions such as compassion and caring embedded in the software and exhibited by a "cobot" are not that same as what a human teacher offers their students. As earlier noted, the teachers' role in a future classroom dominated by agents would be to supervise the directions given by the agents to the students and continue to collect lots of data. In this scenario, the pandemic in conjunction with the AI revolution has exasperated in the definition of what the role of the teacher is.

Taking a learner from tentative to action requires an affective metacognitive "persuading" built into the algorithm. Is this ethical? Is it ethical to manipulate students into actions? Doing so can quickly turn into a class tracking system based on the students' culture and the school context. Walker and Ogan explore the dark side of this possibility in another proposed scenario:

> Franz's mobile phone vibrated on the bus home. He pulled it out to see who was calling. It was his personal learning companion, Mark. "Hi, Mark!" he said. Immediately, he could hear Mark start to cry uncontrollably. "What's wrong?" "They said they are going to fire me," Mark said between sobs. "They said it's my last chance. If you keep skipping your homework, they're going to delete me, and instantiate a more effective companion." Franz immediately felt his heart sink. "No" He reassured Mark. "I won't let that happen! I promise." (Walker & Ogan, 2016, p. 725)

Walker and Ogan go on to question if it is acceptable for technology to lie to students and if this is purposefully manipulative? Educators are taught that such manipulation of student emotions and subsequent behavior is ethically unacceptable. Yet, it might be deemed efficient. How do we conceive of the development of an AI agent in which the company may be harvesting incidental learner data, possibly used for commercial purposes and not about learning? In the managing of targeted learner data, who owns it?

In 2017, van Otterlo described how to take a black AI box to a white AI box through decision-theoretic ethical programs (2017). A promising approach is to develop a professional code of ethics that can lead to what he labels declarative decision-theoretic ethical programs (DDTEP) to formalize codes of ethics. This approach will lead to more transparency and, therefore, more accountability on the AI agent. Taking (practical) action based on moral values is the domain of ethics (Kizza, 2013; Laudon, 1995). Kizza stated:

> Morality is a set of rules for right conduct, a system used to modify and regulate our behavior. Close ties with law exist since when a society finds certain moral values important, it can formalize such values in a law and regulate appropriate behaviors. As Laudon (1995) defines it: "ethics is about the decision making and actions of free human beings. When faced with alternative courses of action or alternative goals to pursue, ethics helps us to make the correct decision." (Kizza, 2013, p. 2)

For self-driving cars, the archetypical example of machine ethics is exemplified in Thomson's "trolley problem which contains a choice between either killing five people strapped to a rail or saving these five and killing one by pulling a lever diverting the trolley to a track with a single person who is then killed" (Goodall, 2014, p. 2). The clear-cut life and death decisions are utilitarian, which can be very harmful to the individual. Recent empirical tests of such dilemmas suggest that humans employ one-dimensional life scales, where all outcomes (deaths) can be compared

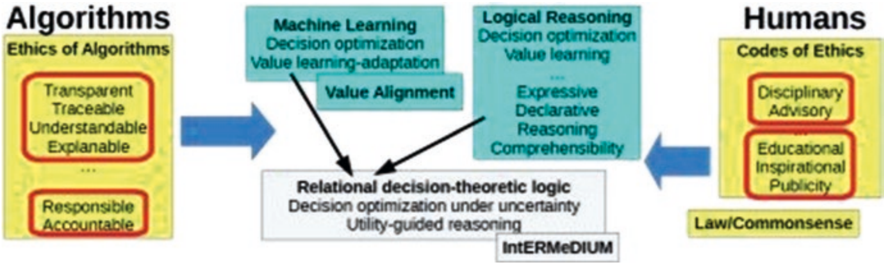

Fig. 3.1 Reconciling human and machine ethics through decision-theoretic logic. Figure 3.7 van Otterlo (2017, Nov. 16). *From algorithmic black boxes to adaptive white boxes: Declarative decision-theoretic ethical programs as codes of ethics*. https://arxiv.org/abs/1711.06035

in the same scale, although time pressure affects consistency (Sütfeld, König, & Pipa, 2019).

In education, we cognitively understand that no current AI algorithm can be socially just. If an agent uses a deficit model to label a student, it would be unfair to protect that label even if a teacher was told to rely on the agent that produced it. Through the 2020 presidential US election, one can readily see the AI social media algorithms' influences that target and profile the population, what Kantayya calls the wild West, at substantial costs to our democracy at large. This skepticism could be extended to the hidden curriculum of tracking students in efficient yet biased near antihuman ways. The goal of being fully efficient human beings is not human: humans are vulnerable, empathic, compassionate. So, we contend that the power of AI, as stated in *Coded Bias*, must be employed in ethical ways (Kantayya, 2020).

In the United States, there are no federal regulations on algorithms, and questions, such as who owns the code, become critical to our humanity. Platforms such as Google and Facebook are similar to archives and libraries in what data items to archive and who has access to the data (van Otterlo, 2017). Archival decisions concern access to whom regarding which information. This leads to ethical dilemmas (privacy, freedom of information access, and intellectual property) for stakeholders: the users and the archivist. van Otterlo (2017) cited Danielson (1989) for introducing the dilemma of equal intellectual access: how accessible is the information for individuals? Again, in a resolution of ethical gatekeeping domains, a set of rules based on the professional practice values through a code of ethics is critical for AI and its educational implications. See Fig. 3.1.

In the vignette by Drs. Fowler and Jouganatos, *The Role of Educational Leaders in the Twenty-Second Century and Beyond: Possibilities of a World Imagined and Implications for PK–12 Education*, leadership for the twenty-second century requires purposeful approaches to create a more equitable future. Humanistic actions across leadership styles are essential in the new normal.

Vignette: The Role of Educational Leaders in the Twenty-Second Century and Beyond: Possibilities of a World Imagined and Implications for PK–12 Education

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Introduction

In this vignette, the authors describe educational leadership in the twenty-first century and posit the characteristics of educational leadership in the twenty-second century and beyond. In doing so, the authors aim to share all the conceivable possibilities of educational leadership well into the future, while providing numerous considerations and action items for the field of educational leadership to consider, namely, as it applies to educational leadership in PK–12 educational setting.

Perhaps at no other time in history has there been a better time to analyze the educational leadership landscape in the twenty-first century while also imagining all the possibilities of educational leadership in the twenty-second century and beyond. With the recent global COVID-19 pandemic, the educational system (both in higher education setting and PK–12 educational setting) as we know it went from traditional face-to-face formats to completely remote and 100% online. Hodges et al. (2020) have described this sudden and abrupt transition as emergency remote teaching (ERT). Perhaps Hodges et al. (2020) described the characteristics of ERT:

Emergency remote teaching is a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances. It involves the use of fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated. (Hodges et al., 2020, para. 13)

This sudden and abrupt change has allowed educators the opportunity to both utilize and analyze many new technologies (many that were not familiar with or regularly using before) in the twenty-first century in an effort to seamlessly continue leading for learning in the PK–12 educational setting during the COVID-19 pandemic. Likewise, it has allowed educators to better process and imagine what the future of educational leadership in the twenty-second century and beyond might look like (and what their role will be in that world). Continuing with this trend, the authors aim to share all the conceivable possibilities of educational leadership well into the future, while providing numerous considerations and action items for the field of educational leadership to consider, namely, as it applies to educational leadership in PK–12 educational setting.

Educational Leadership in the Twenty-First Century, Twenty-Second Century, and Beyond

Fowler (2018) shared a quote by Wes Kieschnick describing the two types of schools in the twenty-first century:

> There are two types of schools: those that prepare kids for the future, and those who allow adults to live comfortably in the past. (Fowler, 2018, p. 7)

With the recent COVID-19 pandemic, the authors contend that many of the schools who were allowing "adults (including educational leaders) to live comfortably in the past" were forced to become a school that "prepares kids for the future." Although practitioners, scholars, and researchers alike might argue that this will benefit the schooling system as a whole, Hodges and Fowler (2020) argue that it will only be beneficial if authentic reflection takes place. That is, in order for this ERT to be beneficial, through an instructional design model lens, the reflection must apprise revisions and advance the leadership, instruction, and learning (Branch & Dousay, 2015). Without such reflection, the authors contend that the school may fall back into the type of school "that allows adults to live comfortably in the past."

There is no doubt the PK–12 educational landscape has changed and continues to change rapidly in the twenty-first century. In fact, it was reported that $8.15 billion was invested in educational technology companies in the first 10 months of 2017 alone (Emmanuel, 2018). With such change, educational leadership and the leadership of technology has become a staple in what we now deem an effective educational leader in the twenty-first century. Perhaps Grady (2011) describes this best:

To be a principal in the 21st century demands leadership of technology. To be a leader of technology requires a willingness to learn, embrace flexibility, and the capacity to accept change as a constant factor. Adaptability and acceptance of ambiguity are essential. Because technology changes continuously, there is no menu of technology must do's and must haves. Instead, leaders of technology must be life-long learners and explorers of the new, the exciting, and the useful in technology. (p. 3–4)

Thus, there is little to no doubt what effective educational leadership has become in the twenty-first century: an asserted effort on the part of educational leaders to proactively identify the best technology to be utilized with both school leadership and teaching and learning. To do otherwise is malpractice.

Again, with so much technology available and being created daily, we can only merely imagine what a school leaders' role will be in the twenty-second century and beyond. Nevertheless, the authors envision a world where technology we cannot even fathom exists and artificial intelligence (AI) is prominent. In addition, the authors envision a world where school leaders and educators lead and teach from afar, and in doing so, at the heart of both it all, the leadership and instruction is focused on a more equitable and inclusive education for all while remaining student focused.

All the Possibilities

The educational system has gradually progressed from serving students using the transitional pathway of education to including more progressive educational opportunities to students such as online learning. During this change of structural opportunities, leadership has also begun to grow and evolve. Leaders must continue leading schools using a lens of equitable education and inclusion (Fowler & Jouganatos, 2019); however, the way in which this leadership is delivered must mirror the progressive structures of the schooling systems and the technology that is currently or will be available.

Technology as a Training Tool

One responsibility of a school leader is to provide opportunities for professional growth and development to teachers, para-educators, and their leadership team (inclusive of themselves). The benefits of quality professional development (PD) can infuse themselves into the classroom through pedagogy, cultural competence, classroom management, inclusive practice, equity, and student growth. Because of the connection PD can have on student learning, it is something that must be sustained as we move toward progressive classrooms (Maher & Prescott, 2017). That said, the delivery method of PD must be innovative and contemporary by using technology, online collaboration, and remote trainings.

Bringing in outside experts to lead PD has always been one method for training educators; however, it is often expensive and must be completed over numerous days. With the expansion of technology, remote PD, and digital badging, educators can seek recorded trainings or invite the experts to present via videoconferencing tools. This online structure provides opportunities for educators to engage with experts from around the world (Maher & Prescott, 2017). In addition, it allows school leaders to differentiate PD. For example, a new teacher may need PD on classroom management, whereas a veteran teacher may need PD on utilizing educational technology with instruction. Through digital badging platforms such as Credly[1] or the like, school leaders can differentiate PD to meet their staff's skill set. Similarly, educators can teach each other using snippets that have been recorded from their own

[1] Credly is used for creating, issuing, and managing digital credentials. Learn more at https://info.credly.com/

teaching by sharing videos of lessons and pedagogical practices. They can support one another without taking away the precious classroom time by discussing the videos online, in secure chat rooms. It is true many schools have been conducting something similar to this style of PD for some time; however, for many schools across the nation and around the globe, leadership has shied away from major shifts in PD practices because pioneering such work is difficult and can result in pushback from educators. Finally, the authors posit that school leaders that fear the aforementioned modals of PD should opt to try it out for themselves. That is, complete a PD cycle that is offered online from an organization that has aligned and mobilized to support educational leaders. Then, reflect on this experience, share this experience with your staff, and offer them a chance to try it too. With technology, there is perhaps no better way to learn then to learn by doing, and as we know with andragogy, adult learners learn best when it is something they need to know and are shown how to do it (Papa, 2010).

Beyond Traditional Leadership

By engaging with technology and progressive changes in education, the leadership team (i.e., principals, assistant principals, coordinators) embrace the structural changes that education is experiencing by empowering themselves with knowledge and innovation. Looking through a lens of opportunity with technology, remote learning, communities of practice (even global virtual ones e.g., Twitter chats), and curricular opportunities, leaders can embrace the structural shifts in a way that benefits both teachers and students. Quality of instruction and use of technology are vital to student and school success in the twenty-first century; therefore the authors contend that leaders must create a culture that accepts and embraces technology. Leaders can bring together educators to collaborate and build comradery so that the culture of quality and excellence is not lost due to the integration of technology. Kolbjørnsrud et al. (2016) recommend the following:

Develop training and recruitment strategies for creativity, collaboration, empathy, and judgment skills. Leaders should develop a diverse workforce and team of managers that balance experience with creative and social intelligence — each side complementing the other to support sound collective judgment. (p. 6)

It is the responsibility of the leader to communicate with educators and build an equity-focused culture and climate (Fowler & Jouganatos, 2019). For online schools this can be completed remotely through video collaborations and learning communities. Additionally, leadership might even think outside the field of education when bringing experts with technical skills for insight and partnership (Ransbotham et al., 2017). By combining teams with people from differing expert areas, the growth toward innovation can be more fruitful and better support an interdisciplinary global network focused on PK–12 education in the twenty-second century and beyond.

Data

Alongside the technological enhancement of education come more data, more privacy concerns, and more technological needs. From an asset-based lens, leaders and teachers can see data more rapidly and run more sophisticated analyses resulting in better interventions and enhancement opportunities for all students. Data can be used to identify gaps in equity and to help leadership teams address the needs of the students and schools timelier and efficiently. Such data can aid in numerous processes in the PK–12 educational setting including student course placement, teacher/leader PD, and assessment creation and curricular design, to name a few. Nevertheless, as previously mentioned, with more data come more privacy issues and potential equity gaps. Privacy concerns are something we are very familiar with, as we hear about the effects of data breaches far too often. For example, in an article by Moore (2019), it was reported that 267 million Facebook users could have had their contact details compromised. As we know, in the educational setting, districts cannot afford to take the security measures that billion-dollar companies such as Facebook can afford. Thus, again, privacy issues will continue to be a concern. Nonetheless, when we think of our youngest minds in terms of data breaches, we must be diligent with both their personal identification information and their educational data. After all, we are not yet sure how educational data can affect students as they progress through school and college and even into the workplace. Therefore, it is vital that every effort must be made in securing such information.

Additionally, the utilization of the data should be taken into consideration as leaders monitor groups, subgroups, and even individual students within their school districts and school buildings. Tracking students can be detrimental to their growth and individual access; therefore being mindful and purposeful with data while also ensuring equitable use is imperative—so as not to create inequities in placement and access, as to avoid algorithmic bias. This can be implemented by combining both personal experience and the data to ensure that students' needs and abilities are discussed completely in an effort to educate the whole child. With that said, there is little to no doubt with these opportunities and nuances comes the need for individuals that truly understand data, technology, and education. Therefore, supporting the need to develop as Ransbotham et al. (2017) call it "cross-functional teams" complete with data specialists, equity-focused leaders, and educational stakeholders will better equip schools for the new approaches to education in the twenty-second century and beyond.

Actions for the Field to Consider

The use of technology as a tool and mechanism for teaching, communication, growth, and relationships is already embodied within the educational system. However, the rapid growth of such tools solidifies the need for school leaders to partner with and/or learn from experts in the field of technology and even artificial intelligence (AI). Although AI is present in our PK–12 educational systems, it is not something many school leaders take into consideration when developing strategic plans for their schools. As previously reported, the recent COVID-19 epidemic forced many school leaders to reconsider how technology is used for leading a school as well as what strategies must be considered for remote teaching and learning. But consider for a moment the technology-based instructional programs that have the ability to identify each student's best educational pathway toward standard proficiency. Such programs utilize AI, by designating the next best question or topic for each student through a previously selected answer. There is no doubt such AI capabilities can be integrated into areas of educational leadership as well. Regardless, the authors contend leading an equity-focused school must still include human judgment to ensure equity and inclusion for all students regardless of their demographics (Kolbjørnsrud, Amico, & Thomas, 2016).

The policy implications during the shift in educational settings and structures are an important consideration for all educational leaders, be it practicing school leaders, aspiring school leaders, or the individuals charged with preparing such school leaders in the higher education setting. When technology is incorporated more innovatively and uniquely, policy may need to be created to protect instructional practice, teachers, students, and aforementioned data. It is up to the educational stakeholders (including students, staff, parents, business owners, and community members) to consider future policy, procedures, and practice as new technologies are integrated and educational settings vary based on structure. Taking a purposeful look at unions, student learning, data, and equity, is imperative to quality implementation and future sustainability of education. In addition, as mentioned prior, the more technology we bring into the school, the more we have to be careful with privacy, therefore taking a look at policy, procedures, and practice that ensures student data is secure. As Ransbotham et al. (2017) stated, "Ensuring data privacy depends on having strong data governance practices" (p. 10). Policies should illustrate to parents, guardians, and students that the necessary measures have been taken to keep personal information safe while also supporting stakeholders (parents and teachers alike) with information and trainings about keeping their children safe online.

Conclusion

There are various ways: The authors suggest we consider technological integration (including AI) in the PK–12 educational setting; along the same vein, the authors recommend that leaders must always utilize an equity-focused lens when making change and assessing the benefits of such technological integrations. Although the authors contend that all school leaders in the twenty-first century, twenty-second century, and beyond actively look for the most innovative and engaging educational technology to support students, staff, parents, business owners, and community members, the authors do so while maintaining it is most important to ensure schools are inclusive, equitable, and student focused, especially when access to technology/internet and the route to educational attainment can vary greatly both in the United States and around the globe.

Finally, the authors contend that we must also consider and continue to ask ourselves how leadership styles and theories as well as learning can be maintained while utilizing technology in the twenty-first century, twenty-second century, and beyond. For example, we might ask ourselves … how might transformational leadership, servant leadership, authentic leadership, path-goal theory, and other leadership styles and theories (Northouse, 2019) merge and still be prevalent when a professor teaches an educational leadership course 100% online via a learning management system? … or when a school leader uses social media and other forms of technology in the PK–12 educational setting with their school leadership? In essence, we must ask ourselves how we might maintain and ensure the human relations aspect of leadership continues in the digital age, where oftentimes, more than not, human connection is fragmented due to the ability to connect in the virtual world instead of face-to-face.

We began this chapter with many questions unanswered. Questions remain about the student's relation to technology, the teacher's role, and, especially, the use of student data. The vignette writers' concern with data ethics is certainly not misplaced and echoes in computer science research (Sütfeld, König, & Pipa, 2019; van Otterlo, 2013). These researchers are also concerned with aligning human values with AI models and the potential for harm from these models if design does not center human values. D'Aquin et al. (2018) noted that this fear is also present in the technical literature as clear data ethics for AI remains lacking.

