Ethical Use of Technology in Digital Learning Environments: Graduate Student Perspectives

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Introduction: Co-Design in an Ethics and Technology Graduate Course

VERENA ROBERTS, BARBARA BROWN, MICHELE JACOBSEN, AND CHRISTIE HURRELL

Leading and Learning in a Digital Age (also referred to as the digital age program) is a four-course graduate certificate offered at the Werklund School of Education that can be completed as a stand-alone credential or as one of the steps towards a Master of Education Interdisciplinary degree. The digital age program provides students with opportunities to examine the complexities of leading and learning in inclusive and high-quality digital learning environments. While completing this graduate certificate, students must develop and critically assess authentic interdisciplinary and technology-rich learning designs and environments, demonstrate technological fluency and competencies in technological literacies, advocate for high-quality digital learning environments informed by understanding of current trends and issues in the field, and develop teaching and learning practices in school and other workplace contexts that engage and empower learners and promote active citizenry in a participatory and digital age. The four courses in this graduate certificate are offered in the following sequence: (1) Interdisciplinary Learning and Technology, (2) Technological Literacies, (3) Ethics and Technology, and (4) Leading in a Digital Age. The courses are interconnected and provide a scaffolded pathway for learning within an online community based on Scardamalia and Bereiter's (2014) knowledge-building principles. The chapters in this book result from an assignment that was part of the third course in the program; however, the development of the knowledge-building community started in the first course and continued through to the third, when the students started to co-design this e-book. Following the completion of the digital age program, the students, their instructors, the academic coordinator for the program, and a research team remained dedicated to helping the students share the products of their co-design and learning in an open access format.

The Concept of Co-Design

The foundations of co-design can be attributed to Gee's principles of learning design, which empower learners as active agents (producers) of knowledge rather than viewing them as recipients (consumers) of knowledge. According to Jahnke et al., (2020), the term 'co-design' connects to co-operative design, and in their study exploring student engagement in group work in higher education contexts, they describe co-design as a way for students to become active agents of their learning and to exceed the expectations of the instructor and the learning intentions outlined in the course. Similarly, in the digital age program, we used 'co-design' to describe the participatory pedagogy used by the instructors as well as the expectation that students would be active agents of their learning.

Within current research literature, the oft-cited research on co-design focuses on small collaborative groups that design for a class or professional learning experience (Roschelle et al., 2006). While limited in scope, current research on co-designing digital open learning experiences does describe the importance of situated context when examining co-designing learning processes, the influence of reflective learning practices, and the roles of instructors and students in the learning process (Barbera et al., 2017). In addition, Sanders and Stappers (2008) describe the implications of the shift from user-centred design to co-designing as a participatory pedagogical process.

Practical examples of co-design as an open participatory pedagogical practice are found in the literature (Barbera et al., 2017; Paskevicius & Irvine, 2019; Roberts, 2019). Examples from practice on how instructors have co-designed student learning experiences include DeRosa and Robison's (2017) case studies that describe authentic and meaningful student projects and assignments and The Graduate Centre Learning Collective's (2017) handbook that describes student-centred learning and teaching practices. The open-practice-focused literature identifies an increase in student

engagement when students are active participants in the design and construction of a course syllabus, pressbook, wikipedia entry, or video (Hilton & Wiley, 2019; Paskevicius & Irvine, 2019).

Characteristics of co-design that informed the learning activities in the ethics and technology course:

- Assignments are designed to intentionally involve students as participatory partners in the learning process and in creating final learning products.
- Educators and students collaboratively personalize and contextualize their learning pathways and connect their learning to the course/project learning outcomes.
- Educators and students share responsibility for the design of conditions for multiple forms of engagement, representation, and expression.
- Iterative and continuous feedback loops and processes, which are responsive to learner's needs while ensuring students meet the learning outcomes, are used by educators, peers, and other experts.
- Group memory and knowledge building are a collective responsibility and open endeavour (Bereiter & Scardamalia, 2010; Hendricks et al., 2019; Jacobsen, 2010; Jacobsen & Friesen, 2011; Jenkins, et al., 2016; Thomas & Seely Brown, 2011; Roberts, 2019).

In current SoTL research, there are examples of student-instructor partnerships that consider how to engage post-secondary students in collaborative, authentic, and relevant participatory learning opportunities to promote shared responsibility for learning (Cook-Sather et al., 2014; Hill et al., 2019). Researchers also demonstrate positive impacts of open educational resources on student learning (Colvard et al., 2018). There is both promise and possibility in studying co-design as a participatory pedagogy in higher education, whereby instructors build upon initial course designs through collaborative engagement with graduate students to co-design individual learning pathways and to engage in new approaches to knowledge building.

The Open Learning Design

In the Ethics and Technology course, students examined safe and ethical uses of technology in digital learning environments. Students explored the ubiquitous influence and complexities of technology in a participatory culture and the evolving issues that confront communities. Students also explored how elements of a participatory culture and the ethical implications involved, can serve to support and change how curriculum outcomes are approached and how to navigate and lead in a complex culture where the line between consumers and producers is blurring. At the beginning of the course, graduate students were invited to choose a personally relevant issue in Ethics in Education to examine in more depth. As the course proceeded, the students examined the literature, reflected on their readings and assignments from earlier coursework, reflected on their professional practice and experience, and then started to develop their open Pressbooks chapter.

The process for the co-design of the chapters in this book included the following iterative design, which took place during the course and continued for six months following the completion of the course and program: instructor-designed learning activity to model collaborative knowledge building, an initial individual student response, peer feedback loops, reflection, instructor formative assessment, initial draft, external reviews, cycles of edits, and then final publication.

Overview Framework for the Ethics of Open Education

Each author used a common framework as a lens for analyzing the ethical issue selected as the topic for their chapter. A common theoretical frame for analysis provided a through line for the learning community. Farrow's (2016) comparison of relevant and current ethical research policies and guidelines provides a framework in which to consider the ethics of researching in open learning contexts, and this course used that framework as a guide to support the learners in considering multiple ethical perspectives and specific ethical guidelines for completing research in academic contexts.

This graduate course focused primarily on the safe and ethical use of technology in digital learning environments. The course was organized according to four topics based on Farrow's (2016) Framework for the Ethics of Open Education.

The four topics were:

Topic 1: Full Disclosure of Ethical Topics in Digital Learning Environments.

Topic 2: Privacy, Data and Personal Security, and Informed Consent.

Topic 3: Avoiding Harm, Minimizing Risk and Integrity.

Topic 4: Respect for Participant Autonomy and Independence.

Students were asked to review, analyze, and synthesize each topic from three meta-ethical theoretical positions: deontological, consequentialist, and virtue ethical (Farrow, 2016).

A deontological ethical position focuses on duties and responsibilities, and it emphasizes moral obligation and the rule-based nature of morality. As a result, deontological theories focus on the rules, cultural expectations, and consequences of these guiding principles. Some examples of the deontological position include religious rules about unacceptable and acceptable behaviour. Non-religious examples of this position include respecting authority and participant rights to informed consent.

A consequentialist ethical position focuses on doing what is objectively 'right' in terms of the wider context rather than what is necessarily best for oneself. There are different perspectives about which 'right' consequence is actually desirable. Hence, consequentialism focuses on the perceived outcomes of one's conduct and a greater balance of good over evil. Some examples of the consequentialist position include legalizing public education policies to send children back to school during a pandemic.

Finally, a virtuous ethical position focuses on emphasizing the importance of virtue, character, and experience in acting ethically and in accordance with one's nature and or character. As a result, a virtuous position emphasizes one's moral character. Some examples of a virtues-based ethical position include those who recognize morality as a holistic and developmental process, such as teachers who choose to use social media to share their classroom experiences and practice with others.

Designing an Open Pressbook Chapter

Each student had the opportunity to create and co-design (with their instructor, peers, academic coordinator, and other faculty members that were part of the project) one chapter in the collaborative open Pressbook. The chapters are intended to inform other students and learners worldwide as a result of the addition of the creative commons license to the chapters which make the Pressbook openly accessible to all. The chapters in this open educational resource (OER) were co-designed using a participatory pedagogy with the intention to share and mobilize knowledge with a broader

audience. Pressbooks is a sustainable and openly shared digital publishing tool used to create an openly licensed digital textbook that current and future students can reuse, revise, and remix with others.

This Pressbook was created with support from Libraries and Cultural Resources, University of Calgary and Open Education Alberta, and may serve as a model that can be used in other graduate courses. Librarians can provide guidance and instruction to students about the practical and theoretical issues involved in finding, using, and remixing openly licensed materials, and can furnish students with an understanding of the links between intellectual property, copyright, and licensing (Bradlee & VanScoy, 2019). These issues are crucial to building students' understanding of their rights and responsibilities as participants in the scholarly conversation as both consumers and contributors, and also help broaden their understanding of how scholarly works are produced. Additionally, libraries often have expertise in providing repositories to house pressbooks, preserving them long term, and increasing their discoverability.

Pressbook Chapters

All the authors were students in the ethics and technology course that was part of the digital age program. The authors engaged in knowledge-building discourse with their peers during the course, and this was strengthened by their professional experiences and considerations for the ethical implications of technology use ranging from K-12 through to university and professional settings.

Underlying Ethical Issues and Value of Technologies: Artificial Intelligence, Social Networking Services, 3D Printing

The first three chapters in the book discuss specific ethical considerations related to technologies such as Artificial Intelligence (AI) , social networking services (SNS), and 3D printing. Kerr's chapter considers to what extent students and teachers can be affected by Artificial Intelligence (AI) Based Assistive Technologies. Specifically, Kerr suggests the potential benefits for students when AI is used judiciously and ethically by teachers in K-12 learning contexts. Then, van Streum's chapter contextualizes the prevalent teacher use of social networking sites (SNS) as a means to communicate with parents and community. This chapter examines why teachers might want to communicate with SNS, and what the ethical implications can be for themselves and others. Finally, Neutzling challenges educators to consider the potential of learners as creators, of using 3D printers as a catalyst for the shift away from consumption and towards creating and collaboratively building knowledge. The authors all examine research and evidence-based practices with regard to ethics and technology issues, and all reflect on the process of assessing the value of a web resource along with ways to effectively engage users with the underlying ethical issues for any such resource.

Promoting Equity in Personalized Learning Contexts: Academic Resource Sharing, Adaptive Learning Systems, STEM, Assistive Technologies

The next four chapters shift to a broader discussion of resource sharing, adaptive learning systems, STEM, and assistive technologies. The authors in these chapters explore the challenges and opportunities, and the strategies, for educational software; discuss links between designers, users, and other stakeholders; and identify the ethical issues that emerge. Lowry's chapter illustrates how academic integrity may influence the concept of academic resource sharing (ARS) in higher education contexts. This chapter highlights multiple ARS examples used primarily by students which has ignited, and continues to ignite, tension over academic honesty, plagiarism, copyright laws, and collaborative learning. Next, Zarkovic considers the ethical implications for adaptive learning systems. He asserts the importance of humans in understanding how to integrate ALS in educational contexts. Then, Ansoger explores the past and future potential of Science, Technology, Engineering, and Math (STEM) in K-12 learning contexts. Finally, Marles describes the importance of using Alberta's Learning and Technology Framework Policy to ensure equity when using Assistive Technologies in K-12 schools. This chapter advocates for the affordances educational technology can provide to equalize learning opportunities for students with special needs. The four chapters in this section amplify the need for more ethical

considerations of how to consider the potential for educational technologies in order to promote equity in personalized learning contexts.

Nurturing Ethical Awareness in Institutional Contexts: Admissions and Communications

The final two chapters discuss admissions and communications that need to be considered from an institutional perspective. First, Lockyer's chapter considers to what extent educational technology has influenced the current admissions processes in higher education. She emphasizes the possible inequalities along with ethical considerations to help future students and institutions. Finally, Partenis's chapter considers how fake news can influence educational organizational culture and policy. This chapter considers how organizational leadership teams can communicate by considering clear, transparent, and factual messages in order to promote factual shared knowledge within learning communities. The authors of the final two chapters discuss how to nurture ethical awareness in educational environments and the value of making use of digital media in relationship to admissions and news/communications.

In each of the nine chapters, the authors discuss the connection to the value of technology in education, and practical possibilities of learning technologies for inclusive, participatory, democratic, and pluralistic educational paradigms. Farrow's (2016) Framework for the Ethics of Open Education guided the learners with their writing as they consider emerging topics in the ethics of educational technology. The chapters within this Pressbook were written by the graduate students while they were in the #EdTechEthics course in the digital age program; however, the Pressbook itself was edited and published as a result of the collaborative efforts of multiple researchers, educators, librarians, and students from the Werklund School of Education, and Libraries and Cultural Resources. We are delighted to share these ideas, and to model the process of open learning design by amplifying the potential of connecting open educational resources (writing an open Pressbook) with the open participatory practices (co-designing Pressbook chapters). Enjoy!

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PART I: UNDERLYING ETHICAL ISSUES AND VALUE OF TECHNOLOGIES: ARTIFICIAL INTELLIGENCE, SOCIAL NETWORKING SERVICES, 3D PRINTING

Chapter 1: Ethical Considerations When Using Artificial Intelligence-Based Assistive Technologies in Education

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Educational Assistive Technologies That Incorporate Artificial Intelligence

As a society, we want to simplify tasks whenever possible. Individuals who use technological devices to make life easier are likely engaging with artificial intelligence (AI), which has computers performing tasks that traditionally required human intelligence (Congressional Research Service, 2018). Educational technologies continue to develop to assist student learning and achievement, and the integration of AI is becoming more common. The type of artificial intelligence with which individuals regularly interact is called 'weak AI,' as there are only one or two tasks that this AI performs (Johnson, 2020), and it is often in the form of machine learning. A video from the organization Code.org [New Tab] relays how AI operates and functions in terms of machine learning.

Machine learning relies on software to gain knowledge through experience. All machine learning programs are task specific. Such a program analyzes thousands of data sets to build an algorithm from patterns that would be less obvious to humans, and the algorithm is then adjusted based on whether or not the machine achieved its goal (HubSpot, 2017; Zeide, 2019). This cyclical process is then repeated, and the data sets in the program expand, which some describe as the program getting smarter. The algorithms on which many of these technologies operate are typically not disclosed to the users, but often student data and information is used to run them. AI-based assistive technologies that use weak AI are the ones that will be examined in this chapter, based on the question: What are the ethical considerations of using AI in the form of assistive technologies, and how are teachers and students affected, both positively and negatively, by the integration of these tools? This chapter will discuss different ethical concerns and possible solutions, along with the precautions teachers can take before implementing them in the classroom, and the ways in which students and teachers can use AI-based assistive technology tools to promote positive educational experiences.

Recent years have seen a marked increase in the number of products that use machine learning. AI is becoming more accessible to students, as mobile devices contain a voice assistant, and many devices found in technology-filled homes are programmed with similar functionality (Touretzky et al., 2019). As we continue to use them, the programs within these devices are always learning and always monitoring our choices. (Popenici & Kerr, 2017). Even though these systems are able to perform a wide array of functions to help make our lives easier, they do not have the ability to understand why we request these tasks; however, if we plan to use these programs in an ethical manner, we should know why they do what we ask of them (Atlantic Re:think, 2018). The ability of these programs to improve our lives is what makes them a beneficial technology to our everyday experiences, as well as our education systems. Table 1.1 identifies how AI-based assistive technologies incorporate multiple intelligences through the tasks they are able to perform.

Table 1.1 Summary of the multiple intelligences that AI-based assistive technology can and cannot perform, as described in Roberts (2018).

Intelligences that AI-based assistive technology is capable of performing	Intelligences that AI-based assistive technology cannot perform
• Linguistic – writing and speaking • Logical/Mathematical – algorithms designed to solve problems • Spatial – art creation; image recognition • Musical – recognizing notes and composing • Interpersonal – conversations with smart assistants	• Pedagogical – teaching others • Intrapersonal – engaging in metacognition • Existential – understanding themselves and the world around them

The inclusion of AI technology in the classroom can alleviate some aspects of a teacher's workload and can also benefit student learning and achievement. Some AI that is available as assistive technology can be chosen and "tailored to fit individual student rates and styles of learning . . . but not replace the work of human teachers" (Johnson, 2020, para. 17), because teachers are better equipped to determine which teaching methods will meet the needs of each student. Teachers can work with machine learning technology to solve problems and challenges, and when used correctly, it can help their students become better learners and members of society (Atlantic Re:think, 2018; HubSpot, 2017). The following video examines how AI has developed to deliver personalized experiences and what considerations should be made as this technology continues to advance.

Video: Advanced Infographic, Hot Knife Digital Media Ltd., 2017

A Vimeo element has been excluded from this version of the text. You can view it online here:
https://openeducationalberta.ca/educationaltechnologyethics/?p=34

Appendix A is adapted from Farrow's (2017) "Uncompleted Framework" (p. 103), which focuses on normative ethics in relation to educational research, and provides a summary of each section in this chapter. It can be used as a reference for the ethical considerations that teachers should make when using AI-based assistive technology with their students to promote enhanced learning experiences.

Full Disclosure for Using AI-Based Assistive Technology in Educational Settings

Identifying Assistive Technology Tools

Teachers are constantly searching for methods to enhance students' educational experiences, because all students have different requirements for their learning. Teachers often use digital technologies to give students access to various resources and materials to help them succeed and to support their diverse learning needs (McRae, 2015). Since assistive technologies are available for all students, these tools can engage students and assist teachers in meeting curricular goals, allowing them to be easily integrated into classroom environments (Sturgeon Public Schools, 2019). The majority of current educational artificial intelligence is provided through various software formats, making this technology more manageable and accessible in school settings (Zeide, 2019). Assistive technologies that use AI can also "significantly enhance student learning compared with other learning technologies or classroom instruction" (Holstein et al., 2018, p. 155), making them effective at improving student achievement. There are many different types of AI-based assistive technology, including applications (apps), extensions, and web-based programs; this allows students and teachers to choose the ones with which they prefer to work. Examples of these tools are identified in Figure 1.1.

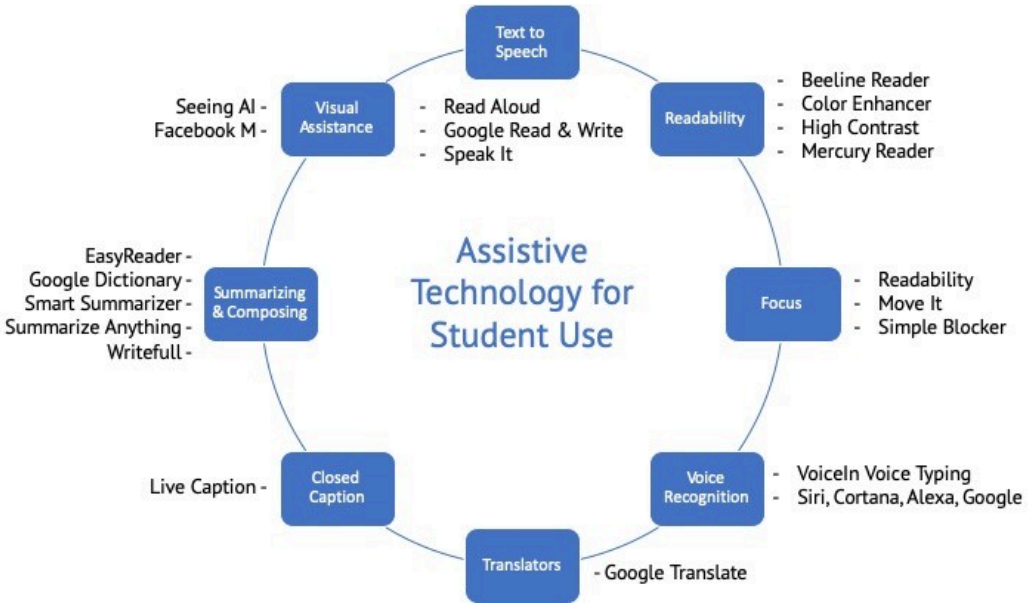

Figure 1.1 Various options for assistive technology to direct personalized learning. Created by K. Kerr (2020).