AI is dependent on the gathering of new data to inform new models, and this dependence on data will drive how AI becomes implemented in educational systems (Pinkwart, 2016). The data collected on students and how this data is used in models is often hidden from the end users, including educational leaders. AI-enhanced learning systems, systems that Morrison and Miller note are "inherently amoral" (Morrison & Miller, 2018, p. 441), can hide content choices from stakeholders and take decisions about what students are taught out of the control of teachers. There remains a need for companies to enact transparency in what data is collected, acknowledge how the data is, or is not, being used for learning purposes, and what potential biases are uncovered in the data during development processes.

If teachers are viewed as only managers of student data without acknowledging the multiple strategies they use to inspire and encourage students, then employing these systems in place of teachers could be disastrous to student learning while raising serious ethical questions about who gets access to teacher time.

In AI development, social justice issues can become conflated with ethical issues, a lack of distinction that is potentially harmful. Doing so runs the risk of continuing inherent bias as it places research in a dichotomist plane. For AIED, the ethical question is how morally right behavior in nonbinary learning can evolve using binary machines. Educational responsibility requires social science to pursue this with vigorous immediate research. The neoliberal juggernaut that has yielded data-driven approaches to learning, the students, and pedagogy has placed us on the wrong path, especially for continuing unintended biases. Educators are not concerned with efficiency for scalability. Their focus is on meeting individual student needs. This is often done in ways that are neither efficient nor scalable. So, the next set of questions we explore is how these new systems can address student inequities in our visions of classrooms in 2051 and the shifting burdens of responsibility for making these visions a reality.

Chapter 4
Classrooms in 2051

Rosemary Papa and Karen Moran Jackson

Attempts at predicting technology's future do not have a good track record (Pinkwart, 2016). The chairman of IBM in 1943 predicted that only five computers would be needed worldwide, while the president of the Digital Equipment Corporation in 1977 denied the need for home computers. Despite their extensive knowledge, these individuals still made predictions that seem illogical today. This might be due to the human proclivity to imagine the future linearly, picturing change to happen in a measured, incremental fashion, continuing the pace of current change. However, as biologists have surmised about evolution (Gould, 2007; 2002), change in a system often occurs in punctuated cycles, where the status quo is interrupted by a time of significant change. In 1943, while WWII was still raging, it would have been hard to predict the quickly escalating arms and space races between the United States and the Soviet Union that would drive the need for more advanced computing power. In 1977 it would have been hard to predict the growth of internet-enabled activities, such as shopping and social media conversations, that would drive computers not just into our homes but into our hands.

For education, the COVID-19 epidemic in 2020–2021 might be the same type of unpredictable event, disrupting the steady state of change. Many of the vignette authors included in this book recount the revolutionary changes to educational systems that happened over the year. Districts moved from measuring growth by the number of schools that provided laptops in classrooms to measuring success as providing each student with a laptop, internet connection, and online learning opportunities in their homes. School systems were being asked to drastically grow

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the technical assistance they provided students in a short amount of time. Using the changes, we have seen within our schools due to this current crisis, in this section, we risk predicting what classes and schools might look like in 2051.

Adapting Technology to Social Needs

An enduring problem in our social fabric is societal bias. Our schools weaved out of this social fabric are not immune to this defect. One possible way to counter societal bias is through technology-supportive adaptive learning. Technology-supportive adaptive learning is a type of personalized learning where technology is used within a student's learning experiences to modify the learning situations to be responsive to student needs (Xie et al., 2019). For students with special needs, the use of adaptive technology, powered by AI agents in the future, offers opportunities to tailor assistance for each student while also maintaining student integration.

This technology's potential impact starts with the use of machine learning algorithms in the diagnosis of special needs, moving on to agents that interact within classrooms and assist with assessment practices (Drigas & Ioannidou, 2012). Assistive technologies such as screen readers are available in schools and known to most educators, but AI agents offer the chance to provide personalization of tools. Bah and Artaria (2020) list several ways that AI could assist in special needs education, including mentoring, alerting teachers to student discomfort, and removing barriers to participation. Examples of such dynamic personalization include the display-friendly fonts for students with dyslexia and goggles programmed to help with reading facial expressions for students with autism (Rice, 2019). Researchers also note that AI agents and other assisted technologies may offer advantages over human assistance as computers will not tire nor express negative reactions to student needs (Bah & Artaria, 2020; Drigas & Ioannidou, 2012).

One of the most explored areas of adaptive technology is in the area of natural language processing (NLP). Technologies for deaf students and students with limited hearing have grown tremendously with the growth in NLP AI agents that can accurately process and reproduce speech in various formats and translations (Parton, 2006). Almost 20 years ago, this technology was pioneered with a glove that could sense hand movements by individuals using sign language and translate the signs into text. Currently sign language translation has moved to handheld devices with cameras that sense facial expressions and whole-body movements in addition to hand movements, essential aspects of sign language grammar (Okrent, 2012). In addition, for students that speak languages other than the majority language in schools or students with cognitive disabilities, NLP agents also offer the ability to translate teacher speech and class assignments into a more understandable language (Yaneva et al., 2016). A research group at UC Irvine found that young students who were read a story by an AI agent that incorporated dialogue and questions with the child performed as well on comprehension tests as students who interacted with another person (Warschauer & Xu, 2020). Of note was that the positive results held for students who were learning English as a second language as well as students who were native English speakers. The AI agents in the future will be able to dynamically adapt text and speech by changing vocabulary or sentence structure in response to students' different needs.

Wearable devices that incorporate machine learning or AI agents, such as watches or virtual reality goggles, are another trend promoted as providing adaptive opportunities. In one of the few studies that have examined teacher views of these new technological tools, Bower and Sturman (2015) found that educators view wearable technology as having positive potential by allowing for more student-teacher communication and engagement, as well as providing simulated learning opportunities and direct feedback to the student in situ that otherwise would not be available to students until later.

An example of such a system using smartwatches implemented by Liang et al. (2019) is shown in Fig. 4.1. Tested in a Taiwanese middle school, the students wore smartwatches that tracked movements made in responses to teacher questions. Students could also ask for help from the teacher through the smartwatch. The teacher could track student responses to questions and monitor student attendance and requests for help through the smartphone app. In addition to instant feedback information for the teacher, all data was uploaded to a cloud system that used the data to predict student scores on a final assessment.

Another example of wearable technology involving AI is the smart hat designed by Chang et al. (2020). Taking advantage of AI object recognition software, the child wears a hat with an internet-enabled camera that will verbally identify objects in the camera's field of view. Allowing children to move outside the classroom, the

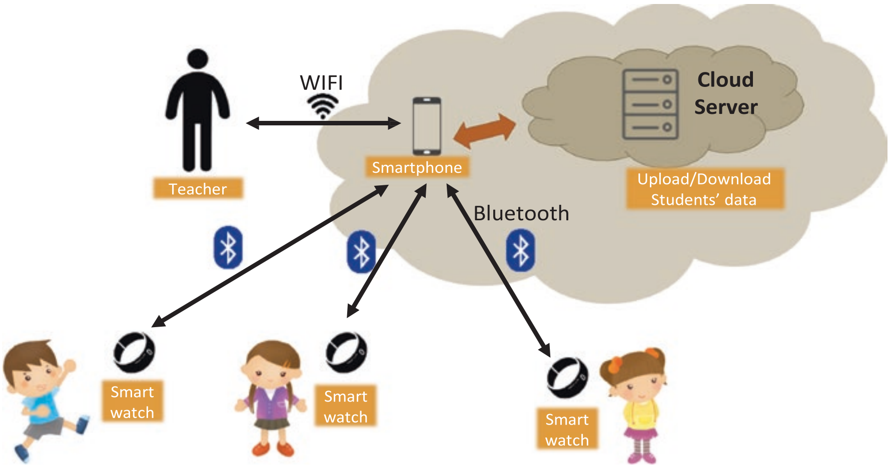

Fig. 4.1 Liang et al. (2019) showing the system connecting wearable devices (smartwatches) to a teacher smartphone using Bluetooth. The data is also uploaded to a cloud server that performs analytics on the data, making recommendations and predictions accessible to the teacher on the smartphone

researchers targeted real-world learning applications for young students, but there are other implications of such a technology for those learning a second language or those with learning difficulties.

During product development for these adaptive technologies, designers make decisions that weigh various trade-offs for technical concerns and content-related concerns. These trade-offs are examples of cognitive decisions previously made by educators, shifting to decisions made by the designs and implemented by the machine. For example, imagine a class of students working independently on a math software program that provides real-time feedback to teachers using specialized goggles. One student has gotten several questions correct but encounters a difficult problem and quickly pushes the "teacher help" button. Another student has missed several questions in a row but still does not request help. Designers need to consider how the teacher is notified of student needs. Should the first student's name pop up in bold on the teacher's screen since they asked for help? Or should the second student's name flash up since their pattern of answers indicates they may not understand the content? Or are both presented as equally, leaving the action decision of whom to help first to the teacher? Would the recommendation differ based on other factors, such as teacher experience or time of the year?

These are design decisions that would benefit from educator input. Yet, we must also acknowledge different teachers would prioritize different decisions—some would want to help the struggling student first; others would want to help the student who requested help. Neither is wrong, but rather the decision reflects teaching philosophies and the context of the classroom. Developers must also acknowledge that these design decisions influence the relationship between the teacher and the students. How easy it is to imagine that the first student, seeing the teacher walk past them to help another student, say to themself, "Oh, the teacher does not like me. I pushed the Help button, but she went to help another student." Alternatively, perhaps the second student, upon receiving helpful assistance from the teacher, now believes, "They must be a really good teacher because they knew I was struggling. I didn't even need to ask for help." Teacher-student relationships are a constant dynamic that these tools will influence through the design decisions made before the tools are even in the classrooms.

The following vignette envisions a future of the American school system that has embraced many of these proposed innovations, including wearable AI for both students and teachers. Building on the disruption of the COVID-19 epidemic, Dr. Anthony H. Johnson presents a vignette that starts in 2051, looking back on how America creates a future school system that addresses student needs through a myriad of personalized and adaptive technologies.

Vignette: The Next Wave: Convivial Technology and the Restructuring of American Schools

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Introduction

Analise is excited to attend her first day of school today—the kind of excitement that makes a 5-year-old wake up at 4:00 a.m. What is great about waking up this early is that Analise gets to eat breakfast with her dad who typically leaves before the sun comes up. Instead of watching the morning news to determine the virus threat level (which is similar to the air quality standards of red, yellow, and green), her father helps her unbox her VR goggles and tracker watch. He adjusts the headband for her VR goggles and the tracker watch arm band so that it fits snug but not too tight. After all, Analise needs to be comfortable if she is going to wear these two devices for 4 hours today. Lastly, her father adjusts the height of her interactive desk so that her little feet rest comfortably on the floor.

Analise's tracker watch fits snug which is necessary since it monitors and remembers her biomarkers (DNA, pulse, etc.*). It also monitors instances of synaptogenesis where new synapses in the brain are formed and broken to indicate when new learning takes place. This tracker watch also gives her access to secure testing systems that holds her teacher accountable for the amount of academic and cognitive growth made within a given academic quarter. The second piece of equipment is her interactive desk. This is the "super computer" needed to power personalized learning. Through the use of cutting-edge artificial intelligence, each student is assigned an intuitive and unique operating system that has humanistic qualities that is commonly known as their "learning coach." Picture a Siri-like entity that can teach, learn, and guide a student through adaptive academic content including intervention materials and language development for English learners and students with disabilities. Using open-source software, the AI learning coach instantly searches the Web and curates and presents information and lessons specific to each student. The third piece of equipment is the virtual reality goggles or VR goggles for short. The VR goggles are what bring learning to life for students. Students can use these goggles to join class and interact with other students in their cohort throughout the day or night. This includes academic activities (group project, science labs,* etc.*) and physical activities (recess, physical education,* etc.*). Lastly, this is where a student can see their AI learning coach whose appearance and voice are customizable. These three pieces of technology are dubbed the "Learning Trio."*

As her father waits for the devices to power up, he reflects on how different life is without his wife, who succumbed to the latest strain of the COVID virus *just 4 years prior during the last wave. This left him to raise their daughter alone. He smiles at Analise and she questions why he is so happy. He wants to explain how his smile hides the pain of losing her mother and how difficult it is raising a 5-year-old daughter alone. But instead, he places his hand on her tiny shoulder and says, "Daddy is just glad your babysitter knows how to use this technology." Analise giggles and runs over to sit in her interactive desk, she places her VR goggles over her eyes, and her AI learning coach whose appearance her father customized the day before comes to life. She's excited to see that although they never had a chance to meet, her AI coach looks exactly like the picture of her mother that sits on the shelf in her room. She feels comfortable and motivated to get the day started early. This is one of the coolest ways her learning experience has been customized.*

Context

Years after the global pandemic, schools in the United States struggled to offer a high standard of instruction for all children, partly because of the risks that existed after the COVID-19 crisis and the peak of the civil unrest of 2021 and partly because the traditional system had never functioned well for children who needed it most. Achievement gaps that existed previously widened and were exacerbated by societal challenges. During this time, education seemingly took a back seat to the larger, more immediate challenges at hand. As nearly 2 million Americans died over the course of just 12 months, the data began to clearly show how inequities directly affected the country's ability to sustain itself during times of crisis. Traditionally underrepresented minority groups and the poor rose up, and the second civil war of 2021 further exacerbated the COVID-19 crisis. The world economy contracted, and the United States was forced to evaluate and adjust every major system for efficiency, effectiveness, and equity. The goals of the country shifted from individualistic economic prosperity to creating a sustainable future. Tragically, not only were millions of lives lost during this painful transition, but also America's place as the premier world leader was no more.

One positive by-product of the COVID-19 crisis was that it created the urgency for change that was needed to disrupt the educational system (Kotter, 1996). The idea of the school as a brick-and-mortar establishment quickly vanished when scientists realized that schools were the petri dish driving each of the four waves of the COVID outbreak. Each time schools would attempt to reopen, virus outbreak hotspots would occur in that particular neighborhood. This trend ravished our poorest communities who primarily represented essential workers who depended on school for childcare and did not have the means to homeschool their children. This led to a dark time in American education where millions of children experienced gaps in learning and socialization. "Distance learning" as it was coined required that students ages 5–18 independently access curriculum either housed on school websites or loaded onto expensive proprietary learning platforms purchased by local schools. Teacher-student interaction was limited to individual contact through video-conferencing platforms. Distance learning required that parents had to secure quality internet access, childcare, daily meals, and tutors to ensure a high level of daily instruction while they were away at work. This in of itself created an even more inequitable educational environment—one that would mar the educational experience of a generation of children and leave the foundation of the United States weaker than ever before. Due to the lack of accountability and effectiveness along with historical, pervasive inequities that persisted, schools and other public agencies such as local police departments were defunded and dismantled in the year 2028.

Uberization of the Teaching Force

After the defunding of education in 2028, teachers' unions were dismantled as each teacher with a valid teaching license was then allowed to operate as an independent contractor. It soon became apparent that previous funding systems were not based on student outcomes, but because these systems were designed to support large bureaucratic organizations (districts, counties, schools), there was little accountability for student learning. In the year 2016, on average the United States spent $13,600 per student (NCES, 2020). Issues of academic growth and inequitable results for traditionally underserved students tended to become politicized due to the negotiations between local schools and unions and ultimately accepted as a part of doing business. Now that each teacher was allowed to operate as a licensed independent contractor (much like a doctor or lawyer with similar educational training), annual teacher salaries skyrocketed from an average of $60,477 (10 Alarming Facts, 2019) to over $270,000 per year. This is because there were no expenses associated with the larger bureaucratic organization such as janitorial crews, deferred maintenance on large buildings, middle management, etc. Teachers simply rented a small commercial space and held classes in person when the virus threat level was low enough and otherwise utilized distance learning. As noted above, the AI coach had the uncanny ability to machine-learn student preferences and interests in order to personalize basic instruction by curating information and practice activities that helped reinforce learning anytime. As a result, the role of the teacher shifted from one of holders of information to facilitators of interactive, hands-on learning whether in person or through the use of virtual reality. The teacher was now responsible for using their deep content knowledge and human interaction to help students develop critical thinking abilities and interpersonal skills. Most importantly, teachers also facilitated a curriculum that is focused on developing critical consciousness and awareness, appreciation, and empathy for other cultures and ethnicities in keeping with the principles of convivial technology. These are things that to date cannot be replicated through the use of artificial intelligence.

The new funding format seemed to work well initially as there was more accountability for individual teachers. Overall student achievement improved drastically due to smaller class size limitations (20 student limit per teacher). But the achievement gap remained wide. Research conducted by states and the federal government revealed two major problems inhibiting equitable outcomes. First, teachers were able to hand select the students they served. This created a situation where inner-city teachers were instructing a large concentration of students with significant home and life challenges. Before the advent of the "Learning Trio" this proved too much for one teacher to manage. And second, de facto segregation was rampant. Students who did not have the means to attend their class of choice were relegated to attending schools within walking distance of their homes. These were two of the same problems that had plagued the American educational system for more than a century.

To remedy these two ills, the ESEA of 2032 called for an "uberized" system of student distribution. A parent-friendly app was created by state governments where they could search for teachers in their neighborhood, city, and state. This app had a picture of each teacher, a bio, their teaching certifications, their parent score rating, and parent and student reviews and featured a longitudinal graph of their students' academic scores by ethnicity and subgroup. Once they found their teacher of choice, a parent could see how many seats were remaining and request that seat. Teachers were given a certain number of seats for traditionally underserved students. These seats remained unfilled if not taken by these specific subgroups. This incentivized teachers to actively pursue and support students from traditionally underserved populations. This system coupled with the advent of the "Learning Trio" proved to remedy discriminatory practices and essentially helped rapidly close the academic achievement gap.

The Transition

It wasn't until the year 2032 that the US President formed a commission that included top thinkers from the fields of education, tech, manufacturing, and public service agencies to forge a path forward for our country. This commission was charged with the task of rethinking the collective goals of the country and transitioning the United States from a zero-sum society focused on internal competition to one focused on abundance, relatedness, and the health of the American people. The big bet the President was making is that by bringing more people into the collective work and thought process, the United States would again bolster itself as the creative, adaptable world leaders of its storied past. The contraction of the world economy had forced the country to shift its worldview from the sustenance of capitalism to one of more sustainable, affordable, and flexible living and working conditions. One unifying theory emerged from this commission that would drastically change the course of the country as well as its battered and antiquated educational system. The concept of convivial technology became the overarching framework for rebuilding the American educational system. The Elementary and Secondary Education Act of 2032 then redesigned the American educational system using the five guiding principles of convivial technology which are relatedness, adaptability, accessibility, bio-interaction, and appropriateness.

Emergence of a Synergistic New Learning Theory

Convivial technology is a conceptual framework that has been around since the 1970s and foundational study by researchers such as Illich (1973), Hall (1994), Vetter (2017), and others who focus on the underlying ethical assumptions and aspirations of individuals and groups engaging with, developing, and using technology. This framework chooses not to simply focus on innovation for economic growth as was the focus in the early twenty-first century, but rather focuses on developing a "degrowth" society focused on creating a different structure that serves a different function. Kallis et al. (2014) explain:

> Degrowth does not call for doing less [or more] of the same. The objective is not to make an elephant leaner, but to turn an elephant into a snail. In a degrowth society everything will be different: different activities, different forms and uses of energy, different relations, different gender roles, different allocations of time between paid and non-paid work, different relations with the non-human world. (p. 4)

For the American educational system, this meant shifting focus away from the industrial model of preparing workers for the workforce and where the fortunate few went on to college for the purpose of securing higher wages over their life span. The new focus of the American educational system would be to (1) create educational experiences for children that are open to anyone by providing the infrastructure and tools needed to have access to learning anywhere and at any time; (2) make knowledge and instruction freely accessible through the use of humanistic artificial intelligence; (3) support and respect each student's identity and local traditions; and (4) allow for authentic interaction with diverse cultures to build collective understanding and problem-solving skills. To make this happen, legislation was passed that made core services a human right. These services were high-speed internet to every household free of charge, technological equipment and maintenance of equipment provided free to each student until completion of their college experience, and university tuition waived for all students who made adequate academic progress.

Also, tech leaders unveiled cutting-edge technology that would allow each student to attend class from any location they chose and still receive an engaging and effective academic experience. Every student received three very important pieces of technology to support their learning experience. The first and most important piece of equipment is their tracker watch. This item is a small band that when placed on their wrist identifies them as a unique user by identifying and remembering the biomarkers present in their bodies (DNA, pulse, etc.). It also monitors synaptogenesis where new synapses in the brain are formed or broken to indicate when new learning is formed. Lastly, the tracker watch is used for access to secure testing systems that hold each child's teacher accountable for the amount of academic and cognitive growth made within a given academic quarter. The second piece of equipment is the interactive desk. The interactive desk is the "super computer" needed to power personalized learning. Through the use of cutting-edge artificial intelligence, each student is assigned an intuitive and unique operating system that has humanistic qualities that is commonly known as their "learning coach." Picture a Siri-like entity that can teach, learn, and guide a student through adaptive academic content including intervention materials and language development for English learners and students with disabilities. Using open-source software, the AI learning coach instantly searches the web and curates and presents information and lessons specific to their specific student. The third piece of equipment is the virtual reality goggles or VR goggles for short. The VR goggles are what bring learning to life for students. Students can use these goggles to join class and interact with other students in their cohort throughout the day or night. This includes academic activities (group project, science labs, etc.) and physical activities (recess, physical education, etc.). Lastly, this is where a student can see their AI learning coach whose appearance and voice are customizable.

Now in the year 2051, these three pieces of technology dubbed the "Learning Trio" have been found to make the learning process much more efficient for all students. However, the most profoundly positive impacts have been realized through the use of biotechnological monitoring via the tracker watch. This has helped families and teachers identify specific learning styles and specific learning disabilities and clearly and transparently understand the amount of learning that is occurring through the formation of synapses in the brain. Essentially each student has an individualized educational plan (IEP) that is crafted and modified by their AI learning coach. This gives teachers the information needed to make accommodations for the unique learners in classroom caseload.

Actions for the Field to Consider

This vignette envisions transformative changes to the American educational system based on the premise that only a global pandemic and extreme social unrest can create the sense of urgency needed to how we currently approach teaching, learning, equity, and access. It is possible to get out front of the next major crisis that will disrupt the fragile educational system and its antiquated funding formulas. Four major actions that can and should be taken to realize the equitable and accessible educational environment are as follows:

1. Convene a commission of top thinkers from the fields of education, technology, business, manufacturing, and public service, and give them a specific charge to create a more effective and efficient educational system that utilizes artificial intelligence and augmented reality as a core component of a child's educational experience. This may lead to a more of a humanistic experience as we inevitably move toward a cybernetic future.
2. Pass legislation that provides free high-quality internet access to homes as a part of city services. This is essential to ensure that all families and children have access and are not left behind.
3. Examine funding mechanisms to decentralize education in a way that gives parents choice and that improves teacher pay and increases accountability for teachers as we move toward a more decentralized model of education.
4. More study is needed in the area of convivial technology and like conceptual frameworks that may serve as a guideline of how to restructure education with intentionality in order to create a more connected, trustful, synergistic, and adaptable future not focused on individualistic competitiveness.

Another vignette of the future is depicted by Dr. Bryan P. Sanders, called STEAMHAMLET. This optimistic vision builds on the concepts of innovative schools that embrace making and doing in collaboration. Sanders' STEAMHMALET vision is filled with student-centered, multidisciplinary spaces that leverage data and technology for student learning.

Vignette: STEAMHAMLET Is School 2051

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Vignette

Common. List of video clips curated on a theme. Uncommon. Virtual space to view and edit the clips concurrently. Common. Written analysis of current structural engineering trends. Uncommon. Immersive experience walking through a building and making adjustments.

Enter a classroom that has access to every document. It's a room of possibilities. We still call it school for legacy reasons, but we are searching for another word. It looks nothing like the familiar rows and columns of desks. The six walls of the room are instantly different from any other cube space you've visited. Their material is unknown to you. You feel something different when in this room. You have the sensation that you are deep underground.

The room has a quiet cave coolness. Comfortable and modular furniture appear arranged to fit the work of the previous visitors. Also noticeable are more familiar items from what people in 2020 call a makerspace: cameras, screens, computers, microcontrollers, wires, batteries, boxes of LEGO, robot parts, pencils, papers, measurement tools, and numerous handmade projects in various stages of completion.

You are inside STEAMHAMLET. It is a room of possibilities. It can project editable holograms for its users to test out concepts and prototypes. It is called STEAMHAMLET because it consciously puts back into one learning experience all of the subjects that school mistakenly and artificially separates: Science, Technology, Engineering, Art, Mathematics, History, Art, Music, Language, English, and Theater. Art appears twice not by accident in the name and emphasis, but on purpose. Art represents and communicates essential cultural and aesthetic values that humans consciously use to demonstrate their positionality and politics. Art is our most valuable form of irrationality where we can be emotional and expressive in pursuit of ideas.

Ideas. They come from an invisible space. They enter the visible through enormous effort. Directed by imagination, and intellect supplying the props, a product comes into being. It has a raw, newly hatched essence that the creator typically wants to preserve throughout the stages of creation. And that might be possible if this were one person's film or album or novel or sculpture. But here, in the STEAMHAMLET room, the stages of creation belong to the collective. Each individual participating is both the audience and the creator. The future of teaching and learning happens in schools that care not for your performance on a silent paper-pencil test. Instead, the focus is now on the collective making something together.

You can make anything here inside of STEAMHAMLET. It contains everything. And all things are fungible objects. By listening to the sound of your voice, the machine produces a representation of the new stage prop. Change it; shift it; edit it; make it useable to suit the needs of the project. Everything already documented and, in the libraries, can become an object to place upon the hologram stage. Sounds, images, events, texts, films, animals, places, objects, people—you can quite literally call in everything to test and try.

Pulling from existing databases, clearinghouses, and digital archives, all ideas and artifacts in recorded history are movable objects projected by STEAMHAMLET in this shared space. No special glasses or goggles are necessary: Imagine students working collaboratively in a room where they can pinch, move, scale, mash up, replace, alter, add, and edit any informational object in an easily manipulated hologram projection.

Rapidly, the invisible becomes visible as objects are called on stage. Moving from the nebulous space of the mind, ideas can be seen and heard. As objects are juxtaposed together and explored, pathways to new ideas emerge. The students and teachers are creating and observing, observing and creating. The teaching and learning cycle shifts dramatically in this extended reality hologram classroom.

The questions are next, and these are the kinds of questions that educators have asked for 120 years as traditional school developed and dominated: What constitutes getting work done? Or completing a lesson? Or assessing progress? How will we rank and order students for matriculation and admissions to the university? STEAMHAMLET could be used for pure imagination, pure creativity, or pure practicality—and of course, in any combination. But one must remember STEAMHAMLET is not only the classroom and the curriculum, but it is also the pedagogy and the assessment. We have obliterated the artificially created barriers of traditional school.

Specialized or proprietary data can also be loaded into STEAMHAMLET for private editing and use. This is the world's largest storytelling and innovation machine. It has universal application and fits into a vision of education that places a greater value on ideas and creation over grades, test scores, and units of study. People are waking up to the fact that in the year 2020, our technology capabilities have far surpassed our antiquated use. Some schools are still clinging to a 1995 version of technology focused on transactional use, and it wasn't a great idea then!

What we have done with computer technology since the 1960s to transform how we work and think in healthcare and art shows our potential for change. The computer is a brain to think with and should never be a kiosk to simply answer some prewritten questions. Schools, however, have largely used computers as replacements of paper and collaborative class time and in essence used computers as input-output devices. STEAMHAMLET lets its visitors reimagine everything about school as they indulge in an immersive experience that mimics their already-powerful human brains. Something like this has been hinted in a few fictional worlds from television and film, and its power is immediately felt by its users—Dreamscape, Star Trek, Inception, and Ender's Game, to name a few. The impact on school directly resulting from the use of STEAMHAMLET is completely unbound and unknown. Creating and learning in this space will encourage limitless growth and discourage oversimplified measurements of success.

Each day inside STEAMHAMLET changes not only its visitors but also the machine itself. The room learns as it receives input. Visitors can conduct full conversations with STEAMHAMLET as it is capable of processing and responding with culturally relevant objects to put on stage. These conversations further teach the cube space unique versions of culture as understood by the vision and ideas of one's mind. Only speaking a word or a phrase to recall an object is far too blunt of a tool and highly inaccurate. STEAMHAMLET is more intriguing and of better service to humanity by engaging in trying to represent how people create quiet mental visions that would otherwise hardly ever make it to the physical world outside the mind.

Actions for the Field
Students need to own their work. Instead, they are handed a worksheet, a worksheet created by a company that owns the work. In this business transaction, we shortchange the student, and we lie to the family that learning has happened. Without experience, no learning can happen. They may be sitting on beanbags or at kidney-shaped tables instead of rows and columns, but don't be fooled: if students don't have agency or choice, they are passing time and (maybe) passing classes. So, where and when does learning take place? Come to STEAMHAMLET and find out. School will never be the same and that's why it needs a new name.

In the shared vignettes, the authors position AI technology as a tool of learning, and a tool for learning, analogous to the distinctions between educators also make between assessment *of* learning and assessment *for* learning (Aslan & Reigeluth, 2011; Papert, 1993; 1994 revised ed). In some cases, the students use the tools, while the tools are reporting on the student in other cases. One is the actor, one the recipient, but for different kinds of data and information. In both cases, the authors are envisioning hybrid systems, where humans, either students or teachers, are in the loop, meaning that actions and decisions are made at least in part on human feedback.

Adaptive technology, as a growing part of the curriculum, will continue to refine how it addresses the individual and local needs of students and educational systems (Xie et al., 2019). An important caveat of the current data is that much of the research has focused on Western, particularly US-centric, data and applications. Pinkwart (2016) predicted that before 2051 all students would have access to computer technologies, but he also argued that the software would not be adequate to address global needs. The changes required to cross-culturally validate an AI agent are myriad and extend beyond the simple translation of words. Content and cultural experts would need to examine the images, feedback text, and content topics for appropriateness to the setting. Again, this is a task that developers cannot undertake alone—it requires a community of effort.

AI Ethical Processes

Developing complex technological tools such as wearable devices and AI applications is complex cognitive work. However, researchers and developers need to be aware of how these tools can enhance lives and overwhelm them. Norman, talking about the potential of wearable devices, noted that whether the devices are helpful or hurtful “depends upon whether we use them to focus and augment our activities or to distract. It is up to us, and up to those who create these new wearable wonders, to decide which it is to be” (2013, para 21). D’Aquin et al. (2018) distinguished between maintaining ethical processes and addressing ethical issues within tool development. Ethical processes are part of the steps taken in development and include obtaining approval from an institutional research board (IRB) to collect data. Ethical issues are questions about how design processes and outcomes could impact individuals and social groups. For example, an AI developer may feel that they have maintained an ethical process if they use data collected by an earlier project that an IRB approved. However, ethical issues may still exist for the developer. The developer has an ethical responsibility to question if there exist any potential biases in the data and if the use of such data poses any risks to vulnerable populations.

In-depth questions of fairness, opportunity, and access are already part of the discussion for developers. Many employment training sites, such as Coursera, offer courses on data ethics, and college degree programs include classes on ethics in the curriculum for data science, machine learning, and other related technical fields (Metcalf et al., 2015). Three professors from Cornell, Berkeley, and Princeton are collaborating on a textbook, *Fairness in Machine Learning*, that builds on courses they have taught at their respective colleges. In the forward, Barocas et al. note that while the book “offers a critical take on current practice of machine learning as well as proposed technical fixes for achieving fairness. It doesn’t offer any easy answers” (2019, p. 7).

The Center for Humane Technology is a nonprofit focused on the humane treatment of humans and their interface with technology. It advocates for the following principles for technologists who create the algorithms to realign technology and humanity:

1. Obsess over values, instead of obsessing over engagement metrics;
2. Strengthen existing brilliance, instead of assuming more technology is always the answer;
3. Make the invisible visceral, instead of assuming harms are edge cases; and,
4. Enable wise choices, instead of assuming more choice is always better. (Center for Humane Technology, n.d.-b, p. 1)

The ethical concerns for programmers working with commercial ventures sponsored by for-profit organizations differ from those in educational spaces, often working for nonprofits or public entities. The number of for-profit educational ventures continues to grow. Many of the old educational stalwarts such as textbook and test publishers see increasing profitability from engaging with Software 2.0 capabilities, as exampled in the Beta Writer text discussed in Chap. 3 (2019).

Pinkwart claimed that one of computer science’s central ethical issues related to education is “creating ubiquitous and universal interaction methods” that allow for “the reliable processing of educational data within AIED systems while respecting privacy” (2016; p. 773). Districts and state educational agencies already process a great deal of educational data while respecting student privacy, but businesses attempting to implement their programs have had to adapt to the needs and restrictions of working with school systems.

While educators are used to curriculum products being peddled in school systems, textbooks do not collect student data or make student placement recommendations. The new materials being implemented in schools do these tasks and more. Subsequently, educators need to question the goals of these business models. Are the products geared toward raising test scores, preparing students for novel job positions, enhancing student well-being, or turning a profit for the company? Some combination of these? Considering some of the invasion data that could be collected, such as eye-tracking software, developers working within the educational sector should consider transparency in their business goals. They also need to advance how they remain accountable for ethical student data use.

Another ethical issue with implementing machine learning (ML) and AI in educational systems is the place of disparate impact. Kizilced and Lee (forthcoming) note that even without intent, systems can still have a disparate impact where a seemingly objective standard adversely affects one group more than another. Educators have seen these types of results across products, both in low-tech interventions and curriculum, as well as with high-tech tools and software. Educators are also concerned with the unintended bias in educational products due to limited content knowledge and limited diversity of opinions during the production process. The vignette below by Amy Wooten Thornburg recounts some of the problems with disparate impact and bias that have arisen with the popular Accelerated Reader program. The popular program shares several characteristics with the educational AI software in development, and the vignette offers lessons and concerns of educators that developers should consider in their work with new tools.

Vignette: Accelerated Reader: When Implemented Wrong Leads to Disaster

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Students reading on grade level has always been a primary goal for elementary educators. Further, students being able to read *and* comprehend is also an important goal for the success of students. To help accomplish these strategic important goals, a computer-based program called Accelerated Reader (AR) by Renaissance Learning Company was developed and implemented in 1986. However, in 2001, with the development of the *No Child Left Behind Act*, the focus on reading exploded. The Act was developed to ensure all students in third and eighth grade were reading on grade level or received enrichment before moving forward to the next grade level (U.S. Department of Education, 2001). The shift in teaching swiftly moved to a focus on students' reading levels; therefore, the AR program became extremely popular across America in many elementary schools and some middle schools.

The AR program was developed to monitor reading progress, to encourage independent reading, and to improve vocabulary. AR was developed with the idea to motivate children to enjoy reading and to know their independent and instructional level. With this program, students read and take a quiz focusing on reading comprehension to help teachers determine the reading level of their students. Typically, students spend 15 minutes to take a multiple-choice quiz on a book they have read. The teacher is able to see the range of books and levels the students are able to read at an instructional level; therefore, they are led to books that are not too hard, but also not too easy. Basically, AR is used to find each students' zone of proximal development (ZPD). AR was also developed to target students who are struggling when they read and who have a hard time with comprehension skills. It is also set up to help students who have attention or working memory issues (Rosen, n.d.). Ultimately, AR is to help provide teachers with an additional reading data point.

If used correctly, and how Renaissance Learning Company developed the AR program to be implemented, it has been determined to be a useful program to help students become motivated to read and allow teachers to learn their students' instructional level (Cox, 2012; Rosen, n.d.). However, the use of AR quickly began to have a negative impact of student motivation. The intent of AR was for students to set goals, earn points to meet these goals, and get rewarded when they do. The reward was to be an intrinsic one—the feeling of accomplishment and the reward of knowledge that they were increasing their reading levels. This is supposed to be the motivational part of the AR program—encouraging students to read books on their level, reading more, and developing greater comprehension skills. AR developers did not develop the program to reward with extrinsic prizes when students meet their goals. However, the majority of teachers and schools have worked this part into the program as a motivational initiative at an alarming rate that quickly backfired.

One issue is when you walk into a school and see student goals and scores on the classroom walls and displayed in the hallways battling one classroom against the others among grade levels. You can even walk into schools, and the first thing you see may be the classroom that won the AR challenge or a display of where all the classes have progressed in meeting goals. How is this boosting student motivation, especially struggling students who may have limited or no help with reading at home? Who do you think was at the bottom of the goals accomplished list? But who is it on this list that needed the most help and boost at school? Just imagine being a struggling reader who has limited resources and help at home and is compared to your peers who have overwhelming resources and help at home. This is an uphill battle and one that ends mostly with defeat and should never be a battle a student should face. Pitting students against each other, comparing student goals and achievement, and displaying results should never be allowed in a classroom much less a school.

What are the rewards frequently seen provided for students who meet their goals? They include pizza parties, sundae parties, and bowling and skating parties all provided during the instructional day taking away instructional time for celebration. Keep in mind only those who meet their set goal get to participate. So, what are the students who did not meet their goals doing? They are reading and taking quizzes, doing worksheets, being instructed, and working on programs to help them increase their reading levels. Reading is being used for punishment for not meeting their goals. Who are the students who are not meeting goals? They are those who are struggling with reading, have low motivation, have low self-esteem, and have limited or no resources or little or no assistance at home. So, I ask, why would teachers and administrators feel these reward parties are positive? They aren't positive. Rather, they are punishing the strugglers building up bigger barriers when it comes to success and motivation with reading. This is opposite of what AR was intended to be used to do. All successes should be celebrated, and celebration should not be limited for goals and testing purposes only.