All classrooms are diverse in the teaching and learning that occurs within them, and each one is personalized in some way. The inclusion of assistive technologies is one method for diversifying instruction and creating personalized learning environments; however, these tools cannot function in isolation and depend on teacher support (Bulger, 2016). Although expert teachers may seamlessly find ways to utilize these assistive technologies to maximize learning and resources, educators should remember that most of these "products are not field tested before adoption in schools and offer limited to no research on [their] efficacy" (Bulger, 2016, p. 11). This notion can raise concerns about how student data is being used or manipulated, and there is debate around the inclusion of AI-based assistive technologies in the classroom; while they have the "potential to revolutionize learning" (Bulger, 2016, p. 3), there is uncertainty regarding

whether or not they can improve educational experiences and student achievement. As a result, AI-based systems should undergo more rigorous trials before being used in education, there should be standards in place for auditing AI systems, and ethical codes for using AI should be held to a high standard of accountability (Regan & Jesse, 2018). Teachers could also examine the following circumstances in which ethical concerns increase when using personalized learning systems:

1. Teacher control or understanding of the program, app, or extension decreases
2. Integration of the data collected by the company and classroom activities increases
3. The type and amount of student data collected by the company increases
4. Any data is used to refine software programs (Regan & Jesse, 2018)

Connecting with Policies and Procedures

School divisions in Alberta have policies and procedures that identify the need for students to have access to technology through networks and devices, with the main goal being to enhance learning through curricular connections. Many school divisions within Alberta are revising policies and procedures that are outdated or insufficient, to account for continually evolving educational environments that incorporate technology to enhance student learning (Wild Rose School Division, 2017). This acknowledgement is significant because of the ongoing modifications that could be made to accommodate these changes in technology and the ways in which technology can be used in educational settings. In some cases, school boards wish to collaborate with innovators in the technology sector to enhance the integration of technology in education (Edmonton Public Schools, 2020b). School divisions should ensure that student and staff security and privacy is maintained, and that data collection and usage is transparent, while integrating the use of technology. In doing so, school divisions are validating that their intention is to provide authentic experiences and to inform users out of respect for those using personal or division-approved devices within the classroom. This strategy could also imply that any assistive technologies permitted for a division's use are scrutinized prior to their introduction, but that those chosen by a classroom teacher may not likewise be approved. As a result, teachers who choose a variety of assistive technologies for their classrooms may want to ensure that students and parents are fully aware of any privacy or security issues that could arise.

Students are also learning strategies they can use to protect their personal information and to maintain their safety when using division technology. This approach promotes independence and integrity in students as they become more responsible for their own digital undertakings. The incorporation of a variety of assistive technologies in the classroom promotes "ongoing support and opportunities for students to demonstrate their achievement" (Edmonton Public School Board, 2020d, Expectations section, para. 8), which is why teachers may find their inclusion beneficial. Since no students learn in exactly the same manner, teachers may want to apply their professional judgement to the various assistive technologies they choose to use with students. This judgement often involves ethical considerations that promote positive consequences within the classroom, such as allowing students to learn in a way that best suits their needs and experiences.

Teachers Using Assistive Technologies

The use of technology to enhance planning, support teaching, and improve assessment is also supported by policy, and could be a component of appropriate standards of practice for teachers in Alberta (Edmonton Public School Board, 2020c). Assessment policies often identify that assessments should be bias-free, "respectful of student differences, and reflective of the diverse student population" (Edmonton Public School Board, 2020d, Purpose section, para. 1, 3).

Assessments that improve instruction to enhance student learning are part of responsive and ethical teaching, and this endeavour could be supported by the use of AI-based assistive technologies. Teachers can use these types of programs to grade student work; however, these programs do not currently apply to higher-level thinking and analysis skills, which means that the amount of time spent on these assessments cannot yet be adjusted (Johnson, 2020).

The ethical implications of allowing a computer to grade an assignment in which critical thinking is necessary are much greater, given the subjectivity of most written responses. Teachers are responsible for ensuring fair and equal treatment of all learners. Since assistive technologies would remove subjectivity and grade a written response assignment from an objective perspective, students who apply the strategies that the program recognizes as exemplary could unfairly benefit (Barshay, 2020). When using programs that grade multiple choice questions, the amount of input required varies. Teachers can determine which program best suits their needs and meets ethical criteria. Programs that require minimal personal information may be the better ones to choose in order to protect student information. Teachers often need to create an account to keep a record of student names with their scores, item analysis, and answer keys for each test, but the decision whether to use the program could be made by teachers, based on the terms of service or privacy policy. Other programs require teacher-created questions to be entered directly into the program along with the keyed response, and students need to log in to answer the questions before receiving a grade. This log-in data may be used for the purpose of benefiting the creator, or it could be sold to third-party distributors; thus, teachers may want to verify where this information is going and share these details with students before engaging with this form of AI-based assistive technology.

Maintaining Privacy, Data Security, and Informed Consent when Using AI-Based Assistive Technology

Meeting Expectations

Teachers at all grade levels are expected to include appropriate digital technology to meet student learning needs (Alberta Education, 2018), which means that all teachers should become familiar with the questions, concerns, and "debates surrounding the security and privacy of digital data…as soon no future educator will ever be separated from its presence" (Amirault, 2019, p. 59). AI-based assistive technologies are similar to many other digital services in that they collect and store personal information. Attempts have been made to limit the length of time personal information is stored, along with maintaining security measures and refraining from selling information as part of a voluntary student privacy pledge (Congressional Research Service, 2018). Since educational assistive technologies are used with students who are minors, the concerns that arise over privacy, data security, and informed consent are ones that should be mitigated, but there are differing opinions on how educational technology companies could be held accountable (Regan & Jesse, 2018). Information collected about an individual should be minimized to include only information that is required for the intended purpose and outcome (Regan & Jesse, 2018). The collection of student data should then occur only for the purposes of promoting student engagement and achievement. Further, student data collection should commence only once the individual knows that it is occurring and they have consented to the data collection. In a study conducted by Beardsley et al. (2019), nearly 75% of students are "actively sharing personal data with peers, companies and, often, publicly," (p. 1030) even though the majority of these students "know they lack knowledge of responsible data management" (Beardsley et al., 2019, p. 1030). As a result, many students consent to the terms of use presented by a program or application without reading through the details contained within the document.

Teachers should ensure that students understand the consequences and outcomes they could experience when using assistive technologies in order to protect their privacy and data. Figure 1.2 displays the six privacy concerns teachers

and students should be familiar with prior to engaging with digital technologies. To help protect personal information, teachers could also ask questions about data collection and security, especially if this information is unclear. They would then be able to determine whether or not this data collection benefits instruction or whether it is intended for surveillance (Bulger, 2016). This strategy can help promote transparency in terms of data collection and privacy and the impact that it has on students using these educational tools.

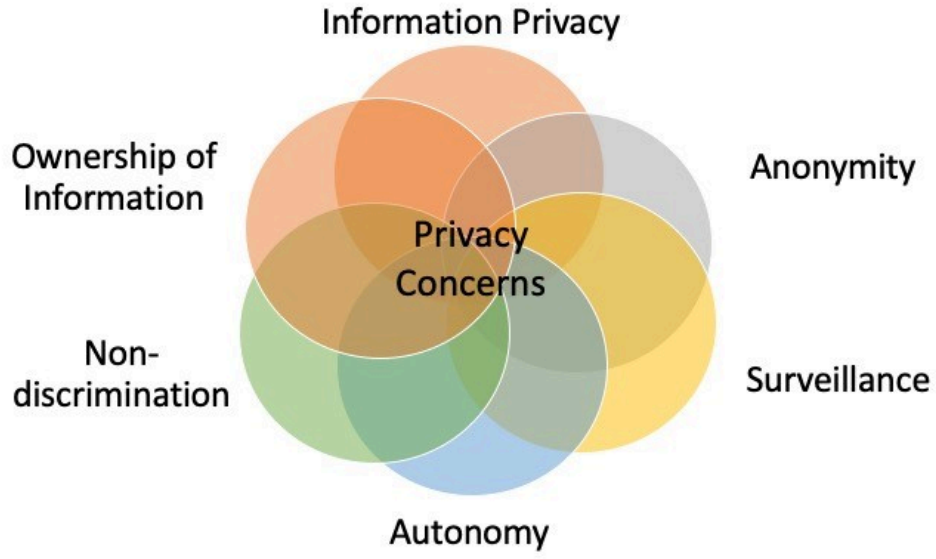

Figure 1.2 Six privacy concerns identified in Regan and Jesse (2018).

Tracking Information

Students are often interacting with AI-based programs in ways that reveal details about their responses to questions, how they process information, and their overall performance, and this collection may not attest to their achievement of learning outcomes (Bulger, 2016; Regan & Jesse, 2018). As a result, student information can be tracked in ways that do not enhance their educational experiences. Surveillance and tracking often require the collection of detailed information, which suggests that increased monitoring of students' activities, and the usage of data generated from those activities, could negatively affect student and teacher engagement with assistive technologies (Regan & Jesse, 2018). A risk associated with using assistive technologies that rely on AI is that a multitude of data is now available to track students and their progress, which could lead to a focus on performance numbers and could impede overall student engagement or call into question teacher performance and effectiveness (Bulger, 2016). This outcome would not be in the best interest of students or teachers, which is why tracking information through AI-based assistive technologies could be detrimental to student achievement.

Effects on Teaching and Learning

Digital technologies should be used to support teaching and improve learning outcomes rather than to determine teacher effectiveness (Bulger, 2016). When teachers provide access to AI-based assistive technologies for their students, teachers may want to consider how these technologies could be used to improve teaching strategies, and if, or how, other students could benefit from these various supports. When using assistive technologies, there is often a lack of

transparency and increased confusion over how data is collected and used, and who has permission to access this data (Bulger, 2016). If the information contained within the data can benefit student learning and achievement or benefit teaching strategies, then teachers should be able to access this previously collected data. Even though educational technology companies may intend to improve student achievement through data collection, biases can often exist or develop with AI technologies. Bulger (2016) mentions that "[d]iscussions of student data privacy address both data and privacy, but rarely focus on students, [and] the expectations and goals of personalized learning may not necessarily match the interests of students, parents, teachers, or even society" (p. 20). These concerns are valid, and teachers could decide which assistive technologies to use based on the goals for each student. If the benefits outweigh the downfalls, and allow students to develop skills that not only help them in the classroom, but in their personal lives as well, the assistive technology is likely suitable to use with students.

As much as teachers should be concerned about protecting student information when using assistive technologies in the classroom, there are some benefits to assistive technologies having this information. For example, while using predictive text or speech-to-text extensions, a student's preferences can be saved, and the assistive technology can develop to become more accurate based on the input it receives. This process can enhance educational experiences as learning becomes more personalized for each student interacting with assistive technologies. School divisions can also access this information to determine which programs, apps, or extensions should be permitted to use within schools and on division-monitored devices. Where possible, teachers should take precautions to "protect [students'] personal information by making reasonable security arrangements against such risks as unauthorized access, collection, use, disclosure, or destruction" (Freedom of Information and Protection of Privacy Act, 2000, p. 42). Although students and teachers have concerns about privacy loss in the classroom, student data will likely continue to be collected on devices that are owned by the school division (Regan & Steeves, 2019). Greater transparency should exist about the purpose of this collection to identify whether information is collected and maintained by only the school division to improve student learning, or if it is shared with educational technology companies to enhance their own programs (or both).

Security and Personal Devices

Students are often encouraged to bring their own devices to school, as they are typically more familiar with them, but when using assistive technology programs or apps that have to be installed on the device, students' personal information and data is likely much more accessible to educational technology companies. If students use their own devices, the privacy protection and security provided by school divisions may not exist to the same extent as it would if students were to use a device owned by the division; however, students who operate their own devices typically use the division's internet. This access often allows certain apps, webpages, or extensions to be blocked to protect student information, which helps minimize the risk of data and/or security breaches. Certain programs can also be installed to protect student data and privacy from being obtained by unauthorized companies or users.

When students use AI-based assistive technologies, the data they generate on their personal device is "transmitted to a company who collects and stores the data, [which is then] permanently retained and tied to [that] specific, identifiable individual" (Amirault, 2019, p. 59). Teachers should allocate time to review terms of use documents with students, and allow them to make the choice as to whether or not they wish to download and operate certain assistive technologies on their personal devices. If the language used in any agreements is unclear, teachers may wish to speak with someone from the school division's technology department to gain a better understanding. Teachers could then ensure that this information is clearly shared with students, using words they understand, so that they also know what they are consenting to prior to using assistive technologies. Teachers could also ask for parental input before moving forward. In order to ensure that consent is valid, a description of the potential risks and benefits should be presented in a manner that does not elicit a specific decision from those who could be affected by the use of these technologies (Beardsley et al., 2019; Miller & Wertherimer, 2011).

"Free" Usage and Data Collection

Many AI-based assistive technologies are free of charge for students and educators, but this unpaid usage may come at the cost of data collection (Beardsley et al., 2019). In the United States, "[w]ebsites that are collecting information from children under the age of thirteen are required to comply with the Children's Online Privacy Protection Act" (Bourgeois, 2019, p. 141), which means that they need to do all they can to determine the age of individuals who access their sites. If an individual is under the age of thirteen, parental consent must be provided before any information about the individual is collected. Teachers should be cognizant of the efforts that educational technology companies make to follow this compliance, and should be more concerned about apps, programs, or extensions that collect student data but do not make an attempt to determine the age of students accessing these tools.

Teachers should also be aware that many companies require users to opt out if they do not want their information to be shared; therefore, by agreeing to use their tools, implied consent has been given to data collection and sharing (Bourgeois, 2019). If the company owns student data and information, they can choose to use this information as outlined in a usage agreement. The question arises of whether or not educational technology companies "should be able to use data generated by students' use of their software programs to improve those programs" (Regan & Jesse, 2018, p. 173) and make students "test subjects for development and marketing of future edtech products" (Regan & Jesse, 2018, p. 173). Teachers should examine how student data is collected and used before allowing students to interact with AI-based assistive technologies in the classroom. In their review of educational technology companies, Regan and Jesse (2018) identified that "these companies are amassing quite detailed information on student demographic characteristics in their databases, as well as detailed information on student learning records" (p. 175). Although determining exactly which data points are collected and stored by companies who create programs, applications, or extensions for the purpose of assisting student learning could be challenging, teachers could review the details stated in user agreements to identify how data will be used before implementing them in the classroom. Figure 1.3 suggests questions that teachers could ask in regards to privacy and data security prior to engaging with AI-based assistive technologies.

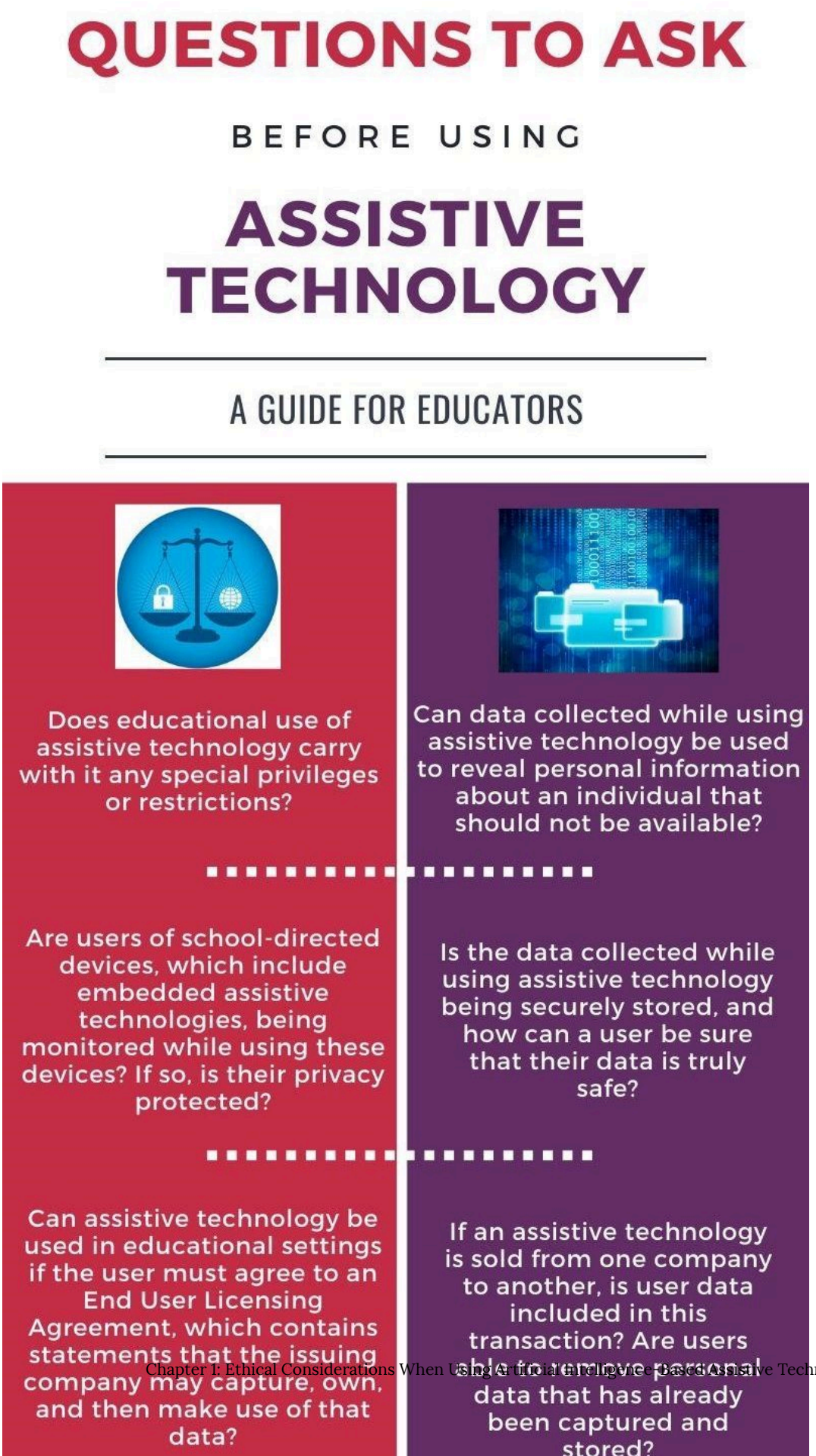

Figure 1.3 An infographic displaying questions for educators to ask before using assistive technology, as described in Amirault (2019).

Avoiding Harm and Minimizing Risk to Students Using AI-Based Assistive Technologies

Participating Anonymously

Students may wish to remain anonymous when using technology, to minimize risks that could bring them harm; however, AI-based assistive technologies need to collect some student information and data to support students in their learning, making anonymity difficult to procure. If students can use an assistive technology under a guest account, rather than creating a personal profile, this option may provide students with the anonymity they desire. Many Alberta school divisions assign students an account that includes their first and last name, followed by the school division's domain. Each time students log in to a division-approved device with these credentials or run a program, app, or extension on that device, their personal information is shared or accessed, whether by the division or by educational technology companies. When students choose to use personal devices, their ability to remain anonymous in the eyes of the school division may exist; however, restrictions put in place by the division, "meant to protect students are much harder—if not impossible—to enforce when [personal] devices are involved and students no longer need the school network for access" (Cramer & Hayes, 2010, p. 41). Students' private information may also be easily accessed by creators of assistive technologies when these tools are used on personal devices, if students do not have the proper securities in place. As a result, students could be harmed, as their personal details are being accessed.

Many students are unaware of strategies that exist to minimize their risks when participating in a digital environment (Beardsley et al., 2019). Teachers might want to discuss with students the details of their interaction with these technological tools, prior to having students sign up for assistive apps, programs, or extensions. Providing access to student information can be beneficial to student learning because the AI-based assistive technology knowledge base will continue to develop for each user as students engage with them; however, the benefits should outweigh the downfalls and minimize the risk of data or security breaches that could negatively impact students. The recommendation could also be made that neither teachers nor students create a personal profile for the purpose of using AI-based assistive technologies, unless the tool is supported by the school division, or the creation of a personal profile has been authorized by the students' parents or the students themselves (Regan & Jesse, 2018). Students would still be able to benefit from the use of AI-based assistive technologies without the creation of a personal profile, but the personalization features that these tools are known for may decline. Students would also then have a greater level of protection when working with these online programs, apps, or extensions.

Recognizing Biases

AI-based technologies may be able to remove educator biases in regards to assessing student work, but there is still the potential for biases to exist and be unknowingly embedded by the developers of the technology, which can affect the way AI-based assistive technologies evolve (Regan & Jesse, 2018). These biases could include suggestions for other assistive technologies that are available for students, which could impact students in ways that discriminate based on various personal attributes, or those that are less obvious; therefore, these biases have the potential to put students and their personal information at risk. If students are profiled or tracked as a result of developer biases, and if student information is used in ways that are not transparent or are not beneficial to student learning, teachers may need

to decide if the benefits of using the technology are worth the risks, and, if so, how these risks can be minimized (Regan & Steeves, 2019). In order to "use these systems responsibly, teachers and staff must understand not only their benefits but also their limitations" (Zeide, 2019, Promise and Perils section, para. 8), and clear procedures should be in place when discrepancies arise between assistive technology recommendations and teacher professional judgement. This recommendation suggests that teachers should be aware of the benefits and consequences of AI-based assistive technologies, and the extent to which students could be impacted, while ensuring that their own biases are not coming into play when determining what is best for their students. Along with biases related to assessment, teachers could also have biases regarding the assistive technology programs, platforms, or developers that they choose to use, in spite of the availability and accessibility of other options that could better support student learning. Teachers could spend time engaging with a variety of technologies before allowing students to do the same, in order to examine the potential consequences of various assistive technology tools. Although this process can become time consuming, it can also minimize or eliminate unwanted risks to students.