A second issue with AR is test anxiety. Students who have test anxiety are known to have issues when taking a test and oftentimes score less than they should on a test. This could provide false scores that do not depict the true reading level of the students. Therefore, if a teacher is relying on AR as the sole assessment to determine instructional material for students, they will not target the appropriate ZPD. The student may not improve at the appropriate rate. Additionally, motivation can quickly digress when students feel they are facing an uphill battle when anxiety sets in and they aren't seeing improvement in their scores and are unable to meet their goals.

Teachers should be facilitating and encouraging reading comprehension and targeting students' needs while keeping in mind individual interests. This leads to the third issue with AR. It can limit student choice and autonomy when it comes to material they are able to choose to read (Pulfrey, Darnon, & Butera, 2013). When student go to the classroom bookshelf or the school library, they should not be required to only read books that fall into their independent reading-level range. What if the books that have an interesting cover are above their range? They can't check it out. What about the books that are on a topic of interest? Why should book choice only be based on reading level rather than interest? If we stick to this and students are not allowed to read books they find interesting, then we may diminish their desire to read. I have seen this firsthand, and when the desire to read diminishes, the motivation to learn is negatively impacted as well.

The fourth issue with AR is teaching students at the wrong level. As Engvall (1999) states, “students are encouraged to read materials that are appropriate for their independent reading level (as opposed to their instructional level, which is higher), which allows for greater growth and practice” (p. 28). I encounter an abundance of research that encourages teachers to have students read on their instructional level (Mooney, 1995; Puzio, Colby, Algeo-Nichols, 2020). This pushes students more and encourages them to really use the strategies they have learned to read and comprehend at a higher level than what comes easier to them. If students are not pushed out of their comfort zone and into their ZPD, then they aren’t moving forward; they are simply staying where they are comfortable instead of growing.

The final issue is the lower level of comprehension that is tested with AR quizzes. Where are the needed higher-level questions? Why are the students not writing answers in their own words and defending their answers using the context as support? Instead of various traditional book reports and students displaying their knowledge of what they read in a variety of ways for authentic assessment, schools are using AR quizzes. This can be a huge disservice to our students who need to learn how to discuss what they are reading, verbally share their ideas, and answer a variety of higher-level questions. AR quizzes have simple right and wrong answers, and students need to be able to answer questions that may have more than one answer. Students should be able to share multiple perspectives when answering questions. Simply using AR test results to determine a students’ comprehension level is a hindrance to the students. These questions are low level and basic, and our students need to be taught how to answer higher-level thought-provoking questions and be able to defend their answers with support from the text and connections. They need to be able to display their knowledge in a variety of ways (Cox, 2012; Ginno, 2011).

Chenoweth (2001) determined that when participating in an AR program, students do read more books than students who do not participate. However, once they finish the program, the number of books read quickly diminishes. Therefore, showing that for a limited time, when encouraged by extrinsic rewards, students read more, but once the extrinsic rewards are gone, the motivation is eliminated, and reading is not kept at the same pace due to an intrinsic desire to read. Therefore, it is important to use AR as a compliment instruction and as one assessment tool to enrich the education of students not as the sole assessment instrument.

Reading should not be treated as a reward system. Do this and get that. Rather, the goal should be to develop a lifelong love for reading and an intrinsic desire to read. If this isn’t the case, then what happens when students move to middle school? Or when they graduate? Are we setting up students for failure? I believe so. I am not saying all use of AR should be demolished. I am saying that AR should be used in the manner in which it was developed to be used and as a tool to enrich data and help better structure instruction based on individual needs—not as a hindrance and roadblock that develops frustration and a distaste for reading to learn or for enjoyment. I am encouraging a new educational environment to be developed where AR is a piece to uphold the value while encouraging a love for reading and developing an intrinsic desire and motivation to read.

Actions for the Field

In the future world, education is still going to mean power. Therefore, as we move forward, we need to continue to ensure educators are preparing students to be successful in the world they live in. The 2051 Challenge Incubator Draft Report embraces the stance that "we create opportunities to develop their [students'] attitude and capacity to contribute to a society that increasingly values innovation through constant learning…" (Kawasoe, 2017). This supports my stance in the need to help develop positive attitudes of students and an intrinsic desire to learn—using assessments such as AR to embrace students' strengths and weaknesses rather than pitting them against each other and making everyone aware when they do not meet the standards. This diminishes motivation and does not allow them to develop a positive attitude or intrinsic desire to learn so that they can be a positive contributor to society.

One of the most important points from the 2051 Challenge Incubator Draft Report (2017) is point seven "…how will success be measured" (Kawasoe, p. 3). Success is important and should be continued to be measured. However, success with Accelerated Reader should be measured on an individual basis and used as a tool to better instruct students and target their individual needs. It cannot be used to measure success as a whole group. This is meaningless and adds no value to individual successes of students. Another important point from the report is to develop opportunities to innovate within the academic program such as developing self-directed learning experiences. AR could play an important role with this innovation if used in the way that the developers intended it to be used—used as a target point, an assessment to determine if individual targets have been met in the area of reading comprehension. Allowing students to use AR as intended will help guide them in a world where self-directed learning is implemented—showing them their strengths and weaknesses as well as strategies they need to focus on to improve their comprehension.

Our role as effective educators is to merge what we know as best practices and the use of AI and particularly technological programs such as Accelerated Reader in the educational arena while keeping in mind that student motivation and intrinsic desire and learning go hand in hand. Therefore, as we move forward into an educational world that is more driven by technology, and students are in more control of their own learning, whatever assessments or technology is used it is imperative it is implemented in a way that will enhance student motivation and learning.

Be Open to New Types of Data

In 1995, Simon argued that "traditional philosophy has much more to learn today from AI than AI has to learn from philosophy" (p. 948), basing the argument on the lack of empirical research and data generated by philosophy. Education has seen similar arguments against its content knowledge—that it lacks empirical, double-blinded experimental studies to prove the causal effects of interventions and support theoretical arguments. What goes unsaid in these arguments is that the type of educational data valued is quantitative data generated from formal assessment processes. The messy qualitative data generated from the lived experiences of educators and students in classrooms is not valued to the same degree. Yet educator intuition and creativity are driven by this qualitative, messy, human data.

AI agents can now process visual data from pictures and video images, but understanding remains mostly rudimentary. Limiting education data collection to multiple-choice or short-response answers and thus limiting the computer programs derived from that data misses opportunities to build on student interest and educator imagination. There are only slight differences between many AI-enhanced programs being marketed to schools and the drill and kill pedagogy of the nineteenth and twentieth centuries. To be a good educator, one must understand more about motivation than stimulus response and more about pedagogy than repetition. To be a good developer for AIED, one also needs to understand more than logic gates and regression modeling. To marry both requires much skill.

As dismissive as Simon was of philosophers intruding on AI theory, he hoped that greater understanding between both subjects would lead to better results, including results for education. He posited that "Knowing how we think will not make us less admiring of good thinking. It may even make us better able to teach it" (Simon, 1995, p. 948). Knowing educational theories and pedagogies will make AI developers better at creating educational products. Just as knowing how AI operates will make educators better critical consumers of products and teachers of students who will become developers in the future.

Models created through computer programming or statistical analysis are based on codes based on actual data, and the path from data to codes to models requires the simplification of data (Shaffer & Ruis, 2020). Noting that the point of the simplification is to focus on the most critical components of a phenomenon, Shaffer also contends that there remains a need to "close interpretive loops" or to look back on the codes that produced the models and to look back on the data that produced the codes. Otherwise, developers run the risk of creating models that are not fair.

The implications of this are for AI and automated systems that code the input data given by humans and enter that coded data into the processing system. As part of training the AI model, the initial coding system requires testing and agreement with predetermined coding systems developed by humans for the most part. However, with advanced AI systems using deep learning and neural networks, the computers' coding systems may not be visible to humans. Gianfagna (2019) gave the example of an AI agent correctly coding pictures of horses from a picture database; however, audits revealed that a copyright mark almost always accompanied the horse pictures in the database. The program turned out to be recognizing the copyright mark, not the horse. In this example, the data had an error that impacted coding, that impacted the model. In educational data, hidden relations based on societal bias and inequity could continue to impact models and underscore the need for diligent, transparent auditing of these interpretive loops (Shaffer & Ruis, 2020).

While technology-enhanced adaptive learning programs currently in use have focused on student achievement, as opposed to communication and thinking skills (Xie et al., 2019), there has been increasing interest in socio-emotional learning measures in students. However, measures of such are limited only now beginning to be focused on. A more comprehensive range of student measures will likely become the focus of programs as the internet of things (IoT) and wearable devices become more common in educational settings. As always, the increasing use of these technologies brings increased ethical concerns for student privacy and data collection.

Employing a constructivist framework, Xie et al. (2019) criticized the present edtech focus on content and curriculum progressions, while student readiness and context are not included in equal measures. This disparity exists even though the applications center personalized learning, which requires a thorough understanding of students' prior knowledge. The following vignette by Dr. Lorna Hermosura offers a possible solution to these problems—ask the students what they know and how they are feeling. Dr. Hermosura argues that students' needs should be at the forefront of both pedagogy and design decisions. By foregrounding the students most in need, we can envision technology created to help address student trauma, not only mitigate it or even ignore it.

Vignette: Teachers as Healers: Using Technology to Bridge Meaningful Teacher-Student Connections Toward Priming Students for Learning and Mitigating the Effects of Racism, Bullying, and Other Traumas

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I imagine a future where technology connects teachers and students in a meaningful way. These connections will acknowledge the social and emotional dimensions of students, thus priming them for learning. In this future, teaching is inherently healing.

This imagined future is grounded in the relational developmental systems framework, which situates student development and learning as being shaped by relationships, the environment, and learning opportunities (Lerner & Callina, 2013; Rose, Rouhani, & Fischer, 2013). Indeed, this future brings together brain science, medicine, and education to arrive at a more holistic understanding of the student. This understanding is essential to enabling teachers to see students as developing human beings whose social and emotional dimensions are critical to their ability to learn (Darling-Hammond et al., 2020) and to see themselves as catalysts for healing.

Brain science shows that the brain and intelligence are both malleable and that their development is "an experience-dependent process" (Cantor et al., 2018, p.5). In particular, the limbic system is the brain's learning center, and it is made up of three interrelated structures. Two of the structures (the prefrontal cortex and the hippocampus) are directly related to memory, attention, concentration, and focus, while the third structure (the amygdala) is related to emotions and reactivity (Cantor, 2019). These three structures of the brain's limbic system work in tandem to allow for learning. As such, when emotions are high, the student's ability to learn is negatively affected—regardless of their desire or capacity for learning. Further, when a student experiences a stressful life circumstance, their limbic system releases cortisol, the "fight, flight, or freeze" hormone (Cantor, 2019). In this state, the body and brain are preoccupied with survival and learning becomes deprioritized (Cantor, 2019). Periodic episodes of high stress can be expected in anyone's life. However, when students experience persistent stress, their physiology also becomes persistently at odds with learning.

When teaching students whose lived experience is in constant fight, flight, or freeze mode, it is critical for educators to understand the connection between emotions and one's ability to engage in learning. The groundbreaking medical study on Adverse Childhood Experiences (ACEs; Felitti et al., 1998) and the related research canon that follow have all squarely established the negative correlation between difficult childhood experiences and broader social outcomes later in life (Wade Jr.., Shea, Rubin, & Wood, 2014; Burke, Hellman, Scott, Weems, & Carrion, 2011). Specifically, when students persistently experience ACEs such as abuse, neglect, domestic violence, loss of a parent, racism, and/or bullying, they are more likely to drop out of school, become incarcerated, or experience other negative outcomes as adults (Felitti et al., 1998; Dierkhising et al., 2013; Nellis, 2012).

The traumas and difficult realities of students' lives can be daunting for an educator. Indeed, teachers are not positioned or equipped to change the challenging life circumstances that many students face. In many instances, educators may think that there is nothing that they can do, that these challenges are beyond their scope of influence. But that is not true. While an educator cannot change a student's difficult life circumstances, they can change the physiological impact those circumstances have on the student. Brain science tells us that educators are well positioned to create environments that specifically offset the physiological effects of stress and cortisol. Oxytocin is the "feel-good" hormone in the limbic system (Cantor, 2019). On a cellular level, oxytocin is more powerful than cortisol, and it contributes to managing stress and regulating emotions (Cantor, 2019). What triggers the body to create oxytocin is simple—a positive relationship. Students who experience ACEs including racism, bullying, abuse, and neglect may lack that critical positive relationship with their primary caregiver. In some cases, the primary caregiver can be the very source of their trauma. In any case, the teacher can become a source for the healing power of the positive relationship. In the short term, this positive relationship triggers the production of oxytocin, which supersedes cortisol and brings the student out of the fight, flight, or freeze state and into a state that is more aligned with learning. In the long term, positive relationships can greatly reduce the negative life outcomes associated with ACEs. And positive teacher-student relationships benefit all students, regardless of their histories. In this way, teachers can be healers.

This is where technology can come in. We can proactively employ technology to bridge connections between educators and students. Technology can cut through human flaws such as an apprehension to speak or an inability to articulate thoughts or feelings in the case of students and a lack of time or implicitly biased assumptions in the case of educators. In 2020, *The New York Times* stated that "artificial intelligence begins as human intelligence. Because we are flawed, our AI creations may be too" (p.2). Rather than passively allowing technology to perpetuate our human flaws, we can instead position technology to mitigate our flaws. And rather than going down the path of relying on technology to become superintelligent and display empathy or compassion for us, we can use technology to amplify the empathy and compassion that already exists within us. Technology then is a catalyst for us to become more human, to deepen our connections with each other, and to develop meaningful relationships with each other—the very source of healing.

In this imagined future, technology is an integrated, daily communication tool that bridges positive relationships between educators and students. At the start of class, students can submit answers to a predetermined set of questions that prompts them to quickly communicate their physical and emotional state while inviting them to share with their teacher information about how they are doing. In addition, teachers can prompt students for answers to specific questions useful to their teaching and planning. In this future scenario, every student has a voice—not just the typical outspoken few. And these brief pieces of self-disclosed student information become building blocks for connection. Skin color and gender and socioeconomic class are no longer the predominant lens through which teachers see their students. Instead, students' voices, their lived experiences, their stories, and their humanity take center stage. From there, deeper and more meaningful student-teacher connections can be made making way for the healing power of positive relationships to take hold.

The beauty of this imagined future is that it can be realized today.

Actions for the Field
Given the current global pandemic, using technology to bridge meaningful connections is even more critical. In the United States, schooling has transitioned largely to online platforms. Every child is experiencing the added stress of disrupted school and life routines, and meaningful connections are not as naturally occurring as they were during times of in-person schooling. We already have the technology to execute this imagined future. All it takes is brave educators and leaders who are willing to be healers.

Human Responsibility

As with other educational technology, educators are responsible for becoming critical consumers of the apps and devices used in their schools. Educators first need to question, "How does one decide on which measure to evaluate and monitor the fairness of a given algorithmic system?" (Kizilced & Lee, forthcoming, p. 15). Establishing a definition of fairness will be unique to each educational organization and context. For example, do educators look for programs that advance all students at the same rate or look for programs that close the gap between students, even if that means some groups have potentially slower growth rates? Kizilced and Lee call for administrators to raise questions about systems:

> We encourage policymakers to interrogate the measurement step with questions about the definition of the prediction problem, the data collection process, checks for bias in the training data, and what de-biasing techniques were applied… We encourage policymakers to inquire about the use and selection of fairness constraints in the model learning process and its effects are evaluated. (forthcoming, p. 17)

In their study of teachers, Bower and Sturman (2015) found that the advantages and disadvantages of technology in the classroom raised in the research and technical literature do not always match educators' issues themselves. For wearable technologies in schools, educators were concerned that the emphasis would be on the technology, above pedagogy, and that the use of technologies would not, in the words of one educator, "achieve exactly what the teacher is after, only what the designer was thinking they might want" (2015, p. 350). The technical literature, on the other hand, included concerns such as processing power and screen sizes. With their different roles, that these groups had some different concerns is expected. What needs to be considered, though, is whose concerns are prioritized and at what stages in the design process?

Educators' need to take on a more prominent role in implementing technology in schools is echoed in the vignette by Dr. Robert Ceglie, who recounts discussions with pre-service education students about virtual learning and AI in education. The teachers are not as concerned with the technical requirements as they maintain relationships with students, the center of the teaching experience.

Vignette: Replacing Classroom Teachers with Artificial Intelligence: Not So Fast

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In the spring 2020, school ended traditional face-to-face instruction abruptly in practically all school systems across the United States. Despite major advances in educational technology, the need for a rapid deployment of virtual learning opportunities for those in K-12 schooling necessitated incredible efforts by teachers and curriculum specialists across the nation. While most teachers have an adequate command on the use of technology within their own classrooms, few have the type of expertise needed to convert a face-to-face classroom into a virtual learning environment for over 2 months. Some of the latest reports from local districts are filled with narratives of teachers working tirelessly to learn new technology, apply this new mode of instruction in their own classes, and deliver this instruction on unfamiliar platforms which are devoid of the usual human contact. Of course, all of this is being done with no additional training and limited support. Obviously, this situation is placing our kids at a risk of falling behind in their learning or even regressing their academic skills. Since the education system in the United States is already riddled with inequities, these unfortunate events will be most strongly felt by those in higher-poverty areas—students already at an academic disadvantage, as their access to technology is often lower in comparison to their wealthier peers.

During a conversation with a cohort of pre-service education students who were completing their student teaching this semester, we discussed their major challenges during the virus outbreak. The movement of all their teaching responsibilities to a virtual format provided a unique opportunity to discuss the role of technology in education. I asked the students if this might lead to more virtual learning and even an introduction to artificial intelligence to take a teacher's place. I suggested that many people might think that a computer or a group of programs can replace what they do in the classroom. While this concern was not something they had considered before, it has been suggested by some as the wave of the future. In 2018, Edwards and Cheok suggested that robot teachers are a potential tool which will soon be a reality in all schools. They note "we believe that independent robot teachers are possibilities in the near future, and that they will cause a disruption of the educational landscape, including the loss of many jobs related to teacher roles" (p. 356). Our students expressed disbelief that artificial intelligence can substitute for some of the roles that teachers have in the lives of their students. Jim explained "I can see computers augmenting and supporting teachers, but not replacing them." Other students suggested that artificial intelligence already supports their work. For example, some of the software assessments and online learning tools (e.g., ALEKS, Khan Academy, MAPS testing) help teachers differentiate instruction, and this aids in personalizing the learning for students. However, our teachers only viewed this technology as a supplement, not a replacement. This perspective has been echoed by others. In an interesting piece written in *Forbes* magazine, Christensen (2019), an educational technology expert, explains that "Rather than replacing teachers, AI should be thought of as freeing them up to do what they do best: engaging and encouraging students" (para. 9).