Another concern arises when educational technology companies gain influence over the individuals who engage with them (Popenici & Kerr, 2017) by providing limited options for assistance. This challenge is even more significant when students – who are typically minors – become influenced by these technological tools. Teachers should consider this shift in authority, as educational technology companies are often not held accountable for their biases toward student learning and the ways in which their assistive technologies support students' educational experiences (Zeide, 2019). As a result of educational technology company biases and possible motivations to benefit the development of their programs, students could be using AI-based assistive technologies in ways that do not benefit their learning and instead make learning and achievement more challenging. Before teachers choose to include assistive technologies as supports for teaching and learning, they may want to consider the notion that students are not volunteering to provide analytics to educational technology companies, and they could consider whether or not the technological tools might work against student learning (Regan & Steeves, 2019). Either of these scenarios could place students' personal information at risk and be detrimental to their learning experiences.

Are the Risks Worth the Rewards?

As with most teaching and learning strategies, teachers are asked to determine whether the benefits are greater than the detriments prior to introducing new strategies as part of students' educational experiences. Provided that teachers have made this decision to the best of their abilities and in the best interest of the students, the benefits that can result from the incorporation of AI-based assistive technologies can be significant. Some of these include "more sophisticated analyses of student learning and testing, more personalized learning, more effective delivery of educational materials, improved assessment, and more responsiveness to student needs" (Regan & Steeves, 2019, "Tech Foundation Activities" section, para. 1). Many assistive technology tools can create these outcomes, as long as procedures are in place to protect students from damaging situations that could arise while using these tools.

Allowing for Student Autonomy and Independence when Using AI-Based Assistive Technologies

Considering Student and Teacher Choice

When students use AI in the form of assistive technology, they should be encouraged to set their own educational goals, which would allow them to advocate for themselves and to take more responsibility for their learning. Assistive technology tools are likely to become more effective when students use them to achieve these educational or learning goals, and students are able to become more autonomous when they act in an intentional manner and understand their choices (Beardsley et al., 2019). Teachers can provide many different options in terms of the assistive technology tools that are available, but the usage of these tools should not be mandatory if one objective is to promote student autonomy. Students should also be able to make choices for themselves regarding the assistive technology tools they choose to use, so that greater autonomy can be supported (Regan & Steeves, 2019). One form of AI-based assistive technology may work very well for one student, but may not provide the best assistance for another student. As a result, students should be allowed to voice their concerns about the tools that are offered and then be able to choose the one(s) that will help them achieve their goals.

Holstein et al. (2019) mention that "[i]f new AI systems are to be well-received in K-12 classrooms, it is critical that they support the needs and respect the boundaries of both teachers and students" (p. 166). Not only should students be given the choice of which assistive technologies they use; teachers should also be able to have their voices heard regarding which assistive technologies could be supported and utilized by their school divisions. Teachers regularly make decisions regarding which tools will best enhance their teaching practices and which will provide the best learning opportunities for their students, so leaving the decision about which technological tools to use in the hands of those who are not in the classroom may provide less than mediocre educational experiences. The ability to decide how much integration of these tools is necessary to benefit both student achievement and teacher roles and responsibilities should also be controlled by classroom teachers. Since teachers know how best to meet the needs of their own students, they should be permitted to find a balance between over- and under-automation and autonomy within their classrooms, which is reflected in Figure 1.4.

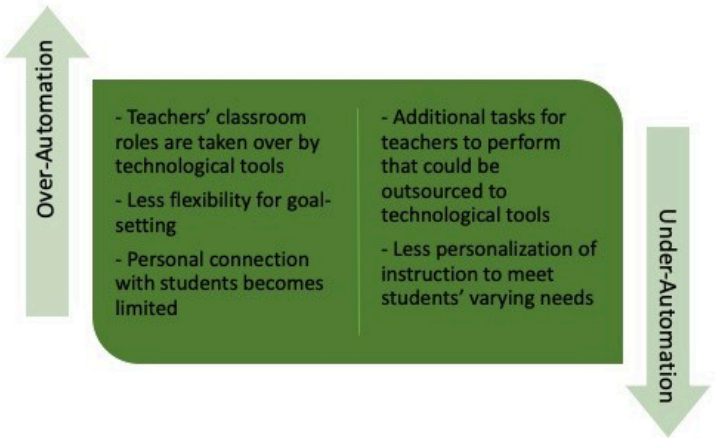

Figure 1.4 An infographic demonstrating the balance between automation and autonomy, as described in Holstein, McLaren and Aleven (2019).

Promoting Independence and Participation

Many AI-based assistive technology tools make recommendations for students based on how others with similar data profiles previously performed (Zeide, 2019), which suggests that students could be manipulated easily by these technologies. Understanding how assistive technology tools make these determinations is not knowledge that could be acquired easily by teachers and students. Consequently, teachers and students should be encouraged to work with assistive technology tools that promote self-interest and avoid unfavourable outcomes (Regan & Jesse, 2018). The opportunity to act in such a way would further promote student independence and may lead to students engage with AI-based technologies outside of the classroom in a much more comfortable and confident manner (Cramer & Hayes, 2010). The skills students learn while using these tools could also increase student participation and engagement with AI-based assistive technologies. Improving teacher and student understanding of how these technological tools operate can promote higher-level thinking and achievement, and can empower teachers and students with more knowledge to help them as technology continues to evolve (Milanesi, 2020). When students use assistive technologies to help them achieve their educational goals, they can receive assistance from both the technological tool and the teacher, which can further encourage active participation and support varying student needs.

Conclusion

As technologies that use a form of artificial intelligence become more prevalent in society, the education system could see a marked increase in the inclusion of AI-based technologies in the classroom. Assistive technologies that use a form of AI may increase student engagement more than assistive technologies that do not include an AI component. Many programs, apps, or extensions that constitute AI-based assistive technologies do not undergo rigorous trials before being implemented in schools, so teachers and students are often test subjects for educational technology companies that design and administer these tools.

Technology inclusion is becoming an increased priority in many school divisions, so the maintenance of teacher and student privacy and security when interacting with AI-based assistive technologies should be a primary concern. Student information that is collected or shared with educational technology companies should be minimized, and should only include information that allows for improvements to be made to student engagement, learning, and achievement.

Teachers can help students protect their personal data by ensuring that personal profiles – to which educational technology companies have access – contain as little identifiable information as possible. Parental support for the use of assistive technologies could also be obtained, and school divisions could generate student log-in information that does not expose students' identities. Students using personal devices should take additional measures to ensure that their privacy and security is maintained. If student performance or information is tracked by school divisions or educational technology companies, teacher effectiveness could be questioned, and biases based on profiling could prevent students from achieving to the best of their abilities.

Allowing students to choose the assistive technology tools that could help them achieve their educational goals can promote greater independence and autonomy. When students can act in ways that promote their self-interest and help them achieve success, they are more likely to become engaged with technology and to have a better understanding of how it can assist them in their lives beyond the classroom. Respecting student boundaries and limitations when working with technology is important, as is allowing teachers to invoke their professional judgement when identifying the assistive technology tools that work best for their students and in their classrooms. Before implementing assistive technologies that operate with a form of artificial intelligence, the benefits to student learning should be clear, along with the potential drawbacks to teaching and learning that could result.

Questions for Future Research

- As teachers and school divisions gain valuable knowledge about the intentions of educational technology companies, should more control be given to learners and educators to make decisions about which AI-based assistive technologies are best for their own learning experiences?
- Considering the breadth of assistive technologies that are available, should school divisions or other educational bodies create a list of approved assistive technologies for teachers, in order to prevent teacher burn-out or lawsuits due to misuse?
- Many teachers are not experts in every educational technology used for learning, so in what ways can professional learning for teachers align with the ever-evolving world of AI in education?
- As AI continues to advance, what expectations will arise regarding the use of AI technology to run assistive programs, applications, or extensions in educational settings?
- In what ways can school divisions and educational technology companies provide greater transparency about the amount and type of data they collect, along with how/why it is collected and how this data is used?
- In what ways can teachers and students be empowered to make decisions about the collection of data, and also to challenge the data that has been collected on them?

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Appendix A

Table 1.2 Completed ethical framework for using artificial intelligence in the form of assistive technology for teaching and learning, in relation to normative ethical theories, based on Farrow's (2016) *Uncompleted Framework*

Principle	Duties & Responsibilities (deontological theory)	Outcome (consequentialist theory)	Personal Development (virtue theory)
Full disclosure	• To provide access to assistive technologies and understanding the breadth of what is available. • To understand the benefits and drawbacks of the technology prior to implementation. • To ensure that students know and understand how to use the technology. • To allow students to choose whether or not to use assistive technologies.	• Meets the educational needs of all students. • Makes learning personalized. • Differentiates instruction. • Data may be used by third party developers.	• Allows students to learn in ways that best suit their needs. • Promotes skill development for the 21st century. • Allows students to take learning into their own hands. • Teachers become technology navigators by deciding which ones to use. • Promotes continuous learning/professional development for teachers.
Informed consent	• To use language that is easily understood to clearly identify how students could be affected by using the technology. • To allow students to decide whether or not they want to use assistive technologies based on user agreements.	• Gain ability to determine the potential risks or rewards of using assistive technologies. • Decide whether or not the benefits are worth the potential risks or concerns. • Gain a better understanding of user agreements.	• Allows students and teachers to transfer their knowledge of user agreements to situations and experiences outside of the classroom. • Allows students and teachers to become familiar with jargon used in agreements.
Privacy & data security	• To identify whether or not personal information is being collected, stored and/or shared. • To become critical of educational technology companies that do not attempt to identify students' ages. • To ensure that information is collected to benefit student achievement and learning outcomes.	• Allows for further personalized learning with the program/app/extension. • Enhances availability of assistive technologies. • Storage and sharing of data may include biases. • Details of data collection or usage may be unclear. • Privacy and security breaches may occur and personal information may be distributed	• Allows students and teachers to become more aware of their online presence. • Allows students and teachers to decide what personal information to provide once intentions are identified and are considered valid. • Promotes scrutinization of agreements students and teachers could enter into with other companies.

Avoid harm/ minimize risk	• To understand the intentions of the educational technology company that created the assistive technology in terms of developing and promoting student learning, and in terms of collecting personal details. • To help students protect themselves through limited sharing of personal information.	• Student information is often shared with the school division while students are using assistive technologies at school, regardless of whether or not they want their information to be accessed. • Student information can be accessed by the educational technology company and used in ways that students and teachers may not clearly understand. • Biases in the programming of AI-based assistive technology can prevent students from achieving to their full potential. • Student learning and engagement can benefit when students and their information are not put at risk.	• Allows students to become aware of the information they share online. • Students can become better learners in and out of the classroom, with tools that they know are safe for them to use and access
Respect for participant autonomy	• To ensure that students know that they can choose to use, or not use, assistive technologies to enhance their learning. • To identify that students will not be penalized should they choose to opt out of opportunities to use assistive technology.	• Participation with AI-based assistive technology benefits student achievement through additional opportunities for students to become engaged in their studies • Should students choose not to participate, they may not see a benefit in their educational experience.	• By using assistive technology, students can learn more about themselves as learners. • Students can contribute to and take control of their own learning opportunities. • Skills students learn in working with AI assistive technology can transfer to other areas of their lives, which can benefit them beyond their educational experiences.
Integrity	• To provide access to AI-based assistive technologies that promote learning and achievement. • To ensure that biases for personal benefit are minimized, whether from the educational technology company that created the assistive technology tool or from the teacher or school division implementing the use of these tools in the classroom.	• Students' educational experiences become more engaging with the integration of AI components. • Students become more prepared for a technological future. • Learning occurs in and out of the classroom while integrating AI-based assistive technology into their lives. • Students become more critical of the intentions of educational technology companies.	• Students are more likely to understand acceptable standards of practise when using assistive technologies. • Students can use their critical analysis skills to determine the intentions of educational technology companies that incorporate the use of AI within their personal lives. • Students can share this knowledge with others to promote informed user engagement with AI-based assistive technologies.

Independence	• To allow students to access AI-based assistive technologies when they choose the access or find it worthwhile. • To accept suggestions from students for different assistive technology options. • To encourage students to use assistive technologies outside the classroom to become more comfortable with them.	• A greater variety of assistive technologies may need to be explored by teachers to ensure their usage is appropriate. • Teachers may need to be more in control in the beginning to help students make appropriate choices, but then their role would change as students become more comfortable with usage. • Students may not have access to these tools outside of the classroom.	• Students develop their abilities to work with AI-based technologies and may become more comfortable working with these technological tools. • Students have their voices heard and know that their suggestions are valued, promoting greater participation and confidence. • Students become more likely to advocate for their learning needs and preferences.

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Chapter 2: Beware: Be Aware - The Ethical Implications of Teachers Who Use Social Networking Sites (SNSs) to Communicate

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Author Note

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Introduction

As teachers strive to build productive and positive relationships with their students, parents, and colleagues, they may employ different techniques to do so. The main reason behind developing effective relationships with these stakeholders is to put students at the forefront of authentic learning. It is recognized that strengthening relationships with parents, students, and even colleagues can be one way to support student learning (Alberta Government, 2018). One of the most critical ways to foster strong relationships is through effective communication (White, 2016).

Teachers are tasked with sharing a multitude of information from events, field trips, and student learning progress to professional learning opportunities and resources. Known as command communication (White, 2016), teachers communicate "in clearly prescribed ways" (p. 70) using tools such as email, websites, and newsletters. As White (2016) points out, "[w]ritten communication is probably the most efficient and effective way teachers provide clear information" (p. 70). Teacher communication is not limited to the command function, but also to a relational function, which is the "basis of effective learning relationships and enables the development of communities of practice, dialogues, and fusions of horizons" (White, 2016, p. 71). Teachers can communicate with both functions to "maximize sharing of information and understanding" (White, 2016, p. 70). This can be challenging to accomplish, but with the integration of technology, teachers build relationships and communities, encourage dialogue, share information and overcome the barriers of time, distance, and even languages. Social Network Sites (SNSs), such as Facebook, Instagram, and Twitter, lend themselves as a platform to achieve strong teacher communication to build and strengthen relationships.

Table 2.1 ***Common social networking sites and their uses*** **(SNSs).**

Facebook	Users connect and share various media, such as text and pictures, with followers, who are known as 'friends' online. Friends can comment on user posts.
Twitter	Users post 140-character messages (tweets) to followers. Tweets can be commented on and shared. Private messages are also available.
Instagram	Users share with followers photos and videos that can be commented on and shared. Altering or filtering is a common practice by users.

Ethical Considerations of SNSs Use in K-12 Classrooms

This innovative use of SNSs creates ethical dilemmas for educators. From the lens of a consequentialist approach, "teachers are in a difficult position of trying to innovate in their classroom using SNSs while at the same time being conscious of the risks" (Henderson, et al., 2014, p. 2). This chapter will navigate the ethical implications teachers face when using SNSs to communicate the learning that happens in their classrooms.

The framework for teachers using SNSs for communication, adapted from Farrow's (2016) OER Research Hub project, identifies the three normative ethical theories and highlights considerations for teachers who do engage with SNSs for communication purposes (Table 2.2). These ethical perspectives attempt to guide how teachers and students can and should behave, which rules and procedures they should adhere to, and which beliefs and values teachers should have (Farrow, 2016). SNSs used in the classroom context can be powerful, but what are the implications of balancing the pressure and desires to use social media for communication from our colleagues and parent community with the ethical expectations of the teaching profession?

Table 2.2 Completed framework for teachers using social media networking sites for communication, in relation to normative ethical theories based on Farrow's (2016) *Uncompleted Framework*

Principle	Duties & Responsibilities (deontological)	Outcome (consequentialist)	Personal Development (virtue)
Full disclosure	• Teachers have a responsibility to follow ATA Code of Conduct, FOIP, and their district's policies when sharing classroom and student information. • Teachers could share with parents and students the purpose, methods, and intended use of the social media platform.	• Parents may opt out of their child being displayed on social media. • Teachers should consider a student's and parent's perspective and allow them to have a voice when the teacher uses social media for classroom purposes.	• Teachers are accountable to be aware of current policies and legalities. • Teachers are responsible for providing a culture of care. • Develops a professional learning network for teachers, students and parents.
Privacy & data security	• There are legal implications for protecting student data. • Read and understand Privacy Policy and Terms of Service of chosen SNS. • When required, obtain consent.	• When interacting with SNSs, a digital footprint is created. • Whether SNS are used personally or professionally, users should consider all posts public.	• Teachers' digital presence is in line with the virtue of being a teacher. • Two options: ◦ One profile for personal and private life. ◦ Two profiles – one private and one public.
Informed consent	• Teachers have to ensure consent from students and parents before posting content that may be identifiable.	• Students & parents have the ability to request posts to be removed and request be honoured. • Due to the changing nature of SNS policies and cultural practices, teachers should consider asking for consent on a regular basis.	• When seeking consent, there is an opportunity to have more forethought before posting. • Students have the opportunity to create their own PLN.
Integrity	• All students have the opportunity to develop their online communication skills and not just for the students who can afford to access from home. • Consider context when communicating online, teachers, students and parents	• Teachers can model communication, digital citizenship and literacy skills. • Teachers should recognize that not all may be able to participate due to financial limitations of affording technology.	• Respect and allow for diverse experiences. • Teachers have in loco parentis.

Avoid harm/minimize risk	• Due to "in loco parentis" teachers have the same rights and responsibilities as the parent and should act accordingly. • Consider that any activity on social media is public.	• As teachers aim to maximize the benefits of using SNSs as a form of communication, they should also take measures to minimize the potential risk of harm to themselves and those they interact with. • Set and share expectations with parents and students.	• Consider that any activity on social media is public, so associate with groups/ individuals that are suitable. • Professional 24-7. • Create and maintain expectations.
Respect for participant autonomy	• Teachers may be directed to use SNSs, but may have the choice of which platform. • Teachers ensure that parents and students can access communication via technology or not.	• Teachers ensure that they minimize the impact on student's digital footprint. • Teachers ensure that students and parents have opportunities to participate in posting content on SNSs.	• By using SNSs, users can connect, create and share knowledge with a larger community.
Independence	• Teachers can control what they post and how often. • Students can contribute to class SNSs content.	• Parents who don't want to communicate via social media may want the information in another modality. • Teachers should consider Equity of Access and how it creates and removes barriers.	• Students are exposed to digital literacy and citizenship skills that can be transferred out of the classroom experience. • Teachers influence online identities.

Full Disclosure

As teachers join the growing movement of using SNSs for their classroom communication (Auld & Henderson, 2014), there are expectations placed on them by their principal, districts, and professional bodies. Even though not explicitly defined, these expectations contain Nias' (1999) six components of a culture of care, which include: being affective, responsibility for learners, responsibility for relationships in the school, self-sacrifice and obedience, over-conscientiousness, and identity (Figure 7.1). Teachers who use SNSs should employ a due culture of care to ensure that they meet the professional expectations placed upon them. This culture of care should include an evaluation of the consequences of using SNSs, followed by the disclosure of the consequences and pertinent information to the parties involved, including parents, students, and colleagues.

Figure 2.1 Six components of culture of care, as described in Nias (1999).

Luckin et al. (2009), as cited in Howard (2013), suggest that "[t]o facilitate effective use of Web 2.0 technology in the classrooms, teachers are encouraged to be willing to embrace risk and to consider small ways of navigating existing cultures and reframing old contexts to incorporate new ones" (p. 44). As teachers transform the purpose of SNSs to fit their classroom contexts, they should consider the notion of full disclosure, which is when the teacher makes all information and facts known (Oxford University Press, 2019). The following section will examine two components to this disclosure: teacher communication expectations and the use of personal learning networks to share and co-construct knowledge.

Teacher Policies and Procedures

Regardless of whether or not a teacher participates in SNSs, there are policies and procedures to which they must adhere to as a member of a professional association, not only for their own professional protection but also for the protection of colleagues, students, and parents. By following the specified policies and procedures for communication, teachers meet the aspects of a culture of care.

Teachers in Alberta, for example, are required to follow the ATA Code of Conduct, the Teaching Quality Standards, Freedom of Information and Protection of Privacy Act, and their own district's Administrative Procedures. These guiding documents define what data and information teachers have access to, who can provide permission to use the platform, and how they can use it to support the learning that happens in their classrooms.

Due to the openness and highly connected nature of SNSs, teachers should communicate to parents, students, and colleagues (including administration) which SNSs they are using and their purpose for using those platforms. As well, teachers should notify stakeholders what they will be posting, before they post it. This will give parents and students

opportunities to have input and the ability to give or refuse consent. As Henderson et al. (2014) point out, "teachers should be aware that this consent might need to be renegotiated at regular intervals" (p. 3). Auld and Henderson (2014) also argue that teachers have the responsibility to ensure that students (and parents) want their own virtual identities to be made public when using SNSs as a tool for communication. As students or parents comment on a post, they are at risk of exposing their online identity which they may not have considered.

Sharing and Co-Construction of Knowledge Through Personal Learning Networks (PLNs)

Many professionals have been adapting and adopting various emerging practices, such as using SNSs, to network, share, and co-create knowledge (Veletsianos, 2016). Teachers may find themselves using SNSs in the classroom for the same purposes, while guiding students in developing the skills to participate effectively in Personal Learning Networks (PLNs). "Research that suggests that such platforms can facilitate the shared construction of knowledge and peer interactions that support learning adds to the perception that SNSs, such as Facebook, could be a catalyst for classroom engagement and collaboration" (Howard, 2013, p. 43). Whether it is a teacher's own PLN with other professionals or a student-based PLN, teachers should disclose what they, themselves, are gaining from integrating SNSs as a modality. As Auld and Henderson (2014) identify, "[t]eachers need to consider what the implications are for co-inhabiting spaces that are designed to connect people and share information" (p. 199); however, disclosure of benefits should not be limited to the teacher viewpoint. Emphasis should also be placed on the student viewpoint. What does the student have to gain or lose by participating in a PLN via SNSs? What opportunities and guidance will students (and parents for that matter) have to participate in PLNs? What opportunities exist to be part of a PLN if parents do not want to use SNSs? These are all aspects of full disclosure that teachers should consider and communicate.

As teachers disclose the purpose for using SNSs in their classroom practice, they should consider the six aspects of the culture of care. By keeping these practices student-centred, the argument could be made that the choices the teacher is making to build relationships and enhance communication are inherently good. By having an environment that is built on full disclosure, teachers will continue to build "a sense of community, people-making, and dialogue" which is foundational to school-family partnerships (White, 2016, p. 69).

It should be recognized that full disclosure should not be limited to the intent and should also include other considerations such as privacy and security. The next section will explore these elements and the ethical dilemmas they create.

Section 2: Privacy, Data Security, and Informed Consent

When it comes to the role of the teacher, and protection of privacy, evolving technology has created a need for privacy and security awareness. As mentioned in the previous section, teachers must follow various policies and procedures, such as the Freedom of Information and Protection of Privacy Act (FOIP) [New Tab] (Alberta Teachers Association, 1999), which is a legally binding document and mandatory. In this particular act, "the privacy of students and parents is protected by rules that school [administrative procedures] must follow in the collection, use, protection and disclosure of personal information" (para. 4). While engaging on SNS platforms, teachers may expose themselves, students, and parents to breaches of privacy and careless consent to the collection of data. In their paper, Regan and Jesse (2019) explored the ethical concerns of privacy in 21st-century learning and identified six distinct ethical concerns. The following section will explore three of the six privacy and data security concerns when teachers post and share content on SNSs.

Information Privacy

When posting any content online, there is exposure and formation to one's identity. Regardless of whether a teacher creates a digital identity to connect with PLCs, share lessons, or celebrate the connections in the classroom, there is a tension between confidentiality and transparency. Teachers may carelessly expose themselves, parents, and students to the collection of data.

Teachers can enlist proper attitudes that help limit exposure. Summarized by Regan and Jesse (2019) as, "notice, consent, choice and transparency" (p. 170), when posting any information online, teachers are responsibility to those parties involved (students, parents, colleagues, etc.) to communicate the purpose and content of the post, to seek consent, and to allow those involved to choose what is posted or to be removed from the post, and to be able to see the post after submission.

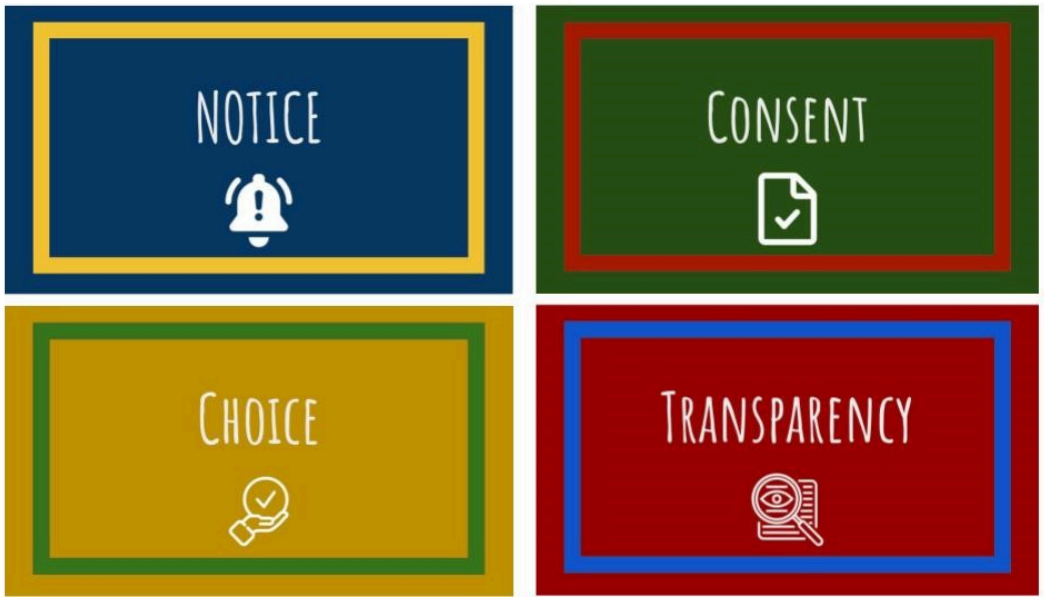

Figure 2.2 Attitudes to limit exposure of privacy, as described in Regan and Jesse (2019).

Ownership of Information

Once content is posted, who owns the post and its contents? The answer depends on the SNS platform and its privacy policy. When looking at a privacy policy, or reading the terms of service before clicking accept, one may notice that these are long and complex documents. Readers can become lost in jargon, and, as a result, users accept the agreements without becoming aware of critical information, such as data collection and ownership of information. For example, Facebook's Privacy Policy [New Tab], which also includes Instagram, explains ownership of information.

According to Facebook (2019), "you own the intellectual property rights (things such as copyright or trademarks) in any such content that you create and share on Facebook" ("Your commitments" section); they go on to identify that if users share, post, or upload content, Facebook is granted the permissions to use, distribute, modify, copy, and create derivative products of the content. If a teacher posts a picture of students working in the classroom, the teacher has given Facebook and Instagram the ability to "store, copy, and share it with others" (Facebook, 2019, "Your commitments" section) based on the privacy settings. Even when parents grant permission to use photos of their child, they may not understand that the child's photo may be used by third-party companies, based on the SNS platform. Students should

be consulted when their work will be posted on SNSs, as they own the intellectual property rights to their content, and they may not want to give those platforms the ability to remix and reuse their work.

> Part of learning is adapting to the changing methods of communication. Engaging in digital environments can promote learning, teaching and collaboration for students, staff and parents. The very nature of SNSs introduces a potential lack of personal control of content and dissemination of content. Due care and attention is required to safeguard privacy. (Elk Island Catholic Schools, 2019, para. 1)

Understanding the agreements of SNS platforms is crucial to effective communication practices. Some may consider the practice of deleting the content after the school year is over, as those students move on to another classroom; however, teachers should be aware of the adage 'once online, always online.' Facebook identifies that if the content is deleted by the user, it will be removed from Facebook's systems, though it may exist elsewhere (2019). As Molnar and Boninger (2015) point out, "[e]ducators are obliged not only to learn how student data may be gathered and exploited but also to develop privacy policies that protect their students from such exploitation" (p. 8).

Surveillance – AI

It would be naive to believe that one's online presence is not tracked in some form or another. "Tracking software also records adult behaviour on the Internet, of course, although many adults may be unaware of it. Since educators are, however, responsible for the children entrusted to their care, they cannot afford to be uninformed about potential threats to student privacy" (Molnar and Boninger, 2015, p. 8). As soon as a teacher engages with SNSs, there is surveillance of their activity and that of the users to whom they are connected. For example, as soon as the student does connect to the content posted on the teacher's SNS, marketers can track the student's online activity and direct ads to that student (Molnar and Boninger, 2015, p. 7).

Even as teachers consider information privacy, ownership of information, and surveillance, they may still fail to protect all invested parties' privacy. A common phenomenon exists known as the Privacy Paradox. First discussed by Barnes (2006), the Privacy Paradox identifies that there is a contradiction between online behaviour and privacy concerns (Table 2.3). The research conducted by Dienline and Trepte (2014) showed that people on SNSs "engage in self-disclosing behaviours that do not adequately reflect their concerns" (p. 285). "Despite privacy concerns, users, most of the time, fail to protect their privacy within SNSs, thus putting themselves and other users at risk" (Sideri, et al., 2017, p. 79).

Table 2.3 *Barnes (2006) observed 4 phenomena related to the Privacy Paradox.*

4 Privacy Paradox Phenomena of Social Network Sites
1. Large quantity of information disclosed online
2. The illusion of privacy
3. Discrepancy between context and behaviour (even when known to be public, act like SNSs are private)
4. Users' poor understanding of data processing actions by online businesses

Knowing the phenomena, teachers can act in an ethical manner that ensures the protection of privacy to the best of their ability. Prior to the first post, teachers should read the privacy policy and terms of service of their chosen platform. They can then act according to what they are comfortable with and what is best for all users involved in the

communication. Also, informing parents and students of the terms and allowing them to create their own limitations of content to be posted, would reduce the breach in privacy and data collection from the post.

In the end, even with instilled practices to limit the accessibility of data or enable privacy features, these features may dissolve at any point, leading to the risk that the content become public (Auld & Henderson, 2014). It is this point that leads to the exploration of what the teacher can do to maintain educational integrity by avoiding harm and minimizing risk.

Educational Integrity by Avoiding Harm and Minimizing Risk

When parents send their children to school, they entrust educators to provide quality education while ensuring that their child is cared for and protected. Known as *in loco parentis*, the teacher is in place of a parent and is given the same rights and responsibilities (Law Now, 2019). In Alberta, according to the competencies in the Teaching Quality Standard (2018), teachers are expected to "recognize that the professional practice of a teacher is bound by standards of conduct expected of a caring, knowledgeable and reasonable adult entrusted with the custody, care or education of students" (p. 3). When teachers engage in posting on SNSs, this care should still be practiced. As teachers aim to maximize the benefits of using SNSs as a form of communication, they should also take measures to minimize the potential risk of harm to themselves and those with whom they interact. This section will look at opportunities educators have to maintain educational integrity while avoiding harm and reducing risks when engaging in online communication.

Modelling Digital Communication

Teachers are held in high regard in society, and what they do in their personal lives will usually be viewed with a lens that relates to the profession. "The teacher acts in a manner which maintains the honour and dignity of the profession" (ATA, 2018, standard 18). This also applies to the teacher's interaction with SNSs. Whether being used to connect with other teachers in PLCs, with parents and students, or with friends and family, "teachers need to maintain a respectful and professional identity" (Planbook.com, 2018, Section 1, para. 4).

In 2012, George Couros, an educator and recognized keynote speaker for professional audiences, posted a blog titled "Personal and Professional vs. Public and Private" [New Tab]. He discussed the debate of teachers having a personal SNS account separate from a professional account. His argument is that whether teachers have separate accounts or not, there is the potential for anyone to see the posted content. "What I am always aware of is that no matter who sees what I put out there, anyone can see it eventually, whether it is through me or someone else" (Couros, 2012, Section 1, para. 4). In fact, by combining the personal and professional accounts into one, teachers have a unique opportunity to model effective digital citizenship and digital literacy skills to their followers, which may include parents, students, and other teachers, rather than letting them figure it out on their own (Howard, 2013).

Setting Expectations

By communicating expectations for parents, students, colleagues, and themselves, teachers can reduce the risks that come with engaging in SNSs. "Even if we deem the benefits of SNSs worth the potential risks, a plan for managing those risks is warranted" (Howard, 2013, p. 44). It is interesting to note that due to the recent COVID-19 crisis (Spring 2020),

educators have found themselves needing to turn to emerging technologies such as SNSs to communicate effectively with students and parents. If they do not set up expectations from the beginning of the school year, teachers may struggle with boundaries and guidelines for themselves, parents, and students. Teachers should look to their guiding policies and procedures to provide support for navigating this challenge. However, it is recognized that with the fast pace of technological change, these policies and procedures may need constant revision to remain current.

Many school districts have developed administrative procedures that identify the expectations of all parties involved with using SNSs. As Howard (2013) points out, "[p]olicies that prevent private one-to-one communication between teachers and students that do not generate a permanent record are extremely important to ensure the public's trust that the users of these networks are operating above-board" (p. 50). For example, Elk Island Catholic Schools (2019) has Administrative Procedure 146, titled "Social Media", which identifies expectations for division staff, students, and parents (Table 2.4).

Table 2.4 Excerpt from Elk Island Catholic Schools' Administrative Procedure: 146 social media (2019).

Procedures
1. Principals shall:
1.1 Ensure students, parents, and staff are aware of the Division's expectations for responsible use of Social Media.
1.2 Encourage parents to communicate to school personnel any concerns they may have about inappropriate use of Social Media.
1.3 Ensure students, parents, and staff are educated in the appropriate use of Social Media and the associated benefits and dangers of a public online presence.

When teachers do set guidelines for how SNSs will be used, they should include expectations for:

- Timeliness of posts
- Expectations and moderation of responses
- Procedures for one-to-one communication
- What will happen to content after the school year is over
- Limitations to having followers and following back

Teachers who model effective use and positive communication skills with SNSs remain consistent with the rights and responsibilities placed upon them as professionals. Each post should be considered an opportunity to develop digital literacy skills for teachers, students, and parents. By setting and following expectations, all stakeholders will reduce risk and the opportunity for harm. However, risk and harm are reduced not only by expectations, but also by understanding how using SNSs can impact autonomy and independence.

Respect for Participant Autonomy and Independence

Teachers may find themselves in situations where they are directed to engage with SNSs, such as when a school leader suggests that teachers can add a Twitter post about their weekly classroom events. When this occurs, teachers may feel obligated to use social media even if they do not feel comfortable with the digital tool. Alberta Education's Learning and Technology Policy Framework (2013), Policy Direction 3 indicates that teachers are expected to "engage in professional growth opportunities that are broadened and diversified through technology, social media, and communities of practice" (Section 3, para. 1). Although some teachers may struggle to give up autonomy over their professional learning choices, they may still have control over what technologies they use or how they use them. The student-centred goal, is that "teachers . . . develop, maintain, and apply the knowledge, skills, and attributes that enable them to use technology

effectively, efficiently, and innovatively in support of learning and teaching" (Alberta Education, 2013, Section 3, para 1). Teachers need to consider the magnitude of this responsibility when they do engage with SNSs, as they are in a position in which they can create and shape their own online persona, while also shaping and influencing the identity of their students. In this final section, we will expand on the ethical examination of the teacher's role in shaping identity and equity of access.

(Re)Shaping Identity

When teachers use SNSs in their classroom, their motivation may be to build relationships, provide support, reduce the feeling of being isolated (for both student and teacher), build personal and professional learning environments, and to create and share knowledge (Forbes, 2018). SNSs are not limited to these opportunities and may provide other features and abilities, such as 'going live' to show parents the events in the classroom; however, the fact that teachers and students have the ability to use these features does not necessarily mean that they should.

As previously discussed, teachers and students who engage with SNSs may blur the lines between private and public identity. What teachers should consider is that as they post content such as pictures, student work, or discussions about what happened within the class, they create a digital footprint for themselves, as well as for their students, which may be accessed and retrieved by others (Auld & Henderson, 2014). As teachers move to a more digital learning environment, K-12 teachers are faced with the reality that their digital interactions influence identity, regardless of whether they take place on a private or public SNS account. *Forbes* (2018) eloquently points out that "what an individual does with social media does not occur in a vacuum and is likely to affect or influence others by virtue of the social character of the communications" (p.178). As teachers consider this influence, they are held ethically to the principle of responsible care, "where professionalism entails doing good and minimizing harm" (*Forbes*, 2018, p.178).

To build on this idea of doing good and minimizing harm, teachers should consider the power of their influence. By modelling positive digital citizenship and literacy skills, they can inadvertently shape their own and students' identities in a positive way. One example is practicing proper citations and copyright practices. As Auld and Henderson (2014) point out, the use of a picture of a celebrity or cartoon picture to create a social media avatar may seem harmless, but it is a breach of copyright and possible identity theft. This is an opportunity for a teachable moment that may have lasting effects on students' identities and on the identity of the original subject whose image was used.

Teachers' ability to model and shape identity is not just proximal. Auld and Henderson (2014) explain that "teachers can model how to respect the other even if they are not known to the students or the teacher" (p. 202). This removal of barriers is powerful, but the strength is limited by the opportunity for digital equity of access.

Equity of Access

Digital access and equity involve many components and ethical considerations that teachers should consider as they use SNSs. Rooted in social justice, there is a belief that emerging technologies, such as social media, will "level the playing field, effectively creating equal access to learning opportunities by democratizing information and instruction" (Bulger, 2016, p. 2). This is supported by the fact that creating an account on SNSs is most often free. As well, SNSs are ubiquitous communication platforms where, because they are digital, users can access assistive technologies such as speech to text, text to speech, and translation to participate in the discussion. By integrating SNSs in the classroom, teachers provide opportunities for all students to develop their online communication skills, not just the students who can afford to access the platforms from home (Howard, 2013).

The argument that SNSs are free is limited to the actual cost to participate on the site. In order to access SNSs, one needs technology and internet access in the first place. As well, parents may not want their children, or themselves, to communicate online. In order to respect the autonomy of parents and students, teachers may want to consider providing alternatives to online communication. By doing so, teachers follow the social justice principle of recognitive, which, as Lambert (2018) points out, involves recognition and respect for diverse views and experiences.

As teachers use SNSs for communication, their reach of influence is not limited to just their own identity, but beyond. In fact, the impact on identity is a community approach involving (but not limited to) teachers, parents, and students. To maintain the educational integrity that teachers are responsible for, teachers should also consider opportunities for autonomy when involving technology-based practices in their classrooms. By allowing for voice and choice by parents and students, teachers can continue, with effective communication, to build the sense of community that is needed (White, 2016), which was the goal in the first place.

Conclusion

As teachers decide to integrate SNSs into their classroom practices, they should consider the ethical implications that this type of technological opportunity creates. According to Auld and Henderson (2014), "a professional SNS profile is a potentially valuable strategy but it still requires considerable thought and considerable maintenance" (p. 199). By focusing on four main areas of ethical exploration, this chapter examined the topics of full disclosure, privacy and security, educational integrity, and autonomy and independence, in order to address how teachers can tackle the complexity and unique opportunities of using SNSs to communicate in their classroom.

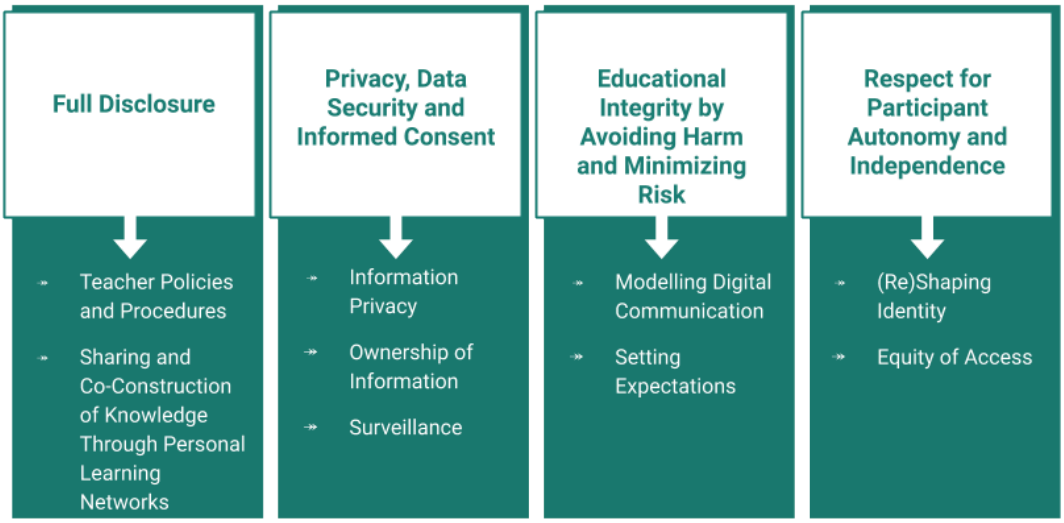

Figure 2.4 Four areas of ethical implications of using SNSs for communication by teachers.

No matter the tool, teachers should consider the magnitude of their responsibility when they do engage with SNS for communication. Part of the attraction of SNSs is the unique abilities to enhance communication, but one may want to have the mantra: just because you have the ability, doesn't mean you should use it. By continually reflecting on the goal and ethical implications, teachers will have a strong foundation for the use of SNSs for communication.

Questions to Consider for Future Research

- Technology is always evolving, and with it, a teacher's practice should evolve, too. COVID-19 has required teachers across the globe to move their classrooms to an online environment. Teachers who had never considered SNSs as a way to communicate are now adapting these platforms to fit their classroom needs. What impact will this mass uptake of using SNSs have on pedagogy?
- In what ways are teachers and students reshaping the role SNSs have in education?
- What ethical considerations should be considered when students who are under the age of consent use technology to support their learning?
- Lastly, as teachers model different competencies in their classroom, there are opportunities to embed digital literacies and citizenship while creating opportunities to develop PLNs online. What do students have to gain or lose by participating in a PLN via SNSs?
- What frameworks could teachers consider to scaffold students developing their own PLNs using SNS (refer to Appendix A)?