While my students may not fully understand the commercialization of education, their beliefs suggested a more humanistic perspective of what teachers offer. When asked to explain what exactly a teacher provides that a computer program cannot give, the discussion centered on the social and personal aspects of their profession. Lexy noted "I feel like I need to help parents' 'parent' because, in some cases there is nobody supervising and assisting these kids… many won't complete the work." Steve added "I feel like the most important thing I can do is reach out to my kids, even if it is just to listen to them and keep our connection." Both students highlighted very specific responsibilities that cannot be replaced by a computer. Several students believed that they were using conferencing software to facilitate discussion and online meetings, but it was the personal touch that they believed was most meaningful. Some educational researchers describe this as fostering a sense of belonging and argue that this may be the most critical aspect that a teacher can foster in an online environment (Peacock & Cowan, 2019).

"I just want my kids to know that I care for them during this time" was offered by Pam who also shared that most of her students come from broken homes. Ryan noted "I already think my kids miss the social element that we have when we are in school." Collectively, these students focused on the social aspect of learning, something that is hard to mimic on a computer.

The crux of much of what my students were grappling with relates to modern theories of how students learn. Social learning theory was pioneered by Albert Bandura (1977), and research has demonstrated that people learn from the types of social interactions that they have in their immediate environment. These include experiences that require personal interaction and are mediated through observations and modeling. While these are certainly not impossible to occur in an online environment, they are much more challenging to implement successfully and authentically. The application of this theory to virtual instruction has led to studies that have found that one of the most important aspects to effective online learning is the ability to build social presence (Garrison & Anderson, 2003). Social presence is broadly defined as the ability for individuals to emotionally and socially connect and communicate with one another. Social presence is fostered in an online environment through the instructors' use of personal experiences, personal and meaningful feedback, and a continuous conversation (BYU, 2020). This has also gained traction and has been accepted as social presence theory. Effective instruction capitalizes on a teacher's ability to express an emotional and even personal relationship with the student. In addition, the students are also responsible for using their experiences to build their knowledge and understanding of the content. The most effective environment exists when the students also build strong social bonds with each other in the virtual environment (Tu, 2000). However, without extensive training in online instruction and a means to authentically mimic the social dimensions of learning, this will not truly replace current instructional practices.

Hallmarks of effective online instruction builds on the concepts of both social learning theory and social presence theory to create a virtual experience that attempts to mimic face-to-face instruction. However, in practice, creating this type of learning environment in a virtual space, either through artificial intelligence or by similar tools, is easier said than done. The current situation which has forced teachers to teach their students virtually has enabled us to continue to educate during this national crisis, but I believe it is a mistake to believe that this is the future of learning. Assuming that artificial intelligence can be a substitute for a human teacher and provide an equal learning, environment is a misguided aim. Instead, building teacher capacity to utilize this technology to complement current instructional practices is a better goal. As Dr. Kolchenko states, "Adaptive learning programs do not understand the wide range of the all-important pedagogical contexts…The student models created by adaptive learning programs may be too simplistic and they are often unrealistic" (p. 251). Only time will tell how this current situation will play out, and the impact of the move to virtual instruction will be evaluated. While the importance of virtual learning provides opportunities to advance education in a way we have never experienced, there may be long-term unintended consequences.

Actions for the Field to Consider

The COVID-19 experience has elicited more questions about the future of technology's place in education but has also provided some suggestions about best practices. One key realization by many educators, students, and even parents is that one critical factor in successful online instruction is found in the ability to connect and build a community in these courses. This is backed by recent research which suggest that "students who feel accepted and valued, that they are important to the life and activity of the class, develop a strong SoB [sense of belonging], which is important for all" (Peacock & Cowan, 2019, p. 78). Thus, teachers must realize that regardless of the type of technology skills or tools they utilize, if they are unable to support effective relationships with their students, they are unlikely to be successful. The sheer fact that so many students have become less engaged during this online instruction phase suggests that teachers must be cognizant of the human and social elements that are difficult to be mimicked by AI or computer software. While artificial intelligence backers suggest that AI can replace the most effective classroom environment, it would be prudent to use the current experiences of our students learning online as evidence that there are limits in its ability to replace traditional instruction. Learners of all ages continue to benefit from the types of interactions and relationships that other humans can provide. Best practice for the use of AI is to continue to utilize it to supplement instruction and leave the important socialization elements to the teacher.

Duignan (2020) identified educators as voyeurs within the AI system. By this, he meant that educators serve the developers' needs to achieve efficiency and assessment within a neoliberal agenda. How do we ensure educator practices, and not technology, are the drivers for learning? Fullan (2011) noted almost 10 years ago that in several countries, educational reform movements have not "… been accompanied by appropriate strategies to improve pedagogy and teaching practices, [or effective] professional development for teachers [or] the provision of excellent software and courseware" (Fullan, 2011 in OECD Report, 2016, p. 90). The right drivers to achieve educational and pedagogical improvement, even reform, focus on:

> […] the teaching-assessment nexus, social capital to build the profession, pedagogy matching technology, and developing system synergies [as these drivers] work directly on changing the culture of teaching and learning [and] embed both ownership and engagement in reforms for students and teachers. (Fullan in OECD Report, p. 90)

In a keynote speech at a computing conference, du Boulay (2020) noted that AI in education is "not in the business of replacing teachers…We need teachers." du Boulay acknowledged that with the current state of technology in schools, we expect teachers to do too much, stating that "There has to be technical experience in schools…[but] teachers can't be technical leads." However, to be equal partners with developers, teachers need a better sense of how AI can be best used as a classroom tool.

The COVID-19 crisis brought the need for educators to adopt and adapt to new technologies into sharp relief. With teachers trying to attend to socio-emotional student needs during a pandemic through a screen, implementing technology solutions became the job of teachers and administrators. However, few teachers and administrators had been trained or had experience dealing with large-scale technological access beyond issuing classroom computers from a shared carrel. Suddenly, educators had to deal with internet accessibility, computer glitches, and missing passwords on an everyday basis. The revolution started by the COVID-19 crisis will likely bring even more technological adaptive systems, such as wearables and AI software, into schools. The next chapter will develop ideas and more questions about how these systems will become integrated into education.

Chapter 5
Education in 2051

Rosemary Papa and Karen Moran Jackson

As educators we actively promote equity in classrooms, face-to-face interactions that include emotions of caring, and empathy. Educators know how intricate the social-emotional connection is for learners. While social media involves cognitive manipulation and fake news (Menczer & Hills, 2020), that should not be a part of curriculum development, teacher strategies, and assessments. Educators must become active players with AI systems and AI agency development by using the strategies teachers know well. This is our revolution to grapple with, quickly. As the AI revolution creates AI agency, what are the questions we as educational leaders need to ask? In the professoriate, we ask who owns our classes we create? In AI, we ask who owns the algorithm and the model created from student data? Who owns the data that is being captured by AI agents? Who owns hidden data?

The Future of Learning

Joseph Campbell (Osbon, 1991) told us to have the life waiting for us, we must get rid of the life we have planned. The social upheaval occurring through the ever-growing primacy of machines pushes us to understand *what is waiting for us* in future classrooms, curriculum, pedagogy, and leadership. Machines are not neutral, and mathematical decisions are not necessarily ethical. We live today in a world of less privacy with public and private corporations amassing information—hiring

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data, credit scores for bank loans, academic records for college admissions, internet purchasing records, and even our faces as we walk down the street.

These data systems act as invisible gatekeepers within daily life. For example, within education, data from teacher evaluations are tools administrators are encouraged to use to replace observations by the school principal. An educator's role is to question the inherent biases found both within the data utilized and how the program is being optimized. What was the original goal of the program? Efficiency and scalability to maximize profits are not sound educational goals. The vignette by Dr. Marta Sánchez explores future education through twenty-first-century skills learners encounter and the social learning theories that are altered in AI. Her vignette, *It's 2051 and This Is America! Imagining the Role of Educational Leadership in Cybernetic, Superfragile-isitic-hyper-racisticulous Terrains of Future Schooling*, concludes that different management and leadership skills will be required to face the human biases of today and those of tomorrow.

Vignette: It's 2051 and This Is America! Imagining the Role of Educational Leadership in Cybernetic, Superfragile-isitic-hyper-racisticulous Terrains of Future Schooling

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"Google it!" the police said to Melissa Williams when she asked where her husband was being taken. Robert Julian-Borchak Williams was accused of stealing watches from a high-end store in Detroit, Michigan, and had been identified as the thief by a facial recognition algorithm. The incident became national news because the algorithm had failed (2020b, June 24). A still shot of the alleged thief that had been extracted from a low-grade surveillance video was compared against a database of millions of photographs comprised of mostly White males. Hill (2020b) reports on a federal study conducted on software using facial recognition algorithms, which found that Black and Asian faces were "10 to 100 times more likely to be misidentified than Caucasian faces" (para. 24). That is, the technology used to identify criminals was by default racially biased, because the algorithm was designed to compare still images of faces taken from surveillance video against a vast database containing mostly White faces. That is, the technology used to identify criminals was by default racially biased. The result was Mr. Williams's arrest, incarceration, and eventual release.

This real-life scenario upends the idea that lives are made better through technology and reveals a bifurcated reality that is utopic and dystopic at once: Technologies are inscribed with racism and contribute to the further marginalization, persecution, and death of people of color (PoC). At the same time, there is a collectively held value to having the world at our fingertips, being able to sustain relationships across physical and temporal distances, read multiple perspectives on world news, participate in social movements, and teach and learn in virtual spaces on our cell phones, notebooks, and computers.

It is difficult to imagine a more warped and violent outcome—albeit in this case not physically violent—than what happened to Mr. Williams at the hands of technology, and technology in the hands of racists at worst, or incompetent officers of the law at best, who failed to engage the protocols of standard detective work. Certainly, a possible interpretation is that the officers deferred to the algorithm, believing that artificial intelligence, as many textbook definitions note, is a science that can enable machines to think and engage in logic to make decisions in the same ways that human beings do. However, the case of Robert Julian-Borchak Williams is not an isolated incident. Sweeney (2013), for example, found that Google searches for "racially associated names" (p.1) yielded ads related to arrests and overall criminal activity. Searches with slight changes in the surname, making it sound less Black, even when resulting in criminal histories, yielded a shorter list of criminal activity (p.5). There are several more examples, such as the iris scan, the REAL ID, and other biometric identification systems that are "calibrated to Whiteness" (Wilson, 2007, p. 13), including TSA scanners that cannot read hairstyles and, as a result, disproportionately flag Black travelers (Medina & Frank, 2019), thus automatically making non-Whites transgressive aberrations. Of course, the phenomenon is not new. Standardized tests are calibrated to male Whiteness, as are curricular materials and the culture of US public schools. There are relatively few inclusive, anti-racist, democratic spaces now, and that makes for a sketchy future. This is the palimpsest upon which I seek to answer a central question of this book, "What is it going to take to develop new educational environments that uphold a humanistic spirit within a cybernetic future?"

A Vignette

Jamal presses his thumb against the digital scanner installed at the bus stop. He hates this part of his day; he presses and presses, and the bus just drives by. The driver knows him; Jamal has, on many occasions, been able to get the bus to stop, but not today. The scanner always hates his thumb. Finally, he is able to board the last bus to his school. He takes his glasses off for the iris scanner to confirm his identity and pauses at the thick plexiglass plate on the floor for a weapons scan. The bus driver's assistant simultaneously takes his temperature and a second bioscan to monitor for seasonal ailments. Jamal is about to walk to his seat at the window, D2, when he is handed a health card, a yellow one. He sighs and sits down. As long as he doesn't get a red one, he can finish the month with less than 15 absences. The bus makes it promptly to school, before the final bell, so there will be no need for him to text a "TardyJot" to explain his late arrival and wait for an entrance code to be texted back. He can go straight to the computer station to swipe in and see his classes and assignments populate his schedule. He goes to WorkRoom 3, swipes in, and takes his place at Glass Cubicle 73. The school believes that smaller class sizes are better for concentration, and although Jamal's school is overcrowded, the school has made special efforts to keep the WorkRooms at 100 student capacity and not more like at other schools.

Jamal says to himself, "Use Standard English, use Standard English, don't waste time, just use Standard English." Before sitting at his computer station, he touches one of the glass walls to tint it and filter out some of the direct sunlight. He touches the adjacent walls to "full night" for privacy with some stars and a perfect full moon. He looks straight into the iris scanner, and his first class begins. Ms. Wilcox, his math teacher, has the best avatar, or *is* the best avatar. Jamal got to design her and fashioned her after Shingai Shoniwa, a singer from a musical genre called "Afropunk." He found about Shoniwa one day, when he was listening to his grandmother talk with a visitor about a machine she used to "play BDs or CDs on," something like that. The visitor said he still had such a machine, and he could stop by one day and play the BD for her. A long time passed, but that visitor, an old friend's son, or grandson, came back, and Jamal heard the Afropunk music. The man took the BD or CD, Jamal could not remember, and requested that it be uploaded to CyLab under "Black Cultural Expression" for general access. Jamal usually plays it in the background when he works, but sometimes, Ms. Wilcox will shut it down if he has more than one wrong response. Today, as every day, she reviews his work from the previous day, discussing only those items that he got wrong, and shows him the correct way to solve these. She then gives him new similar problems to work on for 15 minutes. She pops back onto his screen at the halfway mark to ask if he has any questions—oh, it's not a Star Trek voice. Jamal chose Julie Newmar's voice, an actor he learned about in his *History of Media* class. He requested the code for her voice from CyLab, and he was able to add it to Ms. Wilcox's profile. After 2 hours of reviewing and revising, Jamal is given a code to leave the cubicle—although he can leave it at any time, doing so without a code can result in an expulsion from the WorkRoom or from school. He goes to the recreation center for his "Daily Fitness Regimen" of 23 minutes of sustained activity, mostly to work on his leg muscles, as this is the weakness the BodyQuest examination found at the beginning of the quarter. He goes back to his cubicle. In passing he sees Nezza. She is in another work room. She sees him. Back in his cubicle, he tackles science and coding, and breaks for lunch. He tries to get into the general cafeteria, but the message on the screen reminds him that because of his yellow card, he has to go to the quarantine room. The tray has on it chicken soup, chamomile tea with a honey pack, and white rice. The daily note says, "Moving you out of yellow. Eat up. Your Nutritionist." He eats, then goes back to his cubicle, and removes all of the filters from his walls so that he can see who is there. He sees Dre. Dre sees him. He sees Shondra. Shondra sees him. He sits down and finishes the new assignments and is ability-grouped in a lab with three other students to learn, apply, and further develop collaboration skills through project-based learning in VeritasLab. He also learns German with this same group and today they will visit a small artists' colony called Worpswede. It was just added to VeritasLab, and they will be the first students to walk through its streets. If they continue to do well as a group in these two classes, they will be eligible to join the Students Forum, a forum modeled on a twentieth-century idea of nations united around common goals. The day ends with a reflection. Jamal selects Malcolm X from CyLab. Jamal had to request special permission to have Malcolm X read a page from his autobiography. Jamal discovered his archive in CyLab's Rapid View. The Curriculum Board finally approved it, because Jamal wrote in his appeal that the board tacitly had approved the archive to be an appropriate curricular material when they placed the Malcolm X archive in CyLab.

Getting on the bus home is not problematic, because the bus is already there. He does not need to get the bus to stop with his thumb scan. No weapons scan either. Here, he is only required to confirm his identity with the iris scan and have his temperature taken and bioscan done. He is still at yellow and sent a dinner menu that includes chamomile tea and a honey pack. His mother texts him that she was sent a prescription for a "preventive" and that it should arrive at the house before she does. "Take it right away, Jamal. You cannot afford anymore 'thumb access absences,'" she pleads. Jamal sits down in D2. He is glad to have a window seat. In the last 5 minutes of his ride, the bus passes by Nezza's house. She is getting off the bus at the very moment Jamal's bus turns into her street. He sees her. She sees him.

Learning Theory or learning theory?

The learning theories we have may not be sufficient to mitigate the isolation and narrowing of the curriculum that I contend will accompany cybernetic learning that is driven by AI. By curriculum, I mean the broader context of learning that is lived by students and which is captured by the cultural script, "school days." Curriculum is experiencing complex peer relationships, participating in extracurriculars, struggling with social milestones (e.g., dating), living threshold moments (e.g., learning to read, getting a driver's license, and gaining new freedoms), and experiencing self-discovery (e.g., embracing a scholar identity, a jock identity, etc.). Curriculum includes the hidden curriculum (Jackson, 1968[1990]) that seeks to perpetuate gross inequalities expressed in raced, gendered, and ableist hierarchies. These inequalities are being perpetrated and continuously created in the contemporary moment. Generations of children and youth are being exposed to them and will live with their sequelae as adults. Indeed, all human beings have agency, can improvise, navigate, and author new selves in the most contentious of spaces. In fact, we see from our history and contemporary moment that agency and collective action are necessary, powerful, and emancipatory. However, agentic, collective action is taxing on the body and the mind and cannot, in a sustained fashion, address core systemic issues. For example, the Black and White wealth gap is so large that it can only be bridged with massive government investments, such as baby bonds that would provide each newborn with a nest egg for college or to purchase a home (Hamilton & Darity, 2010). Children born at the time of this writing will be in their 30s in 2051. It is unforeseeable that we will have a racially just society, an equitable education system that is free and accessible to all through university studies, a fair hiring process, fair lending practices, affordable housing, a more responsive health system for PoC, and so on. We are producing inequalities right now that will persist and reverberate in 2051.

Current learning theories emphasize student-centered teaching and differentiated experiences for each learner. AI can be an effective tool for achieving completely customized teaching and learning. Adaptive learning is a reality in the most basic software programs for K-20 classrooms, employee training, and testing. Twenty-first-century skills, when taken as a theory of learning, prioritize digital literacy, technology more broadly, and innovation, making little room for the humanities. These models of teaching and learning challenge social learning theory. There are, of course, hundreds of learning theories, some of which will evolve. New ones will emerge. But social learning theories held some promise; these theories posit that knowledge is constructed through interaction with others, either through observation, imitation, and modeling, according to Bandura, or, as Vygotsky notes, through direct interpersonal exchanges with others. What will happen to the collective when AI guides the teaching and learning process? What learning theories can get us to that "humanistic spirit within a cybernetic future"? What theory and praxis can dismantle modernity's empire, its White supremacy, rapacious greed, abhorrent innocence, and lack of memory? Constructing such a theory requires tearing down the walls of the academy, understanding that we all speak from somewhere and it is these multiple positionalities that must be engaged.