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Appendix A

Table 2.5 Possible frameworks for scaffolding students in developing their own PLNs using SNS (adapted from Roberts, 2019).

Teacher-Led Walled Garden of Open Learning	Transition Between Teacher-Led Walled Garden & Independent Open Learning	Developing Personal Learning Networks
Up to age 11 AND/OR. Emerging open readiness learners	Ages 11-14 AND/OR. Low & medium open readiness learners	Ages 14+ AND/OR. High open readiness learners
Example: Teacher connects with their PLN to share classroom learning experience using classroom social media identity.	**Example:** Teacher co-designs for learning pathway that includes inside/outside experts & open/closed sharing of learning experiences.	**Example:** Teacher co-designs for learning pathway that encourages inside/outside classroom experts, nodes of learning, & perspectives in order to solve problem with choice open/closed sharing of learning.

Media Attributions

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- Figure 2.2 Attitudes to limit exposure of privacy, adapted from Regan and Jesse (2019) © Heather van Struen is licensed under a CC BY (Attribution) license
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Chapter 3: From Consumers to Prosumers: How 3D Printing is Putting Us in the Driver's Seat for Creation and the Ethical Considerations that Accompany this Shift.

How 3D Printing is Putting Us in the Driver's Seat for Creation and the Ethical Considerations that Accompany this Shift

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Shifting Gears: From Consumer to Creator/Prosumer with 3D Printing

The exponential advancement of technology has altered and continues to change the human experience. More specifically, technological advancements – such as 3D printing and other means of self-fabrication – have directly impacted "the way people perceive and consume most of the everyday objects" (Filippi & Troxler, 2015, p. 58). Many see additive manufacturing as a disruptor to the current systems (Bechtold, 2016). It breaks the chain of events that would typically be expected in the manufacturing process. Weinberg (2013) suggests, "just as computers have allowed us to become makers of movies, writers of articles, and creators of music, 3D printers allow everyone to become creators of things" (p. 1). 3D printing is also breaking away from the norm through its roots in the open movement. Based on the idea that openly sharing ideas and intellectual property leads to increased innovation, 3D printing has capitalized on open source plans and designs to push equipment and creation into the mainstream (Neely, 2016). The Open Design and Open Hardware movements have allowed consumers to become "prosumers" with the ability to create and make the same products they would otherwise just consume (Filippi & Troxler, 2015, p. 58). This shift towards creation and away from consumption has also worked its way into the educational setting where, more frequently, engineering and design thinking are incorporated into curricula. A video from the California Management Review (2017) highlights how 3D printing is revolutionizing industries, the economy, and society.

The Shift Expands into Educational Settings

The Maker Movement was born out of the constructivist approach originally derived by Piaget (1967) and later built upon by Papert (1980) and his ideas surrounding constructionism (Kostakis et al., 2015). Both constructivism and constructionism put a focus on the student as creator, as one who builds knowledge through problem-solving and design (Papert, 1980). This type of education allows students to learn based on their abilities and interests through

multiple thinking processes (Blikstein et al., 2017). Again, we see a shift away from simply consuming to creating, in this case from the consumption of information towards students constructing their own understanding. 3D printing, alongside this disruption in education through the maker movement, has provided a platform in which students are able to problem-solve through design, build tangible models or prototypes, and test their innovations firsthand. As Blikstein et al. (2017) point out, students who use 3D printing are problem-solvers, understand and apply the design and scientific process, and integrate and develop specific technology knowledge. Often included as part of a design thinking cycle or STEAM engineering challenge, 3D printing has provided a means through which students can express their thinking and contribute their knowledge to the world.

The following video provides more information on how the maker movement connects students to engineering and technology.

Figure 3.1 Edutopia highlights a student's experience learning STEM skills through hands-on lessons.

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Putting on the Brakes: Ethical Considerations

No longer are students tasked just with absorbing information and regurgitating it on standardized tests. Educational movements have led us down a path where innovating and creating have become the new buzz and focus. Alongside this change, our understanding of 3D printing and our ability to utilize it as a tool for creation continues to grow. As access to this tool increases, ethical issues surrounding the use of 3D printing will also continue to emerge. 3D printing has opened up the ability for students to design, remix designs, and develop tangible objects (Connelley &

Connelley, 2019). Moving students away from just consuming content and into a realm of creating it and sharing it with the world also brings with it layers of questions as to the most ethical way of doing so. Issues that were once concerns for manufacturers or textbook companies, that produced a great deal of what was consumed in schools, have now also shifted into the hands of teachers and their students (Neely, 2016).

As we move toward increased student agency, increased choice, and an increased ability to design and physically produce to meet these needs, we also face increased challenges in how to best navigate the 'prosumer' culture within education. With Open Design Hardwares and Platforms pushing the 3D movement forward, safety concerns and intellectual property rights (Neely, 2016) come to mind quickly as we begin to integrate these tools within educational settings. Open access designs provide our students and teachers with the ability to print just about anything; they now have the opportunity to build items that could improve lives or negatively impact them. The balance between encouraging and monitoring designs and fostering collaboration to promote innovation can make embedding 3D printing into curriculum a complex endeavour.

Appendix A is adapted from Farrow's (2016) "Uncompleted Framework" (p. 103) which provides an ethical lens through which to view educational research. It also provides a summary of the normative ethics discussed in this chapter.

Generally speaking, the process of 3D printing can be divided into three stages – design, materials, and printing (Neely, 2016). Each stage has a range of ethical considerations that go along with successfully integrating the overall educational technology into the classroom. As an educator, one should begin to question each stage of the process before diving into 3D printing as a whole.

The design stage is of particular importance as this stage involves using online computer-aided design (CAD) programs and information clouds for students to develop and share designs (Neely, 2016). As soon as a technology tool requires the use of an online platform, student privacy and protection should be considered. How are CAD programs using student information and data? What policies have been put into place and how do educators know that students' creations are being kept private? What privacy issues are involved when students become prosumers?

Tinted Windows: 3D Printing and Privacy

According to Regan and Jesse (2019), there are six main privacy concerns: information privacy, anonymity, surveillance, autonomy, non-discrimination, and ownership of information. When looking more closely at 3D printing in an educational setting, information privacy, anonymity, and ownership of information stand out when examining online platforms or CAD sites utilized to create and share designs.

Information Privacy in 3D printing (CAD software)

When collecting information about an individual, they should be fully informed as to what specific information is being collected (Regan & Jesse, 2019). The amount of information collected should also be limited to what is required. Data collection would typically happen within the first stage of the creation of a 3D design and could also possibly occur when the design is shared in an online database. The majority of online CAD creation tools require creating a login. Looking at Tinkercad as an example, if a student is under the age of 13, then parental consent is required (through email) or the student must enter as part of a teacher's online classroom. The company reduces the amount of sensitive information collected from children under the age 13 and requires teacher or parent authorization in order to further reduce the amount of personal information held within the system (Autodesk, 2020). Tinkercad does collect Personally Identifiable

Information (PII) from children, such as their birthdays in order to verify age, and this is likely linked permanently to their accounts. According to Bourgeois (2019), "the likelihood of harm caused by a breach involving PII is greatly reduced if an organization minimizes the amount of PII it uses, collects, and stores" (Obtaining Patent Protection section [New Tab]). Perhaps, negative impacts or harms could be minimized if educators use CAD companies that limit collection of student PII.

Anonymity in 3D Printing (CAD Softwares)

According to Regan and Jesse (2019), "individuals should be able to remain anonymous or obscure if they so choose" (p.171). With the use of software such as Tinkercad, it could be difficult for a student to remain completely anonymous. The site requires a user to complete a sign up and login setup. Students could feasibly use falsified information in order to remain anonymous but the company does have specific policies in place to prevent this. Even if a student managed to keep the majority of their private information away from the account that they created, their creations and designs could still be tracked, and this information could be linked to their account and online identity within the program. It is also possible for an IP address or location tag to connect a specific computer to their login, and it is hard to determine the amount of information that could be connected to the student in this way.

Ownership of Data in 3D Printing (CAD Softwares)

Ownership of an individual's data and creations can also be questioned when looking more closely at CAD software used in creating 3D printing designs. Regan and Jesse (2019) explain that "one of the most problematic issues involved is whether educational technology companies should be able to use data generated by students' use of their software programs to improve those programs, raising questions about whether the companies are using students as test subjects for development and marketing of future Edtech products" (p. 172). CAD companies are able to collect student-created designs, and the data involved in these creations – even if it is not shared publicly in the companies' open libraries – still remains within their databases. With 3D printing, it is very easy to replicate designs, and, in many ways, replicating and modifying is encouraged. CAD companies could have access to student designs and could potentially use these to analyze and develop future software, use these base designs in other ways that could bring profit to the company, neglect to inform the user, or fail to consider the intellectual property rights of the student.

In the Fast Lane: Avoiding Harm and Minimizing Risk

Avoiding Harm and Minimizing Risk Through Access to Designs

Much of the 3D and additive manufacturing momentum revolves around open access and the sharing of designs (Neely, 2016). As much as this can fuel innovation and creativity – two areas important to the shift towards students as creators – this open access also has the potential to put those students at risk. Websites such as Thingiverse [New Tab] have hundreds of thousands of designs ready to be printed. The initial stage of the 3D printing process, and its use of CAD software and open libraries, requires educators to be cognizant of the ethical issues that could arise in the realm of avoiding harm and minimizing risk. Some of the designs openly available to students could be dangerous to the

individual printing them or those in contact with them. For example, there are open and accessible designs for printing guns and other weaponry. The images in Figure 3.2 and 3.3 were found with a quick search on Thingiverse [New Tab].

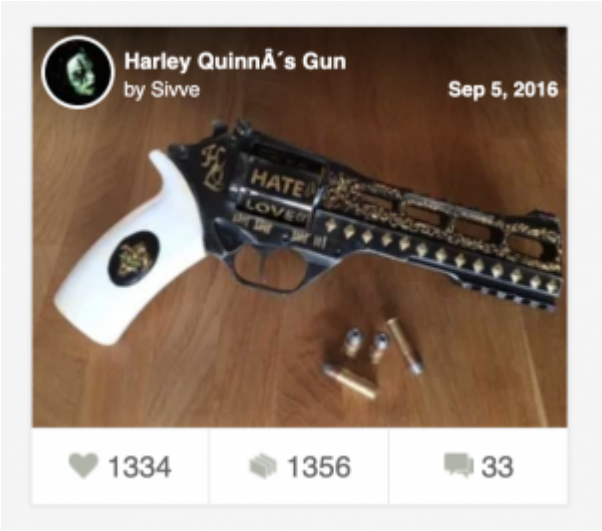

Figure 3.2. Potentially harmful designs (gun) found on Thingiverse. Harley Quinn's Gun by Sivve, 2016, https://www.thingiverse.com/thing:1754962, Used under the Creative Commons – Attribution license.

Figure 3.3. Potentially harmful designs (knife) found on Thingiverse. OTF Knife/Switch Blade by David6722, 2019, https://www.thingiverse.com/thing:3619717, Used under the Creative Commons – Attribution license.

The dark side of the open movement has been made very visible by companies such as Defense Distributor, which have aimed to become 'the wiki for guns,' (Zhou, 2018). This company distributes downloadable plans that can be used to create 3D printed plastic guns (Zhou, 2018). This side of open source has caused legal arguments in the United States between those who believe strongly in the right to own a firearm and those who deem this access a threat to society (Zhou, 2018). An issue with plastic guns is their minimal use of metal (nothing more than a steel nail), which makes them virtually impossible to detect with metal detectors. These 'ghost guns' also do not require a background check to obtain nor do they have a serial number for tracking purposes (Zhou, 2018). This ability to maneuver around the loopholes in traditional laws put in place to minimize harm is one aspect that could make the open movement very dangerous. As this movement grows, and more controversial plans are released, governments are forced to reexamine old laws and quickly pass new ones to minimize the risk to society. This becomes a wide spread issue in that these controls are not always international. Neely (2016) explains that "since the internet is transnational, it is difficult to regulate its content. In the absence of international treaties, we are probably limited to attempting to regulate content on sites hosted within our

country's borders. Since users can simply go to other sites, this is unlikely to be effective" (p. 1289). When 3D printing is brought into an educational setting, and these open designs become more accessible to students, close attention will be needed to manage open design platforms in this context. Minimizing students' ability to access open designs may not be easily controlled by educators. The initial design phase of 3D printing and the underpinnings of this prosumer movement has, in many ways, been fuelled by open access to designs.

Even when focusing on the good and working towards disrupting the assumed failures of a traditional manufacturing chain, 3D printing could still lead to more harm than good. During the COVID-19 pandemic, many 3D printing hobbyists and communities joined forces in an attempt to make up for the lack of medical equipment required as more and more patients flooded the hospitals. But many individuals are not stopping to consider the risks involved and the limitations of basic individual-owned 3D printers. Gallagher (2020) interviewed MIT's Martin Culpepper [New Tab], who highlights the issues with using 3D printing to reduce the shortages of personal protective equipment (PPE) needed in hospitals during the pandemic. One major issue is the "material compatibility with the sterilization techniques hospitals currently use and the use of certain materials in a setting where it is uncertain how they interact with other chemicals, devices, and contact with patients and care providers" (Gallagher, 2020, para. 5). Another issue is the "false sense of hope" (Gallagher, 2020, para. 7) provided by relying on 3D printing. It is also important to note that 3D printing is a time consuming process; if MIT – an organization with some of the top quality equipment in the world – is not prepared to print personal protective equipment, then why do hobbyists feel they are in the position to do this (Gallagher, 2020)? Many schools have jumped on board with this quest to reduce shortages and would say that inspiring students to act in a way that positively contributes to society is an authentic and worthwhile learning activity, and may not have considered the negative issues associated with producing PPE.

Educators are placed in a powerful position to highlight the importance of using 3D printing to connect and collaborate in order to develop new designs and prototype them. As Culpepper mentions, "3D printing technologies are set up to build proof-of-concept designs, not to manufacture medical products at scale," (Gallagher, 2020, para. 5). Teachers focusing on innovation and designing new products to meet needs during this time, and then helping students to connect with manufacturing companies equipped to make their creations happen on a large scale, may be a more effective way for teachers and students to contribute during this crisis. A prime example of the case of Quinn Callander [New Tab], a young boy who responded to a Canadian medical facility that needed solutions to the discomfort that medical masks can cause when worn for prolonged periods (Uptas, 2020). Quinn designed a plastic clip that removes the pressure of masks on ears, started 3D printing his design for the medical facility, and then provided his plans on an open platform to allow others to access, print, and donate (Uptas, 2020). This contrasts the idea of emergency printing PPE in that this student came up with a new design solution to a current issue and then demonstrated how sharing his design in an open platform can benefit society. Not only medical staff are faced with wearing masks for hours on end; other essential workers such as grocery clerks face the same challenges. When 3D printing is used as a medium for innovation, creation, and prototyping, it can become a powerful tool for learning in today's educational environments.

Similar to many technologies, 3D printing is not neutral. Teachers need to be aware that helping students develop the skills necessary to create CAD designs and effectively 3D print, that they are enabling them to create and build objects that can be helpful or harmful. Creating projects in which the 3D printer is used to solve problems in a positive way may influence students to think of the 3D printer as more of a tool of positive solutions versus one in which harmful objects can be built. Ultimately, educators are left to decide if teaching students the skills needed to design, 3D print, and become prosumers cause more benefit than harm.

As a school or individual educator working towards effectively implementing 3D printing, it is worth looking deeper into the user agreements set up to allow students to actually print. At the printing stage of the process, we may gain back some of the control to minimize harm that may be lost during the design stage. An acceptable use policy (AUP [New Tab]) provides directions to users regarding behaviour and use of technology approved by the community as a whole (Kostadinov, 2020). A school starting to implement 3D printing could work to create an AUP before allowing

educators and students to access the printer and CAD software. An AUP for a 3D printer may include screening designs and administrator review or even approval before printing; this could help prevent inappropriate designs from becoming tangible objects through the use of school equipment. AUPs may also address intellectual property concerns by preventing the printing and distribution of any kind of illegal content (Kostadinov, 2020)

Avoiding Harm and Minimizing Health Risks

Policies surrounding the physical location of the 3D printer and access to it also need to be considered when working towards minimizing harm and risk. Physical harm can occur during the actual printing process through student exposure to the plastic chemicals used in filaments (Zhang et al., 2018). Studies have found that 3D printers release ultrafine particles (UFPs) and volatile organic compounds (VOCs) during the printing process (Sharma, 2018; Zhang et al., 2018). Exposure to these particles can lead to respiratory and cardiovascular issues. These potentially harmful chemicals remain in the vicinity of the printer even after the process has been completed (Zhang et al., 2018). These same studies indicate that filaments manufactured by the same companies as the 3D printers tend to produce less emissions than the lower cost budget options (Zhang et al., 2018). This becomes an ethical issue for schools wishing to capitalize on the benefits of 3D printing while keeping costs low. PLA filament is FDA approved [New Tab] and tends to be the preferred material in terms of health standards. Due to budget constraints, schools also tend to opt for PLC, which according to a study at Georgia Tech may be safer for school settings, though these types of filaments still produce UFPs and VOCs when heated (Zhang et al., 2018). Schools and educators looking to reduce costs could unknowingly gravitate towards filaments that may be more harmful, health-wise, to their students. The video below provides further details on the study.

Figure 3.4 Georgia Tech researchers reinforce the importance of standardizing the measurement of non-engineered nanoparticle emissions from 3D printers

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When selecting 3D printing as a means of creation, it is important for educators to know the possible health ramifications of plastics and how to reduce health-related issues due to fume exposure. Georgia Tech recommends that:

- 3D printers only be operated in well-ventilated areas.
- Nozzle temperature be set at the lower end of the suggested temperature range of a given material.
- People stand away from machines under operation.

- People use systems and materials that have been tested and verified to have low emissions (Molitch-Hou, 2018).

Educators should ensure these suggestions are followed, and design an acceptable use policy for the equipment, to help them glean all the benefits of creation that 3D printing has to offer while minimizing potential harm and risk to their students.

Avoiding Harm and Minimizing Risk Environmentally

As students can create real, tangible objects using a 3D printer, environmental impact should also be examined when aiming to minimize harm and risk. The material and printing stage of the 3D process can lead to excess plastic waste due to printing multiple prototypes. Mistakes can also occur while printing due to incorrect temperatures or setups, leading to more waste. Excess plastic build up has become a global concern. By integrating 3D printing into our educational settings, are we just contributing more to this global issue? Many schools have the money to invest in the basic equipment, printer, and filament, but do not invest in what is necessary to minimize waste and recycle the excess plastic.

Others (Huang et al., 2013; Nowak, 2013) argue that 3D printing "may have a positive effect on our environmental impact, since it allows us to cut down the supply chain effect by printing objects as they are needed," (Kietzemann et al., 2015, p. 212). Kietzemann et al. (2015) also mention that there is a "positive impact of printing objects closer to their point of consumption, thereby reducing road and air miles" (p. 212), subsequently reducing pollution problems. Ethical, fair trade filament [New Tab] companies have surfaced in response to the constant need for plastic filament in the 3D printing process, one of which is Protoprint, a company out of Pune, India (Pelley, 2014). Protoprint has been licensed to sell fair trade 3D printer filament (Pelley, 2014). Protoprint sets up filament labs next to landfills and garbage dump sites. They collaborate with waste picker cooperatives in training the pickers to clean, shred, and extrude the filament (Pelley, 2014). The choice to utilize recycled plastic for 3D printing filament is then placed in the hands of the educational facilities that provide student access to the printers. Educators have the ability to minimize environmental harm that may be caused by 3D projects by making environmentally sound choices in the materials provided to students.

Educators need to consider whether the 3D projects are intended to create plastic objects that will be used for a purpose, such as constructionist learning through design and making, or solving a problem, or innovating, or whether the 3D projects will be used merely for novelty purposes.

Intellectual Property and 3D Printing

According to Bourgeois (2019), "intellectual property is defined as 'property (as an idea, invention, or process) that derives from the work of the mind or intellect." This could include creations such as song lyrics, a computer program, a new type of toaster, or even a sculpture" (Intellectual Property section). As Bechtold (2016) mentions, there is an "intricate relationship between intellectual property and innovation," (p.535); therefore, as we begin to see students as innovators and creators, this intricate connection begins to intertwine within the educational setting. With students innovating and designing their own products, care needs to be taken when sharing their ideas with the world. Combine this shift in education toward constructing knowledge with a tool such as the 3D printer and the associated online platforms that go with it, and this calls for an exploration of creation rights.

Interestingly, the fact that 3D printing is a tool now accessible to schools could stem from the expiration of a range of key patents (Bechtold, 2016; Hornick, 2015). This – along with an overall movement towards open source version control systems, software repositories, and online marketplaces – have all set the stage for the collaborative and innovative

community that has pushed 3D printing into the mainstream (Hornick, 2015). A large majority of personal 3D printers have been made available due to the RepRap project (Bechtold, 2016). Bechtold (2016) explains that "the goal was to create a 3D printer which could replicate itself. All of the designs of the project have been released under the GNU General Public License (GPL)" (p. 524). This means that anyone can copy and improve the project as long as they share alike their modifications (Lunpa, 2012). The very beginnings of 3D printing have gone against the need to individually own ideas and innovations and instead have encouraged innovation to be shared freely to further inspire and grow ideas. Bechtold (2016) shares that "this has also facilitated the creation of specialized 3D printing software programs, which are either licensed under open source licenses or under proprietary copyright licenses, but are provided for free" (p. 523).

This leaves educators wishing to capitalize on the collaborative nature of 3D printing as a medium, with the need to develop an understanding as to what protection is available for student's intellectual property. How should these ideas behind the openness in remixing and sharing be effectively communicated? Students should be made aware of what exactly could happen to their designs and should be provided with options regarding how much they want to share and how they want to be acknowledged.

It is easy to get swept into the romanticism of openly sharing one's creations, but as Parks (2016) highlights, "creators want to be credited for their designs because it feels good to be recognized, plus as a creator you want to know if and how your work is being used" (para. 1). Many open platforms like Thingiverse and Sketchfab are establishing ways for creators easily to upload and mark their designs with a Creative Commons license in hopes of more accurately providing attribution (Parks, 2016). Oftentimes these libraries of designs contain markers for tracking derivative work, families of designs can be pulled out, and the ancestor or the original design is openly acknowledged (Lunpa, 2012). But not everything is open and not everything is protected. This grey area causes questions of concern for educators: are students copying and printing copyrighted materials? How does one know if a design is open to anyone or closed to all? This requires educators to look more deeply into the copyright and patent laws that could impact 3D printing.

How 3D Designs and Objects are Protected

3D printing is a new medium that continues to disrupt systems, including how educators look at intellectual property rights – particularly in regards to digital technology use in schools. Works that in the past have been digitally created (e.g. music, photos, movies) are generally all creative works and therefore fall more easily into the established copyright laws (Weinberg, 2013). Useful objects would generally be protected by a patent. 3D printing and this newfound ability to create tangible objects that may be artistic but also useful begins to blur the lines between copyright and patent. As Weinberg (2013) states, "most (but by no means all) physical objects are not protected by any type of intellectual property right. That means that anyone is free to copy, improve, distribute, or incorporate those objects as they see fit" (p. 1). Page 2 of Weinberg's (2013) report *What's the Deal with Copyright and 3D printing?* [New Tab] includes a table outlining what type of intellectual property is protected by copyrights versus patents.

In many ways, 3D printed creations combine creativity with functionality and thereby make the process of protection complex. Weinberg (2013) explains, "if you have a useful article you cannot protect it with a copyright. Conversely, you will not be issued a patent on an artistic work. That means that if something is eligible for patent protection – even if it does not have patent protection – it cannot be protected by copyright" (p. 4). U.S. laws focus on severability when examining copyright in regards to objects that are both creative and useful (Weinberg, 2013). Severability is used to find the artistic element of the object that could stand alone; this part of the object could be limited to copyright (Weinberg, 2013). Laws continue to develop in these areas as technologies such as 3D printing continue to evolve. In many ways it is up to educators to seek out clarity and remain up to date during these constantly changing times.

Currently, in the United States, the Digital Millennium Copyright Act [New Tab] is used to protect creators' designs online. Figure 5 provides a better understanding of how this is put into action. Due to the financial and time constraints of policing the internet, responsibility is placed on host sites to remove potential infringements (Weinberg, 2013). Technically, if a student creates a design that is copyrightable, and then later sees that it has been copied without credit and uploaded to a host site, they can contact the site to file a complaint, and item will be removed. If the individual who uploaded the student's original design challenges this request to remove the file, the host site will post it again. This eventually could progress to the student (or legal guardians) taking further legal action against the uploader. Generally speaking, this system has worked, and not many cases have gone beyond the steps of removing content, but no system is perfect (Weinberg, 2013). Bechtold (2016) explains that, "in general, from a practical perspective, right owners of 3D design files face similar problems to owners of patents on 3D printer production or processes: it is hard to identify consumer infringers, costly to enforce intellectual property rights against them, and it may not be the optimal business strategy to sue your own customers" (p. 530).

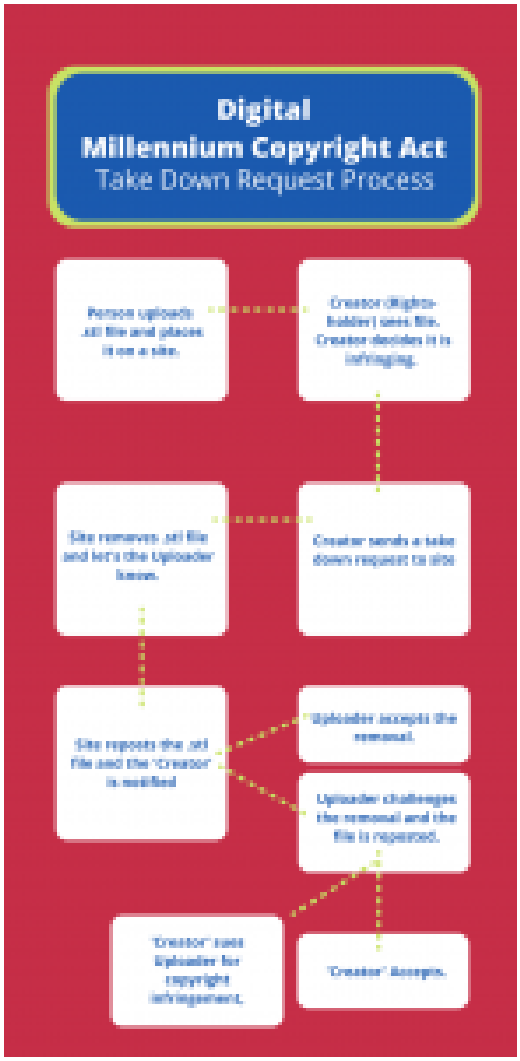

Figure 3.5 Digital Millennium Copyright Act Flowchart. Adapted from "What's the Deal with Copyright and 3D Printing," by M. Weinberg, 2013, https://www.publicknowledge.org/. Copyright [2013] by the Institute for Emerging Innovation, adapted under a Creative Commons Attribution-ShareAlike license.

Knowing which designs online are open and available to remix and what is protected by copyright is important for students and educators to understand, particularly so they can avoid ending up in a DMCA complaint. According to Weinberg (2013), "as 3D printing and modelling grow in popularity, it is likely that we will see more companies and individuals assuming they have a copyright for a design or object and demanding removal of unauthorized versions," (p. 21). The chart in Figure 6 outlines generally what is copyrightable in regards to 3D files and objects, and what can legally be copied and printed by individuals.

Figure 3.6 Copyright of 3D objects and files. Adapted from "What's the Deal with Copyright and 3D Printing," by M. Weinberg, 2013, https://www.publicknowledge.org/. Copyright [2013] by the Institute for Emerging Innovation, adapted under a Creative Commons Attribution-ShareAlike license.

Should Students be Licensing Their Work ?

Given the difficulty of placing a copyright on a 3D printed object, many would argue that licensing that object is therefore pointless. As Weinberg (2013) states, "if there is no copyright, there is no need for permission, and no way to enforce the terms. A license without an underlying right is legally meaningless" (p. 21). On the other hand, despite the fact that adding a Creative Commons License would in theory carry no legal ramifications, it may make a cultural impact that could influence the direction of the 3D collective community (Weinberg, 2013). Connecting a Creative Commons license is a "signal that the creator wants to include her work in the ever-expanding and evolving network of creativity" (Weinberg, 2013, p. 21). This signal also provides confidence in those who wish to remix and use the object as a base (Weinberg, 2013).

As the community of 3D printers expands and the open source movement continues to influence it, more consideration to intellectual property rights will need to be taken in order to create norms that work for this specific medium. The challenges faced by the 3D printing community are also challenges for educators and students as 3D printing becomes more commonplace in educational settings. As Parks (2016) asks, "how do you view the source of a copyrighted 3D printed object so that you can give credit, print your own version, or iterate on the original design? How do you comply with the attribution requirements of the CC license, if in fact it is legally required?" (para. 8). Flath et al. (2017) highlight that the freedom to create and express is dependent on the freedom to remix. Remixing is dependent on open access to others' designs and ideas to spur innovation, and should be viewed as a way of connecting and collaborating, not as infringement (Flath et al., 2017). Finding a balance between protecting intellectual property and openly sharing to encourage innovation will be important as more and more individuals and schools adopt 3D printing as a tool for innovation and creation.

Respect for Participant Autonomy and Independence

When 3D printing is chosen as a medium for creation in an educational setting, it is typically incorporated into a design cycle, STEAM project, inquiry project, or similar process (Wisdom & Novack, 2019). Educators that place importance on engineering design alongside scientific inquiry are likely to gravitate to this technological affordance (Wisdom & Novack, 2019). As Wisdom and Novack (2019) state, "it creates opportunities for inquiry learning where students solve real-world problems that cut across multiple disciplines. Students work on the open-ended design of personally meaningful objects that they research, design, prototype, 3D print, and evaluate," (p. 6). The personalization of these projects creates room for student choice and voice. Choices to create a design from scratch, remix what is already there, and share with others to encourage growth are all crucial components of the further development of 3D printing in and outside of the classroom. Alongside this independence and choice comes responsibility and the need to understand the complete process of additive manufacturing and the impact it can have

on already ingrained systems. Guidance and encouragement are needed to ensure that students are making the best choices for themselves and society as a whole, as they move down this path towards prosumerism.

Conclusion

Undoubtedly, 3D printing has already started to make its mark on the world; however, the extent to which it will disrupt and alter systems has yet to be seen. The impacts that it has already had on humanity have been significant. Flath et al. (2017) suggest that "the growing materialization of 3D printing, and the platforms like Thingiverse that facilitate the technology, have empowered users to be more than just consumers – but producers as well" (p. 38). The world has seen the medical field impacted by the use of 3D printing and the open design movement. The recent problem of lack of medical supplies due to the rampant COVID-19 pandemic has been taken on, to a certain extent, by 3D printing enthusiasts who have been making up for failures in the supply chain by printing everything from protective shields to spare parts for ventilators. As Bechtold (2016) mentions, "it is hard to predict the impact of 3D printing on end-consumer markets, as this will depend on the future ease of use, the adaptation of the technology," (p. 22).

The mark that this technological tool will have on education is equally hard to predict, but also will depend largely on how educators and educational systems adapt it to suit the creation needs of their students. 3D printing has the ability to assist in the disruption of education and has become part of this shift away from the consumption of knowledge and towards contributing to it. As with all disruptors and new ways of approaching situations, ethical questions arise. Educators wishing to make use of 3D printing will put themselves and students in a grey zone ethically, where not all of their questions have clear answers, and not all of their actions have clear consequences. As the 3D printing movement shifts and grows, educators will likely find themselves examining the purpose behind their projects and how they can work to instil a mindset of creating to solve problems. As more CAD design apps are made available for student use, privacy and data protection will need to be further examined, and educators will need to ask questions as to how much information is being collected on students and what is being done with this data (Regan & Jesse, 2019). Aware and informed educators will be needed to set up strong AUPs and to build standards aimed at minimizing the harm that could come from open access to designs, dangerous materials, and the potential negative impact to the environment. Intellectual property rights and issues will need to continually adapt to work with this tool that combines creative and useful works (Weinberg, 2013). Educators will ask themselves: Are my students copying and printing copyrighted materials? How can students properly protect and share their designs? What licensing has become available to address the difficulty in protecting this type of intellectual property?

How we approach 3D printing and the ethical dilemmas that it creates will determine how impactful 3D printing can be in the process of students becoming powerful innovators and creators. Will 3D printing push students into the driver's seat of their learning, or will ethical considerations force them to remain safe and sound as passengers in the educational experience?

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Appendix A

Table 3.1 Completed ethical framework for utilizing 3D printing within an educational setting based on Farrow's (2016) ***Uncompleted Framework***

Principle	Duties & Responsibilities (deontological theory)	Outcomes (consequentialist theory)	Personal Development (virtue theory)
Respect for participant autonomy	• Students should understand that they have a right to independently choose how openly they share their creations. • Students should be able to choose other media for their creations should 3D printing not suffice.	• Students can choose whether or not to participate with this tech or others. • Students could create objects that demonstrate their understanding of how things work.	• Students can build an understanding of the maker culture and choose to contribute their own design. • Students can develop their ability to choose when to share work, when to remix work, and when to copy.
Avoid harm / minimize risk	• Student/Educator/ Administration understand what data is collected on students and how it is used. • Student/Educator understand health and environmental risks associated with materials.	• Student ability to produce harmful or beneficial objects. • Provides students with a way of improving others designs and creating beneficial prototypes. • Negative health/environmental effects.	• Student's ability to make good decisions in regards to printing harmful objects. • Students develop the ability to apply the decision-making process to other areas of their life. • Students develop their understanding of intellectual property and how to effectively share their creations.
Full disclosure	• Educators should inform students of the intention behind the assignment and how their data/work could be used and shared. • Educators should inform students on copyright and creative commons licensing options for their work.	• Meets the needs of the students, as it is personalized and adapted to their thinking and design skills.	• Provides a medium for students to learn 21st century skills. • Allows students to express their learning. • Promotes continuous lifelong learning for teachers.
Privacy & data security	• Educators and students should be aware of the privacy policies of selected CAD softwares.	• Privacy and data security policies may differ depending on region and may suffer breaches.	• Allows educators and students to build their understanding of privacy policies and data security of a range of CAD softwares.
Integrity	• Technology is integrated by educators as a means for students to create, and not for personal gains.	• Students can become more prepared for a future of innovation and utilization of technology.	• Students ability to contribute to the greater good through product design.

Independence	• Students develop their ability to independently make the right decisions in regards to their own designs and creations. • Students become independently responsible for their designs and the impact of those designs.	• Students make independent decisions about sharing their designs, the materials they use to create, and the consequences of those decisions.	• Students develop the ability to independently make good decisions about their creations.
Informed consent	• Students are informed of the data being collected by the specific CAD software being used. • Students are informed of the ways to protect their work and agree to the terms of sharing their creations.	• Students understand the consequences of their creations and consent to sharing them. • Students are informed of the consequences of remixing work. • Students are informed of copyright and licensing.	• Students are informed, and develop an understanding of the best ways to contribute to an open system such as that of the 3D printing community.

Media Attributions

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- Figure 3
- Figure 5 © Nicole Neutzling
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PART II: PROMOTING EQUITY IN PERSONALIZED LEARNING CONTEXTS: ACADEMIC RESOURCE SHARING, ADAPTIVE LEARNING SYSTEMS, STEM, ASSISTIVE TECHNOLOGIES

Chapter 4: Ethical Issues in Academic Resource Sharing

JEFF LOWRY

Over the past decade, a new type of online educational marketplace of ideas has developed. Rather than creating small study groups to discuss class notes and tackle difficult assignments, post-secondary students can now use online platforms to connect with thousands of other students across the world studying similar topics. Academic resource sharing (ARS) sites such as Quizlet (http://quizlet.com [New Tab]), Chegg (http://www.chegg.com [New Tab]), and Course Hero (http://www.coursehero.com [New Tab]) have emerged as popular platforms. Quizlet was visited by one-third of American college students in 2018 (Wan, 2018), while Chegg boasted 30 million users worldwide as of 2019 (McKenzie, 2019). Course Hero has 1 million paid subscribers and 400 million visits per year (Lederman, 2020). It is not difficult to see why ARS sites are so popular. Quizlet contains over 200 million user-created study sets, along with an AI-powered option that builds unique study plans for individual users (Wan, 2018). Chegg began as a textbook rental company but has expanded to offer detailed homework responses, answers to problem sets, and access to experts who can assist with solutions (McKenzie, 2019). In a similar manner, Course Hero has developed into a broad platform that allows students access to course syllabi, essays, exams, and instructors' presentation materials (Lederman, 2020). Simply by accessing one portal, students have access to an array of information such as class notes, study guides, sample essays, and assessment materials – access that would have been considered unthinkable by their counterparts a generation ago.

Although ARS sites offer undeniable benefits in terms of allowing students to access materials and receive assistance, these platforms have come under criticism from educators and administrators. As will be discussed, there have been a number of high-profile cases of students improperly using material from ARS sites. Quizlet, Chegg, and Course Hero all have policies aimed to prevent uploading of unauthorized materials, but given the size of their databases and the amount of material added on a daily basis, enforcement has been inconsistent (Gillis, 2019). Consequently, this chapter will examine the ethical issues that have arisen due to the proliferation of academic resource sharing sites, with the aim of identifying best practices that students, instructors, and administrators can follow to reduce the likelihood of academic dishonesty.

Section 1: Description of Ethical Issues in Digital Teaching and Learning (Full Disclosure)

The proliferation of academic resource sharing sites has had a significant impact on both traditional and digital learning. On the positive side, ARS sites allow students to apply their digital literacy skills as active participants in the Web 2.0 era. In fact, ARS sites fulfill the four main digital literacy skills sets outlined by Hockly (2012): language-based literacies (being able to navigate and interpret multimedia-based sites), information-based literacies (understanding how to search for, manage, and critically evaluate online materials), connection-based literacies (knowing how to generate digital content as part of a network), and re-design based literacies (being able to take existing materials and build upon or repurpose them for other uses, including copyright and plagiarism knowledge). As noted by Gillis (2019), active participation in ARS sites leads to "empowering students and giving them more ownership over their learning processes" (p. 225). By consulting experts on sites such as Chegg, students can learn to negotiate the meaning of course material, and to gain a deeper understanding of it. ARS sites also allow users to connect with peers across the world; as stated by the director

of academic technology at Marist College, "imagine business students at Stanford, Marist, University of Beijing, and the University of Paris connecting up outside their courses to study together and maybe even work on team projects . . . This may become the 'study group' of the 21st century" (Kolowich, 2009, para. 17).

Increasingly, however, ARS sites represent a challenge to traditional university academic honesty policies. Universities have academic misconduct policies often outlining prohibited behaviours. At the University of Calgary, for instance, these include cheating, fabrication, falsification, plagiarism, and unauthorized assistance (University of Calgary, 2019a). Within the category of cheating, two examples may pertain to ARS sites: "having, using, or attempting to use unauthorized materials or devices for assistance in completing academic activities" and "obtaining assistance from another person in completing coursework, such that there is a real question whose work is being assessed" (University of Calgary, 2019b, p. 4). The two other largest universities in Alberta, the University of Alberta and the University of Lethbridge, have similar definitions of cheating. Recent years have seen instances of students finding exam answer keys on ARS sites. At Texas Christian University in 2018, 12 students were suspended after they used answers found on Quizlet to complete a final exam. They claimed that they did not realize the practice exam would be the same as their final exam, but the university argued that it was the students' responsibility to report that they had already seen the questions (McKenzie, 2018). Additionally, in 2019, administrators at Brandon University discovered that a number of nursing students had obtained the answers to their final exam from a private test bank uploaded to an unnamed website. In this case, however, the students were allowed to take an alternate version of the exam, though with a penalty applied (Man, 2020).

Given the potential for cheating and violating academic integrity, ARS sites have developed strict policies about proper use. Many of these policies stem from a deontological approach, which stresses the importance of following clearly defined rules on right and wrong behaviour (Farrow, 2016). Chegg, Course Hero, and Quizlet all have their own versions of honour codes which emphasize that users must not violate their institutions' academic honesty policies. Quizlet, for instance, states, "It's simple: don't cheat. Quizlet is meant for learning, not cheating. Test banks, exam questions, or other confidential course content should not be shared publicly on Quizlet" (Quizlet, 2020, bullet point 5).

For ARS sites, there are also consequentialist considerations (Farrow, 2016) in wanting to prevent students from cheating. High-profile cases such as TCU or Brandon University could lead universities to take an adversarial perspective. In 2019, professors at Purdue University spoke out against the integration of Purdue's Online Writing Lab (OWL) with Chegg's writing tools. As one professor argued, "I don't know why we are lending our hard-earned reputation to a company that is essentially making it easy for students to cheat" (McKenzie, 2019, para. 2). Chegg stressed that it was working hard to prevent cheating, and the integration went ahead as planned. Failing to address cheating could also have negative financial consequences for ARS sites. In defending the partnership, the director of OWL noted that Chegg has a "fiduciary and shareholder responsibility to be ethical and responsible" (McKenzie, 2019, para. 11).

Section 2: Connection of Ethical Issue to Privacy, Data Security and Informed Consent

So far, this chapter has focused on ARS sites mostly from the perspective of students and institutions, but there is one more group that is intricately involved – post-secondary instructors. In many cases, instructors have had their presentation notes, study materials, quizzes, and syllabi uploaded without their knowledge or consent. One professor from Auburn University, for instance, discovered that several notes, articles, and study aids had been copied from his website to Course Hero (Halford, 2010), while a biology professor at Georgia State University came across a set of her final exams while searching Quizlet (Spence, 2018). A faculty member at UCLA whose study guides appeared on an ARS site reflected that "(w)e were already in the digital age, but it still felt like cheating to me . . . I still viewed it pretty

antagonistically" (Lederman, 2020, para. 2). Although more instructors are learning about the challenges posed by ARS sites, this awareness is far from universal. A 2019 poll by Course Hero, for example, found that only 43% of educators had heard of their site (Lederman, 2020). In recent years, ARS sites have tried to reach out to educators and include them as partners in disseminating knowledge. Course Hero and Quizlet include sections for instructors to sign up and share materials; as of 2019, 30,000 instructors had created profiles on Course Hero, though it is not clear how many of the profiles were in active use (Lederman, 2020). Ultimately, given the number of ARS sites in existence, it is not surprising that instructors are having difficulty keeping up with potential misuse of their material.