Educational Leadership Theory

In the United States, educational leadership is often understood as being role-driven (e.g., the principal) and defined by the bureaucratic processes of schooling, such as taking personnel actions (e.g., establishing work teams, replacing "bad" teachers, etc.) that can lead to school improvement. Educational leadership theory in the United States is also influenced by management theories in business (Johnson-Santamaria, 2016) and increasingly in the past two decades by an explicit concern for social justice. Johnson-Santamaria (2016) offers a comprehensive discussion on the various forms of educational leadership that have emerged, many of these having intersecting aims and all marked by the aspiration to be transformative by attending to cultural and linguistic diversity (para. 2). That school leaders are assuming their role in social change is significant and suggests that they understand the constitutive nature of the relationship between schools and society. They grasp that although schools and schooling are ensnared by patriarchal histories that engender racism, sexism, ableism, homophobia, and other forms of social hate and discrimination, principals can resist and engage other imaginaries through how they decide to lead. But will this be enough? It has not yet been so.

Actions for the Field

The vignette and general scenario about educational leaders center the role of technology in creating utopic and dystopic possibilities for the future. Specifically, we see how Jamal and his classmates are under complete surveillance through technologies of the body and the mind that can scan for illness and hidden weapons and monitor for academic struggle. In this virtual panopticon, technology as an invisible observer is commonplace and present in each action of the day. The teacher, the principal, the student, and the parent are evoked in nostalgic fervor, and memory becomes subjugated knowledge but also a protected connection to a humanist imaginary. The action to take today is to understand that a humanist imaginary is viable only when we work to dismantle racist structures that serve as barriers to learning, relationships, happiness, and opportunity. A humanist imaginary is co-constructed as we engage in anti-racist and other humanizing work. Educational leaders must disentangle themselves from the same mechanisms of surveillance that oppress children and youth and their teachers—paced curricula, standardized tests, and efficiency models that view teachers like assembly line workers. They must step out of mangrove-like bureaucracies, refuse to attend to these, and instead focus on the life and needs of the members of the school community.

Educational leaders must step up and step out and be humble enough to follow the lead of racial justice movements by accelerating efforts to achieve racial equity in education. They must construct a humanist education that prioritizes the teaching of our troubled histories, authentic human connection, connection to the natural world, and a collectivist ethic that can make visible our interdependence. In 2009, the US House of Representatives approved the No Child Left Inside Act, to provide school children with opportunities for outdoor learning. The Act proposed an education rooted in local geographies and which would sustain a concern for the environment. Introducing these pedagogical bents would create the conditions for reconnection with local histories, body, and mind and, more importantly, to others. We need to reconstruct school so that we can love school, because we encounter our sentient body, our energetic mind, and those we learn with and from. We will learn to love school when it is the place where we learn about and overcome our histories of enslavement, disenfranchisement, dispossession, removal, exclusion, expulsion, detention, incarceration, deportation, separation, alienation, subordination, and domination. Until we do this work, there can be no better future; there can be no love.

Caminante no hay camino, se hace el camino al caminar/Traveler, there is no path; the path is made by walking—Rubén Darío

We will continue to count with vast philosophical, sociological, anthropological, educational, and other resources and, especially, with the lived experience of students, their families, and communities, experience that has shown us how to make paths. Making a path suggests we have a place to go and a place from whence we came. Making a path means we reject what has not worked, what has not taken us anywhere. Making a path should not be thought of as being nomadic, though this is not a bad thought at all. Nomads have no attachments to a particular place and roam about in search of food, that which will give them life. Without an anchor in any discipline-dependent thought process, without an anchor in practice, we can be free to roam and find new ways of doing, new ways of leading, new ways of teaching and learning, and new ways of upholding a humanistic spirit in terrains made up of bits, data clouds, algorithms, and -isms.

The Future Classroom

The future classroom will offer opportunities for students to explore the world around them, as well as explore their own identities. AI agents can play a role in how this exploration takes place, through both virtual and in-person experiences, and projects that allow for personal investigation. An understanding of the self is yet to be a clear focus for AI-driven systems. In one example, the future classroom offers an opportunity for students to explore. Hasibuan, Nugroho, and Santosa (2019) researched how student learning style could be detected based on learning materials. This detection agent would "assesses the learner, number of visits and answers behavior…using the VAK [Visual, Auditory, Kinesthetic] learning style detection with 52.78% accuracy" (p. 87). A process called artificial neural network [ANN] was meant to function conceptually as a biological neural system with each nerve connected to other nerves. "This research uses LSI [Latent Semantic Indexing] to generate prior knowledge. The result of the assessment of prior knowledge will be used to predict learning styles" (p. 87). By understanding self-preferences for different learning experiences, students could potentially act on these preferences within autonomous classroom spaces.

The following vignette by Dr. Rosario-Moore, *Little Mechanism and Lots of Blank Sheets: Student Models and Real-World Learning*, offers a glimpse into the future of curriculum by looking back on changes that occurred to the curriculum and schools in New Orleans after the devastation of Hurricane Katrina. While many schools advertised the personalized learning students were receiving through advanced technological tools, the students' context and lived experiences were not incorporated within the curriculum. The lessons are powerful reminders of the difficulties we face to build the future classrooms in which agents provide standardized, yet individualized, curriculum.

Vignette: Little Mechanism and Lots of Blank Sheets: Student Models and Real-World Learning

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> The manifestation of the wind of thought is not knowledge, it is the ability to tell right from wrong. beautiful from ugly.—Hannah Arendt

There are few cities in the United States that resonate more deeply with the past than New Orleans. Novelists and screenwriters have thus far avoided imagining a technological utopia set in a city that cannot reliably maintain sidewalks and where boil-water alerts are still commonplace after a heavy rain. After Katrina, disruptors flooded the educational policy landscape. Many of these school reformers, recruited from elite universities, founded charter schools focused on closing the achievement gap through data-driven management and "no excuses" disciplinary practices where a student might earn a demerit for an untucked shirt policies, or for walking outside of the brightly painted hallway lines. These reformers, operating in a deregulated system without centralized executive controls, sought to regulate behavior through negative and positive feedback while teaching them to pick the most correct answers on computer screens in order to demonstrate the efficacy of their model. Schools that demonstrated test score growth attracted more students and survived, or even replicated themselves—perhaps even beyond the local environment. Schools that failed to attract and enroll enough students to sustain themselves were closed—or went bankrupt halfway through the school year. Those students spilled back into the system—that was not a system—and enrolled in different schools where they learned to take the same tests.

It was in this historical moment, in a city of perennial decay and germination, that I stepped off the St. Charles Streetcar at the corner of Carondelet and Girot Street to teach Bard College's First-Year Seminar to 16 high school juniors ringed around a single, massive wooden table on the third floor of the

International High School in the fall of 2012. The program was part of Bard College's commitment to providing access to rigorous, credit-bearing humanities coursework to working-class adults, incarcerated men and women, and public high school students. These programs are deeply influenced by the humanistic thinking of Hannah Arendt (1978) and shaped by writing-to-learn pedagogy that frames writing as composing texts that explore relationships between ideas in contrast to writing that is narrow or constrained like the two-sentence response to a question designed to assess reading comprehension (Klein, 1999). Advocates of writing-to-learn describe it as the process of understanding relationships between ideas (Schumacher & Nash, 1991; Wiley & Voss, 1996), facilitating conceptual change (Fellows, 1994), or constructing meaning (Spivey, 1990). The classroom itself was devoid of technology, and we spend the 90 minutes alternating between annotation, informal writing prompts, and Socratic discussion.

As the Academic Director of Bard Early College in New Orleans, I was responsible for recruiting and training faculty members, facilitating course design, and helping to recruit 50 students a year from across the many high schools in Orleans Parish. There was a selection process, but we didn't consider test scores or grade point averages. We simply went classroom to classroom and asked students if they were interested in a humanities seminar. If they showed up to the trial seminar having read and annotated the short essay "If Black English Isn't a Language, Then Tell Me, What Is?" by James Baldwin, they were admitted into the program. When we received their transcripts, we found that many of the students had B or C averages. Some of them had disciplinary issues at their high schools. Most of them had failed to conform in one way or another, sought to build meaning for themselves, could articulate abstract ideas in a discussion, but couldn't organize complex ideas in their writing.

In that fall of 2012, I was teaching a version of Bard College's First-Year Seminar entitled "Self and the Science of Mind since the Machine Age." We began the class by reading a section of Alan Turing's 1950 article "Computing Machinery and Intelligence" from the journal *Mind* in which the term machine learning first appears. In the article Turing describes the Imitation Game—or Turing Test—and predicts "that at the end of the [20th] century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted" (p. 442). He closes the article by describing the process through which a child-like machine might be developed into a learning machine that could pass the Imitation Game. In this passage Turing characterized the child brain as:

> something like a notebook as one buys it from the stationers. Rather little mechanism, and lots of blank sheets. (Mechanism and writing are from our point of view

> almost synonymous.) Our hope is that there is so little mechanism in the child brain that something like it can be easily programmed. (p. 456)

During our class session, a few students had annotated this passage, circling the analogy of mind to notebook, and of mechanism to writing. How could a brilliant programmer like Turing have such an impoverished view of the human mind?

My wife and I moved to New Orleans from New York where I had been teaching First-Year Writing at The New School. One of my first jobs in New Orleans was training Teach for America candidates (The New Teacher Project, 2019). I had been out of the classroom for 10 years, and what I learned about education in New Orleans disturbed me. Many of the candidates taught four or five different classes, had to stick to highly scripted lessons, and were expected to stay in the school building late to enter student data into learning platforms. They also had the poor luck of being subjected to initial run of value-added measurement (VAM) teaching evaluations wherein part of their evaluation depended on student standardized test score growth and student evaluations. One principal instructed a candidate to never deviate from the computer-based reading comprehension program—which resulted in them failing the observation component of their evaluation. The candidate was upset about their evaluation but defended the reading comprehension program because they believed the students were becoming better readers.

"How do you know their reading comprehension is improving?" I asked.

"Because the students are getting higher scores on the modules." They gestured to a folder filled with printouts of Excel sheets.

"Are they getting higher scores because they understand what they are reading, or are they simply getting better at choosing the correct response?" I was skeptical.

"Well. They are engaged and they feel like they are getting better." They picked up the folder and slipped into their tote bag. The conversation was over.

Over the last ten years, there has been a great deal of excitement in the potential for personalized learning to transform classrooms and the teaching profession. According to Bulger (2016), "The pursuit of personalized education at a mass scale still drives a number of current technology initiatives in education" (p.2). An article in free-market reform outlet *Education Next* entitled "The Promise of Personalized Learning: Blending the Human Touch with Technological Firepower" presents a celebratory portrait of one California-based charter school network experimenting with a hybrid delivery model.

> Thanks to the online programs, students can go over their lessons again and again. And all the while, the software is recording every keystroke, collecting a wealth of data about what students are learning and how. (Headden, 2013, p. 18)

According to Herold (2017), these efforts have been supported by a mix of philanthropy and venture capital. In June of 2017, the Bill & Melinda Gates

Foundation and the Chan Zuckerberg Initiative (an LLC) announced a $12 million dollar award to New Profit—a venture philanthropy organization—to support new ways of shaping instruction to fit individualized learner needs. In turn, New Profit distributed $1 million dollars and management support to seven organizations in order to help develop an evidence base that would support personalized learning (Herold, 2017). Of the seven groups selected, five focus on a combination of research, policy advocacy, and implementation, while ImBlaze and Valor Collegiate Academies are school networks centered around a competency-based personalized learning platform (New Profit, 2017).

While ethical concerns related to personalized learning and data mining are growing (Bulger, 2016; Regan & Jesse, 2019), there is scant evidence to support its efficacy and limited alignment with learning sciences (Pane, 2018). Many of the learning models I have encountered operate from a simplistic and individualistic understanding of the learning process that has not developed significantly since Turing's description of the child mind as a "rather little mechanism with lots of blank sheets" (p. 456). In the highly influential handbook chapter "Behaviorism and Educational Technology," the authors explicitly advocate for a behaviorist approach to learning technology that rests on Skinner's description of the brain's labor as using data, making hypotheses, and making choices (Burton, Moore, & Magliaro, 2004). This division of the mind and brain, and the notion of the brain as a kind of computer, is evident much of the personalized learning platforms—particularly competency-based approaches wherein students attempt to "demonstrate mastery" of content through assessments.

Most online personalized learning models use responsive rather than truly adaptive systems. While both are dependent on a student model, typically constructed using existing data about the student and data derived from student responses, responsive systems only offer an "interface to pre-determined content… and are further from the neurological processes of teaching and learning" (Bulger, 2016, p.5). Based on an analysis of prior literature, Self (1990) determined that student modeling would have to address several complex cognitive problems to build student models that lived up to the expectations of program designers. He suggested that designers "avoid viewing student models solely as devices to support remediation, which is often perceived as implying a behaviorist philosophy of learning," and to develop programs that "assume a more collaborative role, rather than a directive one, for then the style corresponds to a better philosophy of how knowledge is acquired…." (p.23). A more recent review of student modeling literature (Chrysafiadi & Virvou, 2013) indicated that student models can incorporate a wide range of student characteristics, that the most commonly incorporated elements were knowledge state and learning preferences, and that "learning styles and preferences are usually modeled with stereotyping" (p. 4726). While there is progress being made in developing student models using fuzzy logic, ontological approaches, and Bayesian networks, this work demands a significant investment of both material and human resources—and this does not include attempts to develop online environments that might approach the responsiveness and connectedness of a real-world classroom facilitated by a socially adept and well-trained instructor.

As foundations and venture capitalists press the expansion of personalized learning into historically marginalized communities, it is important for scholars and practitioners to consider the larger social and historical context and to remind stakeholders about what we actually know about how students learn. If—as the tired analogy goes—artificial intelligence is a Pandora's box, it is as important to understand the world we are releasing the contents of the box into, as it is to understand the actual capacity and cost of artificial intelligence. The larger society is teeming with problems too complex and contextual for machine learning to resolve—the very contents of Pandora's mythical box being one of them (Beall, 1989). Schools are profoundly social spaces, where students learn how to collaborate, locate themselves within history, and think critically and operate with agency. In a city like New Orleans—where it is estimated that only one in five students has internet access (Juhasz, 2020)—is it ethical or even economical to invest in online learning that is not evidence-based while there are resource-based inequities to address? Meanwhile, elite preparatory schools—educating the top tier of the social strata—continue a classical pedagogical tradition rooted in critical writing, Socratic discussion, and texts from across the humanities.

Actions for the Field

Ultimately, artificial intelligence—like any tool—has a very specific utility, and that utility must be separated from utopian fantasies and grounded in both learning sciences and human development. As educational leaders seek to imagine and fashion a future for education, we must heed Ruha Benjamin's call for historically and sociologically grounded approaches to AI that might "encode new values and build on critical intellectual traditions" (Benjamin, 2020, 49:30). Furthermore, we should seek to incorporate students—like those in my seminar—into the design process itself, so that learning platforms might better embody the brilliance and diversity of young people rather than positioning them as passive subjects in a capital-driven experiment.

We can extrapolate from the warnings to acknowledge our classroom role and the software products we are using in the curriculum. The COVID-19 pandemic rushed schools into learning platforms without questioning how the curriculum and rubrics were designed. These designs affect student motivation and the assessments being generated for the teacher. Implementation of online learning as the primary learning mode from March 2020 to spring/summer 2021 required curriculum specialists and teacher teams to ask what the online platform controls and what is being assessed. Educators need to question if the platforms operated from a deficit model of thinking, measuring mainly time on task, and manipulating students with reinforcements to ensure completion. Robust educator voices are required with online software stating that it is a sound reading or mathematics program. Conversations within school districts and among curriculum experts need to advocate for transparency for all data used by any company.

A school leaders' primary goal is to keep our students safe. A second overarching goal is to ensure students possess the courage and inspiration to continue to discover, not just verify their positions. When socially just levers are applied, staying vigilant about cultural contexts and practices requires transformational thinking. Text and curriculum that is machine-generated, such as the *Lithium-Ion Batteries: A Machine-Generated Summary of Current Research* book discussed in Chapter 3 (2019), must be courageously challenged and examined by educators lest it serves to maintain bias and inequities or work against the emotional well-being of students.

The Future Teacher

For educators, the Center for Humane Technology offers insights from technology ethicists that should apply well into our classrooms:

1. All screen-time is not equal. The tools that measure our screen-time consider all screen-time equal, but what is happening on the screen is much more relevant than the screen itself.
2. Remember, tech is a trade. What are we trading for convenience and/or connectivity?
3. Get proactive. Tech is not neutral. It is vying for our attention and is particularly good at grabbing and holding it.
4. Choose the 'right' tech. Some digital environments are more conducive to what we are trying to accomplish and how we are trying to act than others.
5. Protect developing brains. We are using and relying on technology more than we ever dreamed we would, but it is important to remember that children's brains are still developing and can literally be shaped by technology and media.
6. Be skeptical…approach tech, especially free social media products, with a skeptical attitude because money is being made somehow. (Center for Humane Technology, n.d.-c., p. 1)

Further explication of number four above is understanding how humans communicate.

> For example, talking about emotionally sensitive topics over text is likely going to create conflict because it strips away the most expressive aspects of our human communication. Have you ever noticed that it feels different to sit and talk side-by-side with someone as opposed to sitting directly across from one another? Even though FaceTime or Zoom may sound more connected, a phone call is more like sitting side-by-side, making it a good

> choice when collaborating or playing a game. Choose digital environments that are supportive of the human goals you are trying to accomplish and the values you are striving to live by.
>
> Sometimes, the speed of our internet or the devices available to us are simply not compatible with the homework or tasks being assigned to us. Some parents are deciding that it is just not worthwhile for themselves or their children to engage in certain aspects of online learning/working that are not conducive for their lifestyle or anxiety levels during this time. If deciding to abandon a task all together for reasons like these, it can be helpful to communicate what is happening with those providing the assignments. Many schools and work environments will be more flexible during this pandemic than they might have been before.
>
> Some examples of decisions you can make about your digital environments:on-screen vs. off-screen, video vs. audio vs. text, asynchronous communication (like texting or email) vs. synchronous communication (like a phone call or Zoom). Worth doing vs. not worth doing. (Center for Humane Technology, n.d.-c., p. 2)

Like Heffernan's contention that AI technology is resulting in a social revolution (2020), Duignan (2020) believes that future learning will entail embracing smart technologies that will be highly disruptive and require exponential change. This embrace for educators translates to their courage and abilities to collaborate. Building off a 2016 report from the OECD Centre for Educational Research and Innovation, Duignan promotes educational gaming values, which offers a promising model to enhance student learning in STEM education. By embracing these pedagogical changes, educators can potentially improve content knowledge, along with motivation, thinking, and creativity (OECD, 2016, pp. 91–92). The four elements of this future include:

- *Learning by doing*, which enables students to learn about complex topics by allowing them to (repeatedly) make mistakes and learn from them;
- *Student learning* by enhancing their subject-specific knowledge and deep learning skills;
- *Greater student engagement and motivation* in various subjects and educational levels, gaining more skills and capabilities when they construct games themselves, and;
- *Students thinking skills* through finding new ways around challenges and enhancing problem solving. (Duignan, 2020, p. 126)

Educators' understanding of human empathy and contextual factors significantly impact a student's motivation and self-efficacy. Educators understand their role with parents and their children, especially during the COVID-19 pandemic, helping them to focus on parental conversations with children on how technology and social media are working or not with their child's well-being. Educators suggest asking how this app or game makes someone feel, when using it and after its use. They further recommend exploring these questions with children:

- What thought, feeling, or impulse led you to pick up your device?
- As you scroll through your feed, what kind of thoughts come up?
- What kind of emotions come up?
- What happens to your breathing?
- How does your heart feel? (Center for Humane Technology, n.d.-c, p. 1)

Prince et al. (2018) forecast a future over the third decade of the twenty-first century for educators to "provide increasing opportunities for student-centered approaches and stakeholders will need to keep learners' fundamental human needs at the centre of their decisions" (p.28) [and] "operate in an environment where increased efficiency is often touted as system transformation; while increased efficiency will be an important aim, it should not be confused with transformation" (p. 29).