A personal analysis of Course Hero postings relating to the English departments at the University of Calgary and the University of Alberta found a patchwork of adherence to copyright and intellectual property rules. From the University of Calgary English department, for example, 295 documents have been posted as of April 2020; they comprise a mix of lecture notes, study review notes, course outlines, essays, and assessments. While most of the uploads are either summaries or student-generated study materials, three documents appeared to violate Course Hero's rules: a PDF copy of Shirley Jackson's book *The Haunting of Hill House*, along with two scanned tests that included answers. Other documents fell into a grey area, such as course notes including slides that appeared to be from a professor's lecture, with no indication that the professor had given permission for them to be uploaded. The University of Alberta English department section, with 465 documents, yielded similar results. Some assessments were clearly labelled as sample exams for study purposes, though again with no clear permission given to share. However, an entire set of quizzes was uploaded from one introductory level course in 2014. There were also a number of course outlines and rubrics present, which are covered under intellectual property regulations. In addition, both university sites contained many examples of uploaded student essays, which will be covered in more detail in Section 3, as they raise the potential for plagiarism.

The final consideration in terms of privacy, data security and informed consent pertains to the personal information that users agree to share when signing up for ARS sites. Course Hero, Quizlet, and Chegg all have detailed privacy policies outlining what information they gather from users and how that information can be utilized or shared. All three sites store standard personal information given upon signing up (i.e. name, email address, school, gender, and birthdate), but promise not to share personal information with third-party sites. They also make use of cookies and other tracking technologies, which may lead to targeted advertisements based on usage. If users choose to upgrade to a paid version, their credit card information is not stored on the ARS site. Overall, it would appear that ARS privacy policies are similar to other websites that require personal accounts, and, to date, there have been no reported data breaches. However, as with any other website, users must familiarize themselves with how their personal information is stored and used. In fact, a recent survey revealed that 91% of users agreed to the terms and conditions of a hypothetical social media site without actually having read them (Cakebread, 2017). Users do have control over what additional information they choose to include. On Chegg, for instance, users can create an optional personal profile with a photograph and information about personal and academic interests. In this case, users could rely on their digital literacy skills to decide how much or how little they want to add.

As with using tests for cheating purposes, a deontological perspective (Farrow, 2016) can be applied to the issue of informed consent. Simply put, posting an instructor's copyrighted material without consent is in clear violation of institutional and website policies on acceptable use. However, the issue can also be approached from a consequentialist perspective (Farrow, 2016). By using notes or study materials posted without analyzing their usefulness, students may actually end up harming their learning. The Purdue professor who opposed working with Chegg further stated that "(i)f this were a site that genuinely helped students to master the materials, it wouldn't be a problem. But it's not set up like that – it dangles the solution in front of students" (McKenzie, 2019, para. 2). Additionally, as noted in Young (2010), students who take shortcuts in learning class material tend to perform poorly on assessments. On a positive note, instructors can stress that developing one's own notes and materials can lead to more positive outcomes. As they progress, students can also be encouraged to learn about the ownership they possess over their own work, thus considering informed consent from a virtue ethics standpoint (Farrow, 2016). Chegg has also attempted to address academic honesty from this perspective, explaining to students why it is important to adhere to academic honesty

policies. Their Chegg Intellectual Property Rights Owner (CHIPRO) program includes an FAQ section about why posted notes need to be paraphrased and how individual professors may have differing perspectives on posting material from their classes (Chegg, 2020). It must be noted that the CHIPRO program link is located along with dozens of others in their terms of use, which students are unlikely to seek out. However, it is a good alternative to simply state not to do this.

Section 3: Connection of Ethical Issue to Educational Integrity by Avoiding Harm and Minimizing Risk

In addition to cheating on tests and violating copyright infringement rules, ARS sites raise the risk of students engaging in plagiarism. Plagiarism represents a significant and continuing challenge to post-secondary institutions. A 2014 survey of Canadian universities discovered that plagiarism made up over 50% of reported cases of academic misconduct, more than double the next most common category of unauthorized assistance (Moore, 2014). For students looking for an easy source from which to plagiarize, Course Hero in particular represents an open marketplace. The University of Alberta and the University of Calgary English department sections on Course Hero each contain over 100 essays, projects, or writing assignments. It must be noted that users are not in violation of Course Hero's terms of use by sharing their own written materials; however, copying others' materials is a clear infraction. In addition to simple copy-and-paste plagiarism, there is also the potential for getting assistance with finding solutions on ARS sites. Chegg Study, which is available for $15 a month, contains a section called "Ask an Expert Anytime" in which students can post a picture of their homework problem and receive a solution in 30–45 minutes (Chegg, 2020). The site also contains a database of more than 20 million homework solutions (Chegg, 2020). Unless it is forbidden by the professor, getting outside help with difficult problems is a valid approach that could be compared to asking a friend for help. However, the existence of so many prepared answers surely raises the odds of students submitting copied answers.

The development of the Web 2.0 era may be impacting how university students view plagiarism. Collaboration through platforms such as Wikis has become commonplace, and the rise of blogging and social media has led to what Haitch (2016) refers to as "patch writing: a new kind of writing style . . . (in which) younger people, especially, create blogs and posts by piecing together large chunks from various sources" (p. 267). With ideas being shared and remixed so easily, traditional forms of academic-style attribution are not feasible, as it can be difficult to ascertain exactly who has contributed what (Haitch, 2016). The use and sharing of images is another area in which the Internet has challenged longstanding views of plagiarism. Haitch (2016) compared images found online to "toys left indefinitely in the sandbox of a public park" (p. 272), making proper attribution nearly impossible. Interestingly, some research has shown that students view plagiarism from internet sources as less serious. Heckler and Forde (2014) found that 35% of students believed using ideas from the internet was a justified form of plagiarism since the internet was developed as an open way to share information. Some students also believed that copyright laws did not apply to work published on the internet (Heckler & Forde, 2014).

The preceding paragraph should not be taken as an argument that instructors should accept assignments that contain plagiarized work. Rather, it suggests that a strict deontological approach (Farrow, 2016), expecting students not to plagiarize simply because there are rules forbidding it, is not sufficient on its own. From a consequentialist perspective (Farrow, 2016), instructors can stress the importance of adhering to plagiarism regulations in order to avoid punishment; the existence of plagiarism checkers like Turnitin.com makes it easier for instructors to spot transgressions. A more positive consequentialist approach could focus on the importance of proper referencing style in achieving a higher grade, as most university rubrics contain a category assessing citations and referencing. Another approach, which takes virtue ethics (Farrow, 2016) into account, is to encourage students to reflect on their understanding of plagiarism. For instance, students could consider the differences between remixing existing material online and copying sentences

from various sources as part of an essay. As creators of digital work, students could also gain an understanding of why giving proper credit is important. This would help to develop critical thinking skills in a digital context, which Gillis (2019) claimed is "a valued skill as part of an increasingly digitally enabled society and labour market in which information is a core resource" (p. 215).

Section 4: Connection of Ethical Issues with Respect to Participant Autonomy and Independence

ARS sites have become a fact of life for post-secondary institutions over the past decade; banning students from using them would be impossible. Therefore, all stakeholders should focus on best practices to ensure that students can learn from ARS sites in an autonomous manner, while ensuring that academic honesty codes and intellectual property rights are followed. One major push needs to come from the institutional level. Post-secondary institutions must develop specific policies related to ARS sites that students learn as part of their onboarding. The good news is that some Canadian universities have already done so. The University of Toronto, Queen's University, and McGill University all have specific wording in their academic integrity policies specifying proper use of ARS sites. The University of Toronto presents students with potential scenarios and outcomes related to posting notes online – a consequentialist approach – as well as strategies that students can use to become more effective learners – a virtue ethics approach (Academic Integrity at U of T, n.d.). However, other university policies could be more explicit. The University of Calgary makes reference to file-sharing websites when giving examples of unauthorized assistance, but does not specifically mention ARS sites as part of their overall policy. Creating a separate subsection relating to ARS sites appears a possible starting point for providing clarity to students.

Naturally, it is essential to find ways to properly communicate that information, which is where instructors can contribute. Including an overview of academic integrity policies as part of class orientation would prove beneficial. In addition, instructors could have students discuss scenarios related to academic integrity. This would help students to understand their positions as creators and contributors of content, which is an important part of developing expertise in information literacy (Gillis, 2019). Addressing academic integrity in a proactive manner would also be more productive than assigning punishment after students violate rules (Gillis, 2019). Instructors could also place notices on their materials reiterating that they are not to be shared. On the other hand, instructors could also decide that they will allow students to share certain materials online. Giving permission in the form of a Creative Commons license would clearly delineate how others could use uploaded material while helping to build students' knowledge of proper methods of online resource sharing (Gillis, 2019). Finally, instructors could expand their range of assessments in order to avoid the possibility of tests or answer keys being leaked. Students could complete an in-class problem-solving activity, for example, rather than doing a multiple-choice quiz from a standardized test bank. Although modifying and updating assessments involves extra work, it is a recommended practice for educators and is likely more effective than searching multiple sites for copies of assessments (Lienick & Esparza, 2018).

Finally, students can take a more nuanced approach to ARS sites. The ad hoc rules that exist on other digital platforms are different from the stricter rules that apply when university policies on academic honesty are involved. As previously mentioned, one crucial part of information-based literacy is critically appraising online materials. Students should keep in mind that ARS sites are businesses first and foremost. They all provide limited free access but charge monthly fees for full access to materials and experts. This may prove a barrier for students of limited financial means, so they need to weigh the benefits of signing up for a paid membership. Students also need to be vigilant in assessing the source and validity of uploaded materials. In one healthcare finance class, for instance, over half the class gave similar but incorrect answers to an exam question; the instructor later discovered that the students had been using an ARS study guide that contained numerous errors (Lienick & Esparza, 2018). Instructors could assist by providing students with examples of

learning being harmed by improper use of ARS sites. Ultimately though, students will have to apply their knowledge about academic honesty. ARS sites do not actively police themselves, and requests to remove material can only come from the rights holders. It is inevitable that students will encounter copyrighted material, assessments, or essays, but if they can apply their digital literacy skills and analyze the use of material from a proper ethical standpoint, they will be more successful in using ARS sites in a positive manner.

Conclusion

The challenge of ensuring that students follow rules of academic integrity is not new, but it has become more difficult in the age of ARS sites. If students are unfamiliar with the pitfalls of using these sites, they are likely to run afoul of institutional policies, whether intentionally or unintentionally. They also run the risk of becoming overly reliant on information uploaded by others, which could have a detrimental effect on the development of critical thinking skills. This became all the more likely in the age of emergency distance learning that North American institutions dealt with beginning in the spring of 2020. Instructors rapidly converted to modes of online instruction, uploading documents, and recording lessons for student use. Adherence to academic honesty rules become more important than ever as students work from home and become increasingly reliant on online resources. However, if used properly, ARS sites have the potential to deliver benefits to students who are isolated and do not have access to university libraries or in-person study groups. Instructors could also use this opportunity to explore the range of services offered by ARS sites and to figure out ways to incorporate them into their instruction. It is not yet clear what the results of emergency distance learning will be, but there is an excellent opportunity for students, instructors, and institutions to learn from one another and gain a greater understanding of how to use ARS sites in a constructive and ethical manner.

Note: A summary of the principles of ethics as described by Farrow (2016) and how they apply to ARS sites can be found in Appendix A.

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Appendix A

Table 4.1 Completed ethics in digital teaching and learning based on Farrow's (2016) *Uncompleted Framework*

Principle	Duties and Responsibilities (deontological)	Outcomes (consequentialist)	Personal Development (virtue)
Respect for participant autonomy	• ARS sites must clearly describe what is available in their free and paid versions.	• Students may encounter incorrect information if they do not apply digital learning skills. • Instructors can explore the possibility of sharing materials, potentially with a CC License.	• Students can develop their digital literacy skills by assessing material found on ARS sites.
Avoid harm/ minimize risk	• Users must adhere to ARS and institutional guidelines on academic integrity.	• There is the potential for failure, suspension, or expulsion if academic integrity guidelines are violated. • Students can achieve stronger grades if they follow referencing guidelines.	• If students cheat, they will not build knowledge or develop critical thinking skills.
Full disclosure	• Institutions and instructors must provide students with clear policies on ARS sites during orientation. • ARS sites need to include honour codes for users.	• Students can gain empowerment and build knowledge through the proper use of ARS sites. • If ARS sites enforce their own rules, they can achieve improved collaboration with institutions.	• Students can develop their collaboration skills in a digital environment.
Privacy & data security	• Sharing without consent violates the privacy of instructors' tests & other materials. • ARS sites must protect users' personal data.	• If students do not read the terms and conditions, they will not become informed about how their information will be used.	• Students can learn about the importance of data security and decide what personal info they want to share.
Integrity	• Institutions must protect their reputations from cheating scandals.	• Institutions must enforce their academic integrity policies to the degree necessary to maintain their integrity.	• Students can evaluate the differences between remix literacy and plagiarism.
Independence	• ARS sites must represent an option for learning, not a requirement.	• Students can use their knowledge of academic integrity to use ARS sites in a positive manner.	• Students can discover and reflect on the positive uses of technology in learning. • Students will become more well-rounded and independent learners.

Principle	Duties and Responsibilities (deontological)	Outcomes (consequentialist)	Personal Development (virtue)
Informed consent	• Many instructors don't know their materials are being shared; thus, they can't give consent. • Stealing others' ideas violates attribution norms,	• Without informed consent, instructors' copyrighted materials may be remixed and used in any number of other contexts.	• Students can learn how to offer informed consent when sharing and remixing material.

Chapter 5: Adaptive Learning Systems in Modern Classrooms

SIMO ZARKOVIC

Introduction

In today's modern educational systems, it is very common to have two to three dozen students in a classroom but only one teacher. In post-secondary institutions, this can easily turn into 200 to 300 students for every one professor. Class size is compounded in today's classrooms, which are filled with diverse learners with a multitude of needs along with unique strengths and weaknesses. The complexity and range of student needs can result in an overworked teacher who gives teaching their best effort and still finds that some students fail to meet an acceptable level of concept mastery. Simply put, there are not enough teachers to meet the multitude of students' needs so that every single student can succeed in every single classroom. In recent years, artificial intelligence (AI) has begun to take ever-stronger roots in education, giving rise to Adaptive Learning Systems (ALS). ALSs, created through the fusion of AI software with handheld, network-connected computers, aim to deliver personalized learning. These systems can "help teachers reallocate 20 to 30 percent of their time so they can focus more on student-centric activities such as building deeper one-on-one relationships, refining individual lesson plans, or providing real-time personalized feedback to students" (Microsoft [New Tab], 2018, p.5). These ALS educational technologies are synonymous with intelligent tutoring systems, student-centred learning, intelligent instructional design, and personalized learning applications. Marr's [New Tab] (2018) article defines such systems as "digital platforms that use AI to provide learning, testing and feedback to students from pre-K to college level that gives them the challenges they are ready for, identifies gaps in knowledge and redirects to new topics when appropriate" (para. 3). In the current era of heightened calls for greater personalization and better results in education, "personalized learning applications are currently among the most heavily marketed, exciting and controversial applications of edtech" (Regan & Jesse [New Tab], 2018, p. 168).

Educational Ethical Issue

This chapter will discuss the ethical considerations of Adaptive Learning Systems (ALS) and their impact on students, teachers, and the merchants that provide them. The following question will be examined though consequentialist, deontological, and virtue ethics perspectives (Farrow, 2016), as well as my own perspective: should Adaptive Learning Systems (ALS) be implemented in modern classrooms?

Elevated Calls for Personalized Learning

Personalized learning – where students control pace, content, and assessment – was one of the two emerging findings in Microsoft's (2018) report *The Class of 2030 and Life-Ready Learning: The Technology Imperative* [New Tab]. The report found that "nearly 70 percent of [2,000 surveyed] teachers cited time constraints as their biggest hurdle to providing more personalized content to their students" (Holzapfel [New Tab], 2018b, para. 14). Automated grading

and personalized feedback are common features of ALS, so this two-pronged approach promises to provide more instructional time to teachers to aid students in places where their exceptionally smart digital tutors cannot. The calls for personalization do not stop there; tech companies or 'philanthrocapitalists' such as the Bill and Melinda Gates Foundation, Chan Zuckerberg Initiative, Dell, Hewlett, and Google.org emphasize the differences in ways students learn and the importance of flexible learning opportunities. These five companies use captivating statements such as "a truly transformative, personalized learning experience (Chan Zuckerberg), and real-time assessments for gauging student learning (Gates)" (Regan & Steeves [New Tab], 2019, para. 33), to describe ALSs.

Table 5.1 Examples of real-world applications of artificial intelligence (AI) in educational settings

Adaptive Learning System (Parent Company)	Brief Marketed Description of ALS
iReady (Curriculum Associates)	Delivers online lessons that provide tailored instruction and practice for each student to accelerate growth, while supporting teachers with in-the-moment resources for remediation and re-teaching (Curriculum Associates [New Tab], n.d., para. 4).
MATHia (Carnegie Learning)	Using sophisticated AI technology to adapt at a very detailed, skill-by-skill level, MATHia personalizes the learning and keeps students engaged with customized just-in-time feedback and contextual hints, while providing you with all the real-time feedback and assessments you need to understand where your students are at and where they're headed (Carnegie Learning [New Tab], n.d.a, para. 3).
Exact Path (Edmentum)	Combines adaptive diagnostic assessments with individualized learning pathways to promote growth for K-12 grade students in math, reading, and language arts, as students receive a unique testing experience that precisely pinpoints their instructional level, strengths, and needs (Edmentum [New Tab], 2020, para. 2).
"Jill" Watson (IBM)	A graduate-level teaching assistant who can hold office hours 24/7/365, where "she" spends her days helping students in the online M.S. in Computer Science program's Knowledge-Based Artificial Intelligence course (Georgia Institute of Technology College of Computing [New Tab], n.d., para. 1).
Cognitive Immersive Room (IBM)	An immersive classroom environment, where students feel as though they are in a restaurant in China, a garden, or a Tai Chi class, where they can practice speaking Mandarin with an AI chat agent through immersive technologies (IBM [New Tab], 2019, para. 1).

AI Policy in Education

No educational district wants to be left behind; leaders are on a constant pursuit to bring in new literature and reports, which likely shape their board's learning directive for the next few years. Alberta Education's (2018) Leadership Quality Standard expects K-12 leaders to embody visionary leadership and to lead a learning community. Similarly, boards of governors at both the University of Calgary and the University of Alberta support forward-thinking programs and collaborations to meet AI learning needs in society (Pascoe [New Tab], 2019). Additionally, in 2017, Canada's federal government created a Pan-Canadian Artificial Intelligence Strategy [New Tab] – the world's first national AI strategy. This led to conferences where, thus far, more than 150 researchers, thought leaders, and policy makers examined the social, economic, ethical, and legal implications of AI (Barron et al. [New Tab], 2019). One crucial observation from these gatherings is that many policymakers lack awareness of current AI capabilities and applications, and their associated policy implications. Despite the policy shortcomings with respect to AI, the participants proposed a general framework to guide policy development for public education and responsible innovation, including to:

- Promote awareness of data protection rights and regulations among the general public;
- increase the digital literacy of the public, particularly among traditionally marginalized and vulnerable populations;
- provide government funding to incentivize companies to incorporate transparency into the design of their applications; and

- encourage open source algorithms to mitigate inequality (Villeneuve et al. [New Tab], 2019, pg. 7).

Consequentialist Perspective

Easily interpreted, visual data is a part of every ALS, and these data sets are designed to help teachers recognize learning gaps. This newfound awareness is supposed to lead to greater efficiency when it comes to the time spent during an interaction between a teacher and their student. ALS can also be connected to personal mobile devices that students carry; AI can augment the physical world, overlaying the real environment with virtual information (Luckin et al. [New Tab], 2016). This augmented reality is designed to engage students as it moves lessons from hypothetical scenarios to real-life, and diverges from one-size-fits-all content delivery to a tailored and dynamic learning experience.

Deontological Perspective

Experienced teachers can quickly identify the skills and curricular knowledge that their students both possess and lack. From an equity perspective, teachers want to narrow the gaps as much as possible before moving to the next sequential outcome, and ALS can certainly help with that. Furthermore, "teachers will be able to record their observations of students – and benefit from the observations of other teachers" (CoSN [New Tab], 2018, p. 34) in their work to ensure the most efficient use of resources, both human and artificial.