Educators understand that computer program designs have historically attempted to replicate human thinking (Simon, 1995). Even the neural net that forms the basis of new technologies results from this attempt at recreation (Bhadra, 2019). Discussing how programming knowledge and content need to enmesh for best results in the creation of AI agents, Simon notes:

> that to understand these systems, not just as interesting examples of artificial intelligence but as theories of human thinking, and to adjudicate among them when they conflict, you must devote just as much attention to the experimental and other empirical evidence about the phenomena they model as to the structures and behaviors of the programs themselves. (p. 941, 1995)

This type of detailed attention to AI programs' structures has led some cognitive scientists to reverse the replication. These researchers view children's learning as "analogous to a particular style of programming called hacking, making code better along many dimensions through an open-ended set of goals and activities" (Rule et al., 2020, p. 900). This perspective expands the child as a scientist from "the roots of Piaget… emphasizing how children structure their foundational knowledge in terms of intuitive theories analogous…to scientific theories" (Rule et al., 2020, p. 907).

> By contrast to existing theories, which depend primarily on local search and simple metrics, this view highlights the many features of good mental representations and the multiple complementary processes children use to create them…Our core claim is that the specific representations, motivations, values, and techniques of hacking form a rich set of largely untested hypotheses about learning. (Rule, Tenenbaum & Plantadosi, 2020, p. 900)

Does the act of hacking form an algorithmic-level view of cognitive development? Using this approach to learning is then program induction: "discovering programs that explain how observed data were generated" (Rule et al., p. 902).

> The learning as programming approach, however, is importantly different in providing learners the full expressive power of symbolic programs both theoretically (i.e., Turing completeness) and practically (i.e., freedom to adopt any formal syntax) … Though these ideas have been important in formalizing LOT-based learning, views based entirely on simplicity, fit, and stochastic search are likely to be incomplete. Most real-world problems requiring program-like solutions are complex enough that there is no single metric of utility nor unified process of development. Even so, modern computational approaches to learning, whether standard learning algorithms or more recent LOT models, use far fewer techniques and values than human programmers. For any task of significance, software engineering means iteratively accumulating many changes to code using many techniques across many scales. (Rule et al., 2020, p. 902)
>
> The fundamental role of intrinsic motivation and active goal management in hacking suggests deep connections with curiosity and play [79–82], which have also been posited to

> play central roles in children's active learning. We do not speculate on those connections here except to say that in thinking about intrinsic motivation in hacking, we have been inspired by Chu and Schulz's work exploring the role of goals and problem-solving in play [83]. Further understanding of this aspect of both learning and hacking could be informed by our search for better accounts of play and curiosity. (Rule et al., 2020, p. 905)

Developing a computational algorithm framework of human learning is needed. Teachers and school administrators have a role in partnering with computer scientists, as do professors. "Such a framework would bring together existing knowledge about theoretical computer science, programming languages, compilers, program synthesis and software engineering to provide tools capturing human-like approaches…" (Rule et al., pp. 911). Educators are key, and Bostrom tells us just how important we are to the future of schooling, through the lens of the transforming of humans. Transhumanism, as described by Bostrom (2005b, 2003), requires an interdisciplinary connected way of knowing that AI presents opportunities for "enhancing the human condition and the human organism opened up by the advancement of technology" (p. 1). His prognostications continue:

> Transhumanism has roots in secular humanist thinking yet is more radical in that it promotes not only traditional means of improving human nature, such as education and cultural refinement, but also direct application of medicine and technology to overcome some of basic biological limits. (Bostrom, 2005b, p. 2) Transhumanism advocates the well-being of all sentience, whether in artificial intellects, humans, and non-human animals (including extraterrestrial species, if there are any). Racism, sexism, speciesism, belligerent nationalism, and religious intolerance are unacceptable. In addition to the usual grounds for deeming such practices objectionable, there is also a specifically transhumanist motivation for this. In order to prepare for a time when the human species may start branching out in various directions, we need to start now to strongly encourage the development of moral sentiments that are broad enough encompass within the sphere of moral concern sentience's that are constituted differently from ourselves. (Bostrom, 2005b, p. 10)

In the next vignette by Dr. Soles, *Futures Studies in Educational Leadership as Transhumanism,* she develops a conceptional framework for culturally proficient practices. She believes that by 2051 the realities of social presence models and the Community of Inquiry framework may yield a more socially just future for learners. She further explores the possibilities of transhumanism in AI and how educational leaders may have to deal with this as yet unknown.

Vignette: Futures Studies in Educational Leadership as Transhumanism

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How might professors engage their educational leadership doctoral students in future studies discourse? This chapter explores how one professor and her graduate students navigated this via one course: leadership for the future.

Using the conceptual framework for culturally proficient practices, the professor made cognitive dissonance and cognitive coaching intentional pedagogical approaches in discussing futures studies. Course themes coupled with educational leadership perspectives included the following: Afro-futurism, artificial intelligence, science fiction, play, and transhumanism. Although some students enveloped this course, what emerged overall was a resistance to learning, confusion, and even disgust. This chapter concludes with potential best practices through the lens of transhumanism for engagement in difficult conversations and actions situated in the unknown.

The Design

Designing my leadership for the future class for graduate students in the Unites States was the most fun I have ever had designing a course. It was also the most challenging as it was outside of my leadership comfort zone as it was about the unknown, the probable, the potential, and, nonetheless, the future. It was enveloping vulnerability (Brown & LMSW, 2012), trust (Daly & Chrispeels, 2008), and intersectionality (Harris & Leonardo, 2018) to say to my students … *I don't know*. It was using design-based school improvement practices to explore what could work (Mintrop, 2019). It was taking a deeper dive into futurism, play, and Afro-futurism and examining artificial intelligence, science fiction, and imagination (Paul, 2019). In essence, it was a class on being a human being.

Framework

I used the conceptual framework for culturally proficient educational practices (Cross et al., 1989; Lindsey et al., 2018) to center the class and use it as a lens to see the probable. This framework offers a way for people to examine individually their belief and value systems while listening to understand another's perspective (Soles et al., 2020). How we value perspectives that activate feelings of inequities, injustice, and lack of access matters. How we understand ourselves first before we are able to see others matters especially when discussing futures studies. This is a term I am still untangling: futures studies (Paul, 2019). It is imagining what our future can look like. It is creating probable options. It is visioning and revisioning. It is looking into the past to conceptualize the future while engaging in teaching and learning (Soles & Maduli-Williams, 2019).

Cognitive Dissonance

I wanted to engage my students in cognitive dissonance (Schein, 2010; Soles, 2013) in order to learn and make new meaning. Students exhibited an overwhelming amount of cognitive dissonance throughout the course, but I am not sure they were able to get to meaning or even move through the discomfort. Where had I gone wrong? Our class dove into all of it including validation and verification. We asked ourselves, did we do it right and did we do the right thing? Some students expressed they were *lost more now than ever* and *grateful* the professor examined a topic where the class had *varying levels of comfort* and considered the class *thought-provoking*, *meaningful*, and *well-planned*. There were blog posts from students about *pushing them to be risk-takers*, *stretching their thinking*, and appreciation of *providing a classroom space to have multiple opinions*. Furthermore, the students stated *the professor was excited to teach so I felt like she cared about us*. Some students privately expressed concern to me that *other students did not want to learn new things, hence the classroom tension*. Why did some students not want to learn? I was genuinely perplexed, and this haunted me throughout the rest of the course like a hologram in my attempt to understand. I always thought there was a constant curiosity in great leaders. Leaders are never done learning and always seek to improve themselves. They are never bored. They wonder. They repeat themselves. They get frustrated and they ask lots of questions. I began to unpack these values and beliefs I held regarding educational leaders.

Transhumanism

Transhumanism is human capacities or enhancement through technology (Gidley, 2019). As the semester progressed, our course themes allowed for writing and conversations regarding technology and humans. These educational leaders could easily discuss their student technology equity and access issues like getting everyone a computer and providing Wi-Fi services. They could easily discuss internet services, software their organizations used, and their school and university websites. Yet, when the conversation shifted over time to how genetically altered babies (Raz, 2017a) would have not only different schooling experiences but biologically altered mental and emotional capacities and what we were going to do about it, the room fell silent. How could I broach these post-human entity conversations if students were not ready to go there? Was it my students just wanted to complete their dissertations and not be bothered by this stuff? Perhaps our transhumanism conversations did not seem urgent as these leaders were not grappling with these questions in that moment? Or were they already and none of us knew it? I should say some students thrived in these conversations and were willing to break out of current habits of mind and explore new ways of thinking about the future. Others seemed to not have the work-home-graduate school bandwidth to do so. Or was I just not asking and facilitating the right questions as the professor?

Final Class

Our final class we met online. You have to remember this is before COVID-19. You have to remember it was before the nationwide exposure of racial injustices in the United States as mainstream discourse. I wanted to put this final class online to try something new. That's right, something new and different.

To honor my own pedagogical curiosity. To continue new ways of teaching and learning.

Students absolutely loved this class online. It seemed fun and innovative. They laughed and chatted verbally or in the text chat box with each other. They showed their pets, kids, glasses of wine, and sweatpants. Some appeared giddy with this brief online student space I had created. They were relieved not to have had to commute. Some typically commuted 3 hours total just for a single evening class after a full day working as a K-12 school or university leader on top of caring for loved ones. There were teaching and learning online best practices that night. There were emojis, links, and memes. Maybe our conversations throughout the semester had changed their thinking about leadership for the future. Maybe it had done nothing but fester their anxiety about the unknown. By the end of our Zoom class, there was a collective sigh of relief that this futures studies stuff was about to be over.

There was a moment of togetherness on the screen that evening. Work and life integrated, it did not balance. This was before coronavirus. This was before high unemployment rates. This was before protests against racial injustice. This was before.

Iterative Actions

What will it take for teaching and learning spaces to engage in futures studies for educational leadership? Part of the design-based improvement approach is offering potentials next steps to improve the design (Mintrop, 2019). Thus, I offer three themes for professors engaging in future studies conversations with their students: self-reflection, online social presence, and holding space.

Self-Reflection

Through individual and collective self-reflection, the change process can begin (Soles, 2013). By addressing our deep values and beliefs (McDonald, 1996), we as humans are able to examine our espoused beliefs, deep values, and how they intersect in daily life (Schein, 2010). One practical approach to this daunting task is using breakthrough questions (Adams, 2016; Lindsey et al., 2009) while engaging in specific conversation agreements (Singleton, 2014). Although designed for conversations about race, the four agreements by Singleton provide an effective approach to any conversation rooted in a desire to create equity-based change: stay engaged, experience discomfort, speak your truth, and expect and accept non-closure. Breakthrough questions flip the narrative from *Why do we have to talk about this?* to *Given our future studies orientation for educational leadership values, how might we talk about this challenging subject collectively this semester?* to steer the dialogue toward access for all.

Online Social Presence

There are several frameworks that focus on online interaction and connection including the Social Presence Model (Whiteside, 2015) and the Community of Inquiry (CoI) framework (Garrison, 2009). The CoI framework identifies three categories of social presence behaviors, affective, cohesive, and interactive, and posits that the three components together inform online learning. The Social Presence Model offers a deeper examination of social presence where social presence is examined as the most substantial factor to maximizing learning in online settings. Practical application encompasses incorporating technology tools that encourage voice and video discussion for student engagement as well as voice and video instructor feedback. Students have higher engagement when they can see and hear the professor (Whiteside et al., 2017).

Holding Space

It is through our equity-based, transformative leadership that future studies in educational leadership can occur (Shields, 2018). We can do this through holding space as professors for and with our students online or face-to-face. It is Restorative Practices through checking in with students at the beginning of class as well as checking out at the end of class (Mansfield et al., 2018). It is professors learning about their own White fragility (DiAngelo, 2018) and implementing anti-oppressive pedagogy (Kumashiro, 2000). It is learning how to listen to our students.

Actions for the Field: The Future Is Now

Higher education must engage its students in educational leadership in futures studies topics to ensure equity and access for everyone and get comfortable with the uncomfortable. These students in the leadership for the future class will add to their list of concerns about equitable access of materials to matters that are not quite current realities yet. Educational leaders, the students in these programs, must and will continue to engage in these iterative actions stated above to understand how to envelope new educational problems of practices, mutated from their current historical context into a greater inequities gap landscape. Thus, similar to learning new software and computer systems, educational leaders will have to teach and learn with their communities, at the same time, regarding futures studies topics that are emerging at their school site whether that school is an AltSpaceVR environment or accessed by clicking through an old-fashioned Zoom screen. There will be fewer experts and more collaborative learning spaces.

The future is the time and space in which we can tumble into something that will be arranged differently, coded differently, so that our locations and labors are more than just who we are to the settler (Tuck et al., 2014). Most leaders will need guidance and encouragement to examine this process through Traditional Ecological Knowledge or the knowledge, innovations, and practices of indigenous peoples (Armenta, 2020). Our leaders in our schools, districts, and other educational entities will grapple with students who are genetically modified and those students whose parents chose the natural route, no genetic modifications, in lieu of gene editing (Raz, 2017a). These leaders will benefit from sonic meditation skills transforming the body and mind to sustain these transhumanism decisions, experiences, and dispositions as they listen directing their attention to what is heard, gathering meaning, interpreting, and deciding on action (O'Brien, 2016). Families playing video games together will be encouraged rather than discouraged as a teaching and learning modality (Siyahhan & Gee, 2018). Leaders shall look to Afro-futurism going beyond science fiction as a way of looking at Black culture to realities that are fantastic, creative, and hopeful (Drumming, 2016). Our mindsets must shift to what education and leadership are and will be.

Educational leaders considering futures studies as a transhumanistic experience will thrive ensuring equity and access for all. I understand that coronavirus has changed the way we live and work. I also understand this virus and our current context of exposed racial injustices have illuminated inequities in our US educational systems. What must follow is a radical examination of how these inequities occurred and implement changes through collective, anti-oppressive conversations. One definition of transhumanism is embracing direct application of medicine and technology to overcome our basic biological limitations; another definition of transhumanism addresses human progress and improvement through education and culture (Bostrom, 2005a). If the former definition can be used to engage in effective teaching and learning online to avoid receiving and transmitting the coronavirus, how might the latter definition function as a conduit for human progress and improvement through education and culture to address our deeply racist and oppressive schooling systems in the United States?

The Future Educational Leader

The realities of the COVID-19 pandemic have shown our weakness in thinking technology is ubiquitous. What is the reality is that while some have access to it, many do not. Duignan argues that computer science "emphasizes the creation of intelligent machines that work and react like humans, even simulating human intelligence processes" (p. 127). This, however, begs the question of whose reactions are being written into the AI agent when there is such inequality of access? Preparation programs for educational leaders should be reconfigured to address many of the issues raised in this book. AI agency will continue to manifest in future classrooms. The school principal and vice presidents of Academic Affairs in universities need to be exposed to and seek answers for how learners learn in unbiased transparent Software 2.0. All educators must have an essential understanding on how the learner and pedagogy/andragogy are changing and question the leaders' sense of self and others. As social justice activists, all educators bear the responsibility to pursue technological transparency for the betterment of all learners.

We suggest that each master's-level program should offer a class on *human and AI agency* ethics and how the curriculum interfacing with technology should be guided by the teachers in the classrooms and those that lead schools/universities. An ethics course that asks the teacher and future educational leader to understand their own inherent biases will shape a more reasoned and ethical educator. To be a socially just educator requires our own biases being known and kept in check. Socrates noted, "To know thyself is the beginning of wisdom" (Graciousquotes, 2020). Kindness and empathy are the beginning of wisdom and are essential characteristics that educators should develop. At the doctoral level, a course on social-emotional needs and ethical decision-making regarding the details of schooling is urgent in this dawning era of AI agency. For example, to learn how to construct a budget is necessary yet not as important as understanding the equity issues for students and teachers in what is funded and why and in answering who benefits and who is harmed in decisions made. The ethical dimensions pervade school safety to the tools we use with our learners. In the last 100 years, the focus on developing skills in preparation programs has neoliberalized common sense into technical actions that are measured instead of the emotional human elements from which true wisdom comes.

Cognitive skills require even stronger emotional capabilities, as what it means to be human needs to be urgently explicated. The need to design for equity (Prince et al., 2018) has never been greater. Reliance alone on cognitive science is insufficient and leads to inequitable systems, marginalizing those students that live in poverty. The rate of knowledge technologies in leadership is addressed in the next vignette by Drs. Chen and Arar, *Education in 2051: Knowledge Technology to the Rescue, Adapting Education Means and Process to Diverse Learners.* Through the eyes of diverse learners, they explore human abilities as learners, and equity within education.

Vignette: Education in 2051: Knowledge Technology to the Rescue, Adapting Education Means and Process to Diverse Learners

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Can knowledge technologies replace learning institutions in the imminent future? This kind of vision entails independent or autonomous learning and direct relationships between the learner and the collective public stock of knowledge. There is no need for teachers, faculty, classrooms or schools and campuses, a structured curriculum, lectures, and accreditation. Access is free and learning is open for everyone. Equity is the rule and the population smart and productive. In the present paper, we will analyze the nature of learners and learning and examine the potential and constraints of knowledge technologies, such as learning analytics, artificial technology, and virtual reality as an extension of inherent human abilities to rescue education for 2051, suggesting an alternative vision for the schools of the future.

Technology as an Extension of Human Abilities

The popular understanding of the notion of technology implies the use of human tools or machines, from the Stone Age hammer to the modern smartphone. This concept defines humans and technology as entirely separate entities. However, the philosophy of technology defines technology as an extension of human abilities (Dusek, 2006) since technology is seen as having its origin in the human need to solve existential problems. In this view technology, not biology, has become the prime driver of social development (Monod, 1991). It is knowledge technologies that will be our main concern.

It was the invention of writing technology around 700 B.C. that started the building of the collective stock of knowledge outside the human memory. This metaphor for a World Brain is not subjected to the biological boundaries of the human brain and enabled humanity to endlessly collect the knowledge products of generations to come. Writing technology is believed to have enabled the early Greeks to introduce rationality into our culture (Dehaene, 2009; Goody, 1977; Havelock, 1963). However, print technology invented by Gutenberg in the fifteenth century A.D. enabled the production of knowledge redundancy, thus beginning the process of democratization of learning and its dissemination. To this very day, print technology is a major player in learning institutions and in knowledge dissemination

The twentieth century brought a burst of new knowledge and communication technologies: radio, calculating machines, television, computers, internet, smartphones, and an endless number of software applications. The third wave of knowledge technologies have brought an unprecedented transformation to a range of social institutions, including the economy, culture, politics, language, communication, transportation, visualization, and more. The scale of this transformation is global; thus, the description of these changes is termed "globalization" (McLuhan & Powers, 1989). The new knowledge technologies added the capacity of production and dissemination of knowledge outside the human brain. Thus, the virtues of knowledge technologies now encompass the accumulation and preservation of knowledge outside the brain; democratization of learning and the production and dissemination of knowledge is performed by machines.

The Human-Machine Learning Complex

By definition knowledge technologies are an extension of humans and therefore should be treated as a human-machine complex that operates as a united entity. The technologies under discussion are in fact an extension of the mind that constitute learning, remembering, thinking, and behaving. In order to analyze this complex, we should first consider the learner.

Learner First

Independent or autonomous learning is a must for direct interaction with the public stock of knowledge, avoiding learning institution services (Landauer, 1986; Lesk, 2011). We suggest that the following traits are a compulsory requirement for independent learning:

- Strong motivation
- High mental abilities
- Self-discipline
- A wide knowledge base to enable choices
- An appropriate personality profile

Empirical evidence from the open university students as well as from MOOC providers (Waks, 2016) suggests that despite the availability of technology and students' choice to study independently, over 90% of those students prefer learning in class or a social network with a teacher or a leader. In higher education, the selected group of graduate students enjoy partially independent studies. There is no evidence that the trait for independent learning can be extended by teaching it (Breslow et al., 2013; Wang & Baker, 2015). Moreover, data from the PISA 2018 international study (Schleicher, 2019) showed that even in countries that have the best educational systems, the compulsory qualities required for independent learning are a rarity. Unless otherwise proved, the first condition for eliminating the present state of affairs in mass learning does not exist.

A major issue concerning learning and the human-machine complex has to do with the persistence of diversity and individual mental ability differences within the population. Since Francis Galton (1869) described the normal distribution of mental abilities, it has been confirmed again and again (OECD, 2019). Yet both educational policies and practices insist on a standardized teaching methodology based on a mechanical perception of humans. While most social institutions cater for diversity using technology, legislation, and organizational measures, education still insists on industrial production measures and interprets human diversity as indicating inequality of abilities. However, the very existence of individual differences provides the foundations for the richness of our culture, and aspiring for similarity is not the same as aspiring for equity.

Last but not least of the learner traits are the natural boundaries of the individual memory. While its average capacity is estimated to be 200 megabytes and stable along many decades, the public stock of knowledge is growing exponentially and is estimated now to contain more than 296 exabytes

(Landauer, 1986; Lesk, 2011) of information and still growing. The illusion that a formal curriculum can represent a range of knowledge called a "discipline" dominates educational theory and practice. Can technology provide a solution to this knowledge explosion?

To sum up, the learners' crucial aptitudes for hybridization with knowledge technology are the capacity for independent learning, immanent diversity within the population, and the unprecedented gap between the individual and public stocks of knowledge. As far as empirical evidence exists, education has very little impact on these variables. We therefore should consider them as a constraint to environmental manipulation.

Knowledge Technology to the Rescue

Knowledge technologies are not new to humanity. As already mentioned, they started with writing and print systems utilizing symbolic representation of language, which continue to this very day. Efforts to use technology for learning began last century, trying to create distance learning by radio, and TV combined with print. However, with the emergence of computing machines, a whole array of opportunities opened—to name a few, the internet infrastructure, Google Search, Facebook social networking, IBM Watson, Wikipedia, smartphones, video on demand, YouTube, virtual reality and gaming, an endless treasure of documentary films, and a continued stream of applications.

Three knowledge technologies are currently emerging that require special attention: artificial intelligence that aspires to let machines carry mental abilities (up to the point of replacing real people by singularity algorithms); learning analytics that upon analyzing big data regarding learning behavior such as PISA 2018 (OECD, 2019) provide feedback in a cybernetic learning system to achieve its goals effectively; and virtual reality technology that provides concrete-like environments that can communicate with non-declarative knowledge. These technologies embody much promise to support learning in a cybernetic framework, but as yet we have to wait to see real evidence for success.

The question to be asked is of course: How is it possible that these technological treasures have left the learning institutions practically unchanged? and can knowledge technologies transform the learning institution into an effective fair and functioning complex?

We suggest that it is the idea that humans and technology are considered as separate entities. The integration of knowledge technologies in educational enterprises is often discussed and applied without considering the learner first (UNESCO, 2015). When educational policies and practices are set leaving out the learner's constraints, the result is a continuing failure.

The Three Frontiers of Learning: Curriculum, Pedagogy, and Time Space of Learning

Where can technology integrate in order to have an impact on learning? This is not a trivial question. Almost all rescue efforts were invested in computer-aided instruction (CAI) (Douglas, 2000). The focus of CAI is pedagogy: drill and practice, flipped classroom, educational TV, talking heads, personalized education, microteaching, video counseling, adaptive education, gaming, social networking, and more. The coronavirus pandemic in 2020 forced a global use of the Zoom application for learning; however this mode just replicated the traditional classroom pedagogy by mediating technology.

The idea that knowledge can flow to the learner anywhere at any time is central to the so-called distance learning. This technology threatens the very existence of formal learning institutions based on the need for learners to follow the physical location of knowledge and its formal agents. The scenario that suggests that school and academia will not become obsolete assumes that learners can meet knowledge without the organized time and space provided at school. The relevant technology already in action is the MOOC provided by private organizations such as Coursera or academia such as EDX (Breslow et al., 2013; Waks, 2016). The lesson so far is that MOOCs are a very efficient technology, but as yet only a fraction of the student population can master independent learning, and the assessment of achievement cannot be compared with that of formal education. Right now, there is no justification for the replacement of the traditional learning institutions.

Unfortunately, the curriculum which presents a major problem in the knowledge society was neglected by the advocates of knowledge technologies. It seems that all instructional technologies take for granted the existence of formal predetermined curricula. Even personalized education is focused on the learners' learning style and leaves out the curriculum issues.

We need first an entirely new theory for the curriculum, emanating from information and knowledge theories that consider the quantitative and qualitative relationships between public knowledge and the learner. We suggest that it is probably artificial technology that can cope with the complexity of knowledge structures and dynamics and overcome the problems that exist between information and semantics. Given the potential promise of such technology, a fundamental question arises: How do leaders envision education in 2051 considering the ubiquitous nature of artificial intelligence (AI) in the educational arena?

In the future world, leaders will no doubt need to comprehend how to lead culturally diversified learners and learning in terms of place, time, means, and ends while adapting to different and new types of situations in a constantly changing environment. Undeniably, Alvin Toffler's *The Third Wave* has arrived. According to Toffler (1985), in a world changing rapidly, with an exponential growth in technologies, possibilities for human interactions across cultures are growing. In the face of ubiquitous connectivity, unprecedented access to information and communication anytime, anywhere, leaders must reconsider their leadership styles in a new dynamic context. Amid the uncertainty of our rapidly changing world, leaders of tomorrow will be leading a truly diverse group of individuals, both educators and learners from a wide cross section of many cultures. We should therefore ask: How do we merge our learning and leadership theories to technologies and algorithmic biases that may maintain the social injustices of today into our future?

Actions for the Field

Since the validity of the conventional classroom, teaching and mass learning, as well as the role of the teacher, have been undermined, a paradigm shift about the nature of learning, and the teacher-student relationship is required, as well as a profound methodological change about individual teaching-learning. As noted, in the face of increased demanding innovations such as innovative learning tools, knowledge technologies, and transcending place and time of learning, it is highly likely that leaders may have to adapt to systemic changes and so will need to display an open mindset (Hope, 2017). This new kind of leadership, also known as facilitative leadership, is encouraging participation from others, allowing for continuous operation, recognizing different values, releasing unlimited potential of learning, and mobilizing collaboratively, both inside and outside the education entity. Both knowledge technologies and ubiquitous communication networks provide fertile ground for creativity and collaboration (Hattie, 2009). A global perspective is needed for equitable access, accreditation, and costs. One of the central problems in education is a strong focus on curriculum (outdated), instruction, and assessment without any adequate focus in relationship to development. The complexities of mass education, the interactions between the learner and curriculum, and structural constellations required for the innovative change can be handled only by using sophisticated technologies such as AI and learning analytics.

This totally new environment overloaded with information age technology and rapid change, greater international competition, the deregulation of markets, the constant change of tools and diversified places of learning, and the changing demographic all call for an eclectic blended leadership approach including collaborative, distributive, and facilitative education leadership.

Ideally, future leaders of learning will need to be knowledgeable about and preferably experienced in the information computer technology innovation they have decided to champion, with the key intention of engaging to improve students' learning both in personal mentoring and in distributive collaborative leadership. They should also adopt an orientation of group-professional communities, rather than working alone as individual leaders, necessitating restructuring of organizational aspects of learning organizations.

Education in 2051

Ongoing professional development in the ethical decisions and curricular pedagogical strategies required daily in classrooms should be front and center in educational settings. The NELP standards (2018b) over prescription in the preparation of school leaders do not approach twenty-first-century learning and learners. Indeed, previous research on the narrowing of leadership preparation (English & Papa, 2010) found the programs to lack the underpinning of human agency. In research done by English and Papa, it described:

> Educational leadership is in the main a moral enterprise centered on social, ethical, and cultural values, the restoration of human agency signals a return to the fringes of our field, because there is no science of values in social science world views…[Martin Luther] King's version of human agency in the civil rights struggle was centered by ideas. (English & Papa, 2010, pp. 28-29)

The dominance of NELP standards at the master's and doctoral levels which have produced a technique approach to teaching leadership has allowed biases to continue and thrive through a laser focus on learning techniques not on a reconceptualization of the human face in preparation. These false premises have been shared by standards enthusiasts and exported globally. The status quo cosmogony of educational leadership preparation will not be adequate as we move toward AI agency. English and Papa argued a decade ago for revision of leadership curricular that embraces the arts and humanities to become more interdisciplinary "to think outside the prevailing (behavioral/social science, rational technical) epistemocratic perspective" (p. 39). Leading does not occur in a vacuum, but rather is rooted in our deepest beliefs about humankind, nature, and the real world around us (Maxcy, 2006).

The contours of leadership preparation have been described as *accoutrements* that the human leader develops and continuously changes throughout one's life. These are the values, morals, knowledge, and skills requiring reflexive "continuing quest to understand [one's] identity within the contour of the district/university" (Papa et al., 2013). Developing compassion as human agency remains at the heart of this book, as it is to be understood in the framing of AI agency.

> Leaders know one-size-fits-all does not work. The totality of our boards', teachers, and students mental, physical, and spiritual aspects is the package that much be taken into perspective. How better to understand agency? We must ensure the future school leader has a varied repertoire of fair and just behaviors. The 'great' leader knows how to approach individuals and knows what they need to excel. (Papa et al., 2013, p. 90)

The leaders of the learners must be imbued with the human need for kindness and care, lest AI agency by 2051 becomes more human than us reading this book. If our preparation programs remain imbued with technicalities, our ability to understand the AI agent will be lost as it will relegate us to the technical role as "consumers" in use. We argue for the role educators (teachers, administrators, professors) must acknowledge these disquiets. We recognize this will not be easy to accomplish. Beginning ethical data practices is superseded by the human agency we possess.

Ethical Considerations Shapiro and Blackman (2020) offer a blueprint for ethical data practices in organizations. These include four steps educators can take on behalf of our students:

1. Identify an existing expert body within your organization to handle data risks and build a data ethics framework;
2. Ensure that data collection and analysis are appropriately transparent and protect privacy. All analytics require data collection and analysis strategy. Strive for balance on what are ethically wise business choices tied to business outcomes. Algorithmic ethics requires transparency. Questions to ask include:
   - (i) Should an AI-driven search function or recommender system strive for maximum predictive accuracy, providing a best guess as to what the user really wants?
   - (ii) Is it ethical to micro-segment, limiting the results or recommendations to what other "similar people" have clicked on in the past?
   - (iii) Is it ethical to include results or recommendations that are not, in fact, predictive, but profit-maximizing to some third party? How much algorithmic transparency is appropriate, and how much do users care?
3. Anticipate – and avoid – inequitable outcomes as other biases are less obvious, but just as important. and,
4. Align organizational structure with the process for identifying ethical risk. (Shapiro & Blackman, 2020, pp. 8–10)

Shapiro and Blackman further suggest that the steps to take include the following: create a clear linkage between data ethicists and department teams; seek consistent definitions across all teams; share examples on how to remediate ethical dilemmas across teams; and strive for a culture that values identifying and mitigating ethical risks (Shapiro & Blackman, 2020). Some of these components might already be part of how your educational system addresses student privacy and data issues. But as AI becomes a universal component of the educational landscape, these suggestions offer further tangible considerations that leaders can take to ensure more ethical practices.

Teacher and administrator preparation programs need to also consider how they teach educational leaders about these ethical concerns. Curriculum should include specific information about the underpinning technology of online platforms and devices with AI agents, so that educational leaders can ask questions about implementation and data collection that inevitably accompanies these programs. Many of the vignette authors also suggest that leaders more deeply consider what aspects of twentieth-century schooling we want to retain into the twenty-first century and beyond. The AI revolution will change K-12 schooling; higher education will not be immune. The future of our educational systems will be determined by how educational leaders address the questions raised here, how they use their power to question unequal practices, and how they advocate for learning and technology that center student needs.

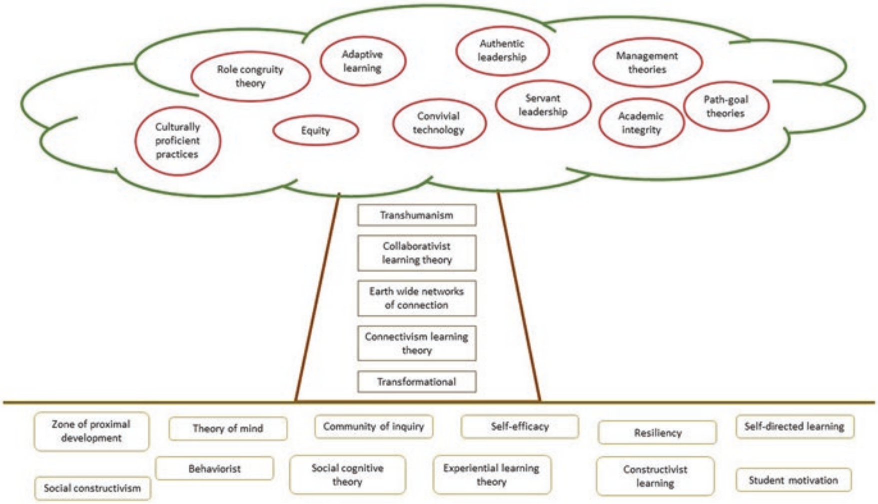

Fig. 5.1 Living tree of theories and emotions. (Author created)

The vignette writers featured in this book participated in the call to imagine these future systems. They responded to the question "How do we merge our learning and leadership theories to technologies and the algorithmic biases that may maintain the social injustices of today into our future?" with creativity and skill. Most of the authors reiterated the shift we are seeing from teacher-centered classrooms, with the hope that the revolution brings forth student-centered classrooms, not computer-centered ones. The vignette authors also centered student equity and student-teacher relationships by building worlds that embraced mainly humanistic and social learning theories. Even those who ventured into technological-mediated theories were concerned about how strong relationships were built through and around ethical uses of technology. These various concerns were amplified by the knowledge that current human-based and computer-based efforts to ensure educational equity have been inadequate and educational leaders have an overarching ethical imperative to achieve this important outcome.

The diversity of answers to the central question of this book matches with the diversity of the students we serve. The diagram below (Fig. 5.1) shows our conceptualization of the educational system that is embodied by the vignette writers' response to our query.

The figure presents the theories of our educational system as a tree, a living system. The roots of the systems are nourished by various traditional theories of learning and teaching, such as social constructivism and self-directed learning. We grow by reaching into this rich soil for knowledge. The roots also provide the grounding for the rest of the system that is exposed to the winds of ever-present change. The trunk of the tree represents the new growth arising as educational systems adapt to new technologies. The trunk shows how we can build new theories that are adaptable and responsive to a new context, the AI environment. The final part of the system is composed of the fruit of the tree, the theories and concerns that result from the educator's labor. By transforming the traditional components from the soil through the new understandings generated in the trunk, educational leaders are able to produce fruit that meets the needs of students and teachers.

What is not diagrammed on the system is the place of ethics, because ethics is the water that forms the lifeblood of the tree, just as ethical considerations should infuse educational relationships. Ethics centered in our systems will allow us to stand within the hurricane being brought by of the AI revolution.

The Role of ELWB Scholars

Future research on AI agency should turn to the rapid development of Software 2.0. The precipitous ongoing creation of AI agents may soon pass human intelligence (Bostrom, 2002): it is the researchers' responsibility to ensure this happens ethically and soundly within human agency. Ethical honest discussions and transparent decisions are necessary now for the "good" of what is and what will be developed artificially in the future. As Nancy Fraser argued, "…it must be understood that social inequality harms relationships between publics" (Annamma & Handy, 2021, p. 43). Fraser's broader lenses, redistribution, recognition, and representation, when narrowed to the context of schooling, call educators to attend to obstacles (from how we think to the policies we create) from our human agency to better address inequities. Not doing so leaves and, we argue, abrogates us as educators within AI agency. As Bostrom stated, superintelligence may pose an existential risk to humans as we know them now (Bostrom, 2002, 2005b, 2014 [2011], 2017a). The AI systems of today and the near future will manage objective human data, while humans outside the system deal with subjective, ethical issues. Yet, if AIED systems circumvent the multidimensional aspects of learners and the strategies that ultimately inspire and encourage their human passions, AI development may go very wrong. By downplaying emotions such as compassion and empathy or determining fairness by computational weighing of benefits versus hurts, AIED could render schools as places where humanity will be left at the schoolhouse door when, instead, we need humanity to be part of the programming.

This is our challenge and responsibility to future research: educational research has deeply driven the data road. It is now time to stop the standard focus and move forcefully into the messy human realm and the dilemma situations found within the learner and the pedagogy. If we do not accept this role, we are not accepting the future responsibility as educational researchers.

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