Virtue Ethics Perspective

The shared narrative between people, schooling institutions, and government agencies seems to be that people "who are unfamiliar with the use of AI-driven technology, will not receive the same benefits as those who have adopted these tools" (Villeneuve et al. [New Tab], 2019, p. 9). It makes sense to employ ALS, which can automate grading and thus free teachers to forge deeper socio-emotional bonds with their students. Instructional flexibility offered by ALS can provide access for students to progress at their own pace; not only to catch up, but also to accelerate learning. An industry-sponsored white paper called The Equity Equation [New Tab] by McGraw-Hill showcases "institutions like Columbus State, Arizona State University and Triton Community College in Illinois, among others, which are improving educational equity by applying new learning methods and tools that adapt to individual student needs" (Neelakantan [New Tab], 2019, para. 4).

My Own Perspective

As teachers, students, and parents become aware of ALS, the pressure to purchase will likely increase, and the delay of implementation may result in frustration. I am surprised that the marketing teams of various ALS have not advertised as heavily in Canada, where they could leave the impressionable public feeling disadvantaged if their school boards do not acquire 'the latest and greatest' for their pupils. This will be reminiscent of computer purchases that occurred just before the turn of the millennium, with schools hurriedly purchasing both PCs and Macs to accommodate their student populations. The leadership of modern school districts must demonstrate that they are aware of powerful and influential corporations' potential hidden intentions, and honour the expectation to disclose and justify their choice of one ALS

vendor over others. Over the last two decades that I have spent in classrooms as a student and as a teacher, I have noticed significant amounts of technology brought in, with limited rationale provided about the purchasing decisions. I have encountered bulky desktops, then slim laptops, and, most recently, Smart Boards in classrooms, with little time allocated to learning about the rationale for the purchase, insufficient resources invested in preparing users, and inadequate discussion of concerns behind the proposed enhancements. As ALS arrive in classrooms, many teachers will need to be trained how to effectively incorporate them in teaching routines in order to gain "new ways of understanding and interacting with their students" (Microsoft [New Tab], 2018, p. 5). Otherwise, these costly systems will remain in boxes at the back of classrooms, as untrained teachers continue to teach, undisrupted, and without using the latest technology gadgets.

Benefits and Challenges of Implementation of Privacy Protection, Data Security, and Informed Consent in Adaptive Learning Systems

Predicting the future is challenging work, and this applies especially to the personalized predictive lessons generated in ALS immediately after students input their unique responses. The concept of accurate error diagnosis is fundamental to all successful tutoring, and ALS will only be as good as the size of a database that it is connected to (Ferster [New Tab], 2017). This "entails collection of more, and more granular, information about students, teachers, and families, as well as administrative details regarding the functioning of educational institutions" (Regan & Jesse [New Tab], 2018, p. 168). As ALS collect and analyze multiple streams of data in real time, "there is a real possibility of continuous improvement via multiple feedback loops that operate at different time scales – immediate to the student for the next problem, [and] to the teacher for the next day's teaching" (Bienkowski et al. [New Tab], 2012, p. viii). Recent big data aggregator systems such as InBloom had "some 400 'optional fields' that schools could choose to fill in and that included sensitive information such as disability status, social security numbers, family relationships, reasons for enrolment changes, and disciplinary actions" (Regan & Jesse [New Tab], 2018, p. 169). ALS databases need to strike a balance between not asking for too much data and going defunct – as in the case of InBloom – while also requesting as much data as possible in order to better personalize the next ALS-generated learning task.

Fuelled by renewable student populations, the market for student data is only projected to increase; "analysts forecast the Artificial Intelligence Market in the US Education Sector to grow at a CAGR (Compound Annual Growth Rate) of 47.77% during the period 2018-2022" (Research and Markets [New Tab], 2018, para. 2). This equates to an incremental [four-year] growth of 253.79 million USD, with one of the key market drivers being "an increased adoption of ITS [Intelligent Tutoring Systems] . . . in the education sector" (TechNavio [New Tab], 2018, para. 2). As private student data transfers from schools to remote servers, "we need to be particularly careful about educational technologies which store and/or access information outside of Canada; these educational technologies are not always bound by Canadian law" (University of Victoria [New Tab], 2019, para. 2). This could lead to foreign corporations selling the data to other merchants or even to foreign governments nefariously targeting people by deeply digging into their personal data.

Research Data of Various Adaptive Learning Systems and How They Impact Instruction and Learning

Getting ALS raw data is a challenge. No peer-reviewed data exists, only industry-sponsored data. Additionally, "there are no established standards for describing or evaluating the extent to which a learning experience is personalized, and

often the difference between responsiveness and adaptiveness is not accounted for in product descriptions" (Bulger [New Tab], 2016, p. 4). ALS companies such as iReady state that rigorous and scientific analysis is their priority, but this has been slow going, because the process requires "extensive data sharing, privacy safeguards, significant funding, and longstanding relationships with districts and schools" (McKinnon [New Tab], 2018, para. 16).

Table 5.2 Self-reported results of adaptive learning systems listed in Table 5.1

Adaptive Learning System (Parent Company)	Excerpts from Self-Reported Data
iReady (Curriculum Associates)	Students using iReady Personalized Instruction for an average of 45 minutes or more per subject per week for at least 18 weeks showed statistically significantly greater growth than the average student who did not receive iReady Personalized Instruction during the 2017–2018 school year (Curriculum Associates [New Tab], 2020, p. 2).
MATHia (Carnegie Learning)	An independent study by the RAND Corporation and the U.S. Department of Education found that MATHia's blended approach nearly doubled growth in performance on standardized tests in the second year of implementation (Carnegie Learning [New Tab], n.d.b, para. 1)
Exact Path (Edmentum)	Results indicated that use of Edmentum Exact Path is positively associated with student achievement outcomes in math, reading, and language arts. Statistically significant effects were found linking the amount of time spent on Exact Path and end-of-year diagnostic scores (Edmentum [New Tab], 2017, p. 2).
"Jill" Watson (IBM)	Jill was a highly effective teaching assistant for students, answering questions with a 97% success rate. Out of 10,000 queries that require little thinking, Jill's aim was to answer 40% of all these questions (Maderer [New Tab], 2016).
Cognitive Immersive Room (IBM)	Acquiring a new language naturally, through cultural immersion, may be more effective than non-immersive practices. One of the biggest obstacles in learning a foreign language through immersion is students' fears of being judged by native speakers (IBM [New Tab], 2019, para. 2).

Consequentialist Perspective

According to Neelakantan [New Tab] (2019), "powered by advanced algorithms, adaptive learning technologies boost completion rates and give students confidence" (para. 1). Furthermore, mining and analyzing data gathered by an ALS "can analyze underlying patterns in order to predict student outcomes such as dropping out, needing extra help, or being capable of more demanding assignments" (West [New Tab], 2012, p. 2). Despite a teacher's best efforts to provide formative feedback in lectures, and summative feedback on an occasional assignment or quiz, use of the ALS enables more frequent, real-time feedback to students on tasks and interactions in the system. While it would be unrealistic to expect a teacher of two to three dozen students to adjust a lesson based on each student's needs, ALS makes this type of responsiveness possible using the data that is collected from students.

Deontological Perspective

Data, upon which the ALS relies, can be insufficient, meaning that unseen threats are pending to everyone who is overlooked. Students can also become overlooked and underserved by teachers who rely heavily on thinking that AI knows best, without using their own intelligence to think, probe, and teach. Lerman [New Tab] (2013) suggests that the "big data revolution may create new forms of inequality and subordination, and thus raise broad democracy concerns" (p. 60). Furthermore, continued differences in decisions about how best to hold ALS vendors accountable remain uncertain, especially when it comes to critical issues of data security and privacy protection. As Regan & Jesse [New Tab] (2018) point out, "one of the most problematic issues involves whether edtech companies should be able to use data generated by students' use of their software programs to improve those programs" (p. 173). This supposed

mutually beneficial practice blurs the lines on whether student learning profiles are used for a student's own good or for corporate profit.

Virtue Ethics Perspective

Big data's use of mathematical algorithms and artificial intelligence to make predictions about individuals based on their information and that of others raises questions about treating individuals as individuals fairly, accurately, and in ways they can understand (Citron & Pasquale [New Tab], 2014). More so, big data critics worry that "the world's increasing 'datafication' ignores or even smothers the unquantifiable, immeasurable, ineffable parts of human experience." (Lerman [New Tab], 2013, p. 56). Any teacher can attest that it takes attentive emotional intellect and relationships with students to read the cues that students put out, and that students' learning is affected when they are in an escalated state of mind. Consequently, there has been a recent interest in supporting teachers to become better acquainted with Trauma Informed Practice (TIP) and student mental wellness.

My Own Perspective

Regan & Jesse [New Tab] (2018) explain that "a critical ethical concern raised with personalized learning is whether such programs constitute tracking and sorting of students that might be considered discriminatory" (p. 168), as in the 1950s, when children were divided by race, ethnicity, gender, and class. Some of these divisive factors might come back or can even be encouraged, especially in less socially progressive countries. Though such divisions are opposed in Western societies, the wealth gap seems to be widening (Litwin [New Tab], 2019). Data gathered by an ALS could serve as a foundation for parents or guardians of very affluent students to advocate for redirection of the school's limited budget to fund elite, exclusionary classes for their children. ALS are often marketed as having the potential to accelerate brains, so influential parents within any particular school could demand a special settings class where "as the pace of change accelerates, learners will demand more ways to convert learning to earning" (Consortium for School Networking [New Tab], 2018, p. 8).

Benefits and Challenges of Implementation of Respect for Participant Autonomy and Independence Concerns When Using Adaptive Learning Systems

Through the use of big data and smart algorithms, ALS can be used to help teachers find their own blind spots and even reveal unorthodox thinking and teaching strategies for students. Students can link ALS profiles to their own cellular devices, which can then remind them of deadlines and offer opportunities to continue tutoring and learning at home. Students, teachers, smart machines, and software increasingly interact in new and deeper ways, and may be reshaping our brains in intended and unintended ways. KnowledgeWorks [New Tab] (2018) explains that "repeated use of Google Search has been shown to stimulate the use of short- over long-term memory in ways that may undermine critical thinking" (p. 12). Additionally, a continuous connection to smart devices can lead to mental exhaustion due to lack of downtime – we are wired and tired all the time (Brody, 2017). Both parents and school administration need to ensure that students and teachers have allocated time for themselves by respecting their right to disconnect from the non-stop digital realm. Furthermore, all parties need to find a balance when it comes to the wealth of data available to track

various stages of student development; it is easy to lose sight of the big picture in daily performance metrics supplied by ALS. It is also important to note that the youngest, pre-kindergarten learners tend to learn better watching real, face-to-face events, since they have trouble transferring information from a screen to the real world (Troseth & Strouse [New Tab], 2017).

Avoiding Harm and Minimizing Risk to Educational Integrity When Using Adaptive Learning Systems

With so much attention being paid to improving the standard metrics of success in school, less attention may be paid to students' psychological well-being and social health. However, educators should indeed keep student well-being in sharp focus, since "the strongest signal from [Microsoft's] study was the need for teachers, schools, and school leaders to help students develop stronger social-emotional skills" (Microsoft [New Tab], 2018, p. 10). These skills help establish successful team collaborations and enable discourse plus discussion —not just online but in person. We need our students to be resilient to life's many curveballs, to have the capacity to receive constructive criticism, and to come back stronger after a failure. Furthermore, the same report estimated that 30-40% of future jobs will require explicit social skills and emotional literacy (Microsoft [New Tab], 2018). According to Holzapfel (2018), "social-emotional skills provide students with the perspective and flexibility necessary to function at a high level even when faced with uncertainty, change, pressure, stress, and other work and life challenges" (p. 11). Enhanced socio-emotional capacity will come in handy within the tumultuous gig economy, since people will shift from having a single job to having short-term contracts with multiple employers. Social-emotional and other relational and well-being skills will not be evaluated by ALS, but they still need to be practiced and built, so that students can have happy, healthy, and well-rounded lives.

Consequentialist Perspective

Education is moving toward outcome-based and competency-based learning, meaning that students do not need to sit for hours listening to content being presented, but can instead optimize their time by focusing on mastering the cognitive skills and the socio-emotional and content knowledge they lack. When a student gets ill, connecting to their ALS account from home can enable them to engage with the curricular outcomes missed at school. More mature, part-time students can use their time to learn other skills, which are constantly fluctuating as workplace demands and employability skills change. In their report on the future of work and learning, D2L (2018) writes that the "constantly fluctuating skills market means employee skills are becoming outdated more rapidly and require ongoing training and development" (p. 11)

Deontological Perspective

Traumatic events like war conflict, poverty, family instability, homelessness, and a lack of opportunities frequently result in educational disruptions. ALS can help to mend the gaps in learning, so schools should budget funds to close those gaps for the students in need. The academic part of student well-being is quickly captured and reported, resulting in instantaneous hope and jubilation in those students. KnowledgeWorks [New Tab] (2018) explains that "as students gain the rights to own their own data, data asset advisors help students and their families manage, present and exchange data related to students' learning, locations and device and platform usage" (p. 20).

Virtue Ethics Perspective

Personal autonomy deals with the extent of one's freedom to make choices, and can be affected by the algorithms and intelligence that exist within ALS. When students spend a dozen years of schooling with ALS, these computers can become a long-lasting crutch for them to lean on. As students move on to the workforce, the validations that ALS provided them are gone, and they may feel lost without the devices that they grew up with. At the same time, teachers cannot rely too much on ALS, as these programs and algorithms lack empathic capacities, and therefore provoke feelings of dehumanization that endanger personal autonomy (Royakkers et al. [New Tab], 2018).

My Own Perspective

The recent COVID-19 pandemic has essentially disrupted every single school in the world for months. The first few days and weeks were spent in uncertainty, with many educational leaders drafting corrective directives to enable education from April until the end of the 2019-2020 school year. Through communication with colleagues from different countries, the discrepancies in educational delivery were incredible. Some school boards scrambled to get an exponential number of online learning platforms just as a starting point, while others had ALS programs like iReady and MATHia loaded on their students' tablets, minimizing the educational disruption. On one end, some parents and students were stressed and anxious as many aspects of their world suddenly stopped operating, including schools. On the other end, students continued to log into their ALS accounts daily, ready for timely and targeted curation of learning content for the day. Depending on grade level, the Government of Alberta [New Tab] (2020) mandated that students spend between five to 12 hours per week learning online. With some parents already concerned about too much screen time, school boards needed to ensure that the hours students spent online were engaged through responsive, adaptive, and learner-centric pedagogy.

Conclusion

The cost-effective, scalable, yet personable and impactful learning experience that ALS can provide means the spread of these technologies in K-12 may be unstoppable. "These systems continually assess skill and confidence levels and provide precise direction to fill knowledge gaps, accelerate mastery, and adapt to each student's individual learning styles and unique circumstances" (McGraw-Hill, 2019, p. 11). School boards generally set goals to increase achievement, while students face multidirectional pressures to bolster their own test scores. It is important not to get caught up in the perceived novelty of any new technology, such that "we're so hopeful about upgrades that we rarely look at the practices that technology does not change, [and] those that it changes for the worse." (Watters [New Tab], 2015, para. 9). Before district leaders and other agents of change bring ALS to schools, they need to ask questions about big data, learner profiles, and algorithmic analytics, and to evaluate the marketed information though multiple ethical considerations.

Neither teachers nor parents should agonize about teachers getting replaced by machines, as "most experts believe that teachers will remain irreplaceable, but there will be many changes to a teacher's job and to educational best practices" (Marr [New Tab], 2019). In fact, "actual study findings indicate that personalized learning systems are best deployed as supplements to teachers, rather than their replacements" (Bulger [New Tab], 2016, p. 12). The role of teachers will continue to change, and it is likely they will be expected to incorporate computer tablets containing ALS and associated data into their daily routines sooner or later. The shift to ALS can enable teachers to respond directly to questions not answered by ALS, freeing time for greater emphasis on socio-emotional human connections that empower teachers

to nurture other human intelligences in their students. Due to many complex societal problems, schools have become crucial communal hubs that offer supports for essential services and human connections. With an ever-increasing population and widening wealth gap, the need for such services in school will likely increase in the future. Though schools will continue to have standardized tests, there is no such thing as a standardized student, and this is where the hyper-personalization offered by ALS can be a helpful addition to teaching and learning supports. We cannot let fear hold back innovation in the educational technology field. We need to embrace new pedagogical models for the 21st century – to do otherwise would be unethical.

Questions to Consider

- Which other major societal shifts – comparable to the COVID-19 pandemic – will impact the future of learning?
- What might be the ethical and long-term health and educational implications of using neural enhancement technologies?
- What policies, processes, and protocols will prevent recorded student learning profiles from being sold to prospective employers, financial institutions, and health insurance providers of those students?
- In what ways will classrooms change for present learners, and to better prepare graduates for their futures?

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Appendix A

Table 5.3 Completed ethical framework for use of adaptive learning systems in modern classrooms, based on Farrow's (2016) Uncompleted Framework

Principle	Consequentialist Theory	Deontological Theory	Virtue Ethics Theory
Full disclosure	• ALS deliver all sorts of new data, which provide teachers with new insights. • Teachers are able to use their time with students in more efficient way, to fulfil the gaps that ALS identifies. • Student engagement increases as ALS incorporates student's own data into otherwise static questions and makes the visualization appears on screen.	• Practicing equity, teachers use real-time data to narrow the gaps in student comprehension before moving to the next curricula outcome. • Teachers utilize the recorded ALS observations to better address student needs. • Ongoing information flow about student's learning profile mean no need to reinvent the wheel and waste time asking what was already captured.	• Students who attend schools that do not have funds to purchase ALS become disadvantaged by not having the opportunity to use AI in ALS. • Teacher is freed from spending time marking so more of it can be spent on other pedagogical tasks. • Flexibility offered by ALS can inspire students to go at faster or slower pace, depending on each curricular outcome studied.
Privacy, data security and informed consent	• Data can be analyzed to forewarn about risks of students dropping out. • Thanks to instantaneous feedback offered by ALS, students do not wait for days to get their quizzes or assignments evaluated and recorded. • AI within ALS uses student input to generate personalized lessons for every student in class.	• Gaps in data can lead to students becoming overlooked, erroneously resulting in no interventions. • Regulations are vague or lacking when it comes to ethic expectations and lawful compliance with respect to student data. • ALS merchants could use student data to improve their own AI systems and sell more units, creating a positive feedback loop to generate more money.	• There are many aspects of a human being that go beyond the ALS perimeters, and those unincorporated bits of information can lead to dehumanization of its users. • Automated ALS cannot read emotional cues presented by students, leading to futile attempts to engage actively. • Teachers need to utilize their training to address ALS shortcomings.
Respect for autonomy and independence while avoiding harm and minimizing risk	• Following the competency-based model of instruction, students use their time in school to progress in their own unique pathways. • For times when students cannot be at school, they can remotely connect to their ALS devices to and carry on with learning. • Time spent learning is optimized, leaving students with time to learn other skills that can assist them in the future.	• The spectrum of educational disruption is wide, but customized learning content, generated by ALS can close gaps in a timely manner. • Parents get learning reports frequently, enabling them to focus further at home on topics that students find challenging. • ALS distributes data to students, teachers, and parents, ensuring that all involved parties are on the same page.	• Constant use of ALS can lead students to become dependent on the system for validation. • Heavy reliance on ALS for confirmation can hinder development of student's own internal sense of checks and balances. • Teachers need to use their professional judgement and not depend solely on ALS to drive the direction of student's learning.

Chapter 6: STEM Beyond the Acronym: Ethical Considerations in Standardizing STEM Education in K-12

JENNIFER ANSORGER

The American education system has undergone numerous iterations over the years. From the No Child Left Behind Act of 2002 to the Back to Basics movement (and it's emphasis on the 3 R's – reading, 'riting, 'rithmatic), educational trends have influenced decision-makers to design and build programs in the hopes of improving student outcomes on standardized tests. Over the past few decades, STEM (Science, Technology, Engineering, and Math) has been a widely discussed program in education (Blackley & Howell, 2015; Breiner et al., 2012; Bybee, 2013). However, STEM has yet to be truly defined, since government officials, teachers, parents, and other stakeholders have varying perspectives of what STEM is and how it should look in the classroom (Breiner et al., 2012). STEM is viewed in a variety of ways that are dependent on stakeholders and on ethical considerations – which causes tension when trying to create a unilateral definition in order to better direct teaching practice.

Some argue that standardizing STEM would result in teaching silos (Blackley & Howell, 2015; Bybee, 2013) with little diversity of thinking, leading to STEM subjects being taught as four separate subjects with assessments conducted through standardized testing. Blackely and Howell (2015) argue that "teachers have defaulted to the notion of S.T.E.M. rather than STEM," where the full stops "signif[y] . . . the silo-ing of the four distinct discipline areas, rather than their integration" (p. 104). By teaching science, technology, engineering, and math as separate subjects (or silos), the learning experience shifts from being interdisciplinary, transdisciplinary, and integrated, to one that is focused on an individualized curriculum (Bybee, 2013) that "reflects decisions made centuries ago, especially around science and mathematics" (Davis et al., 2019, p. 3). Others argue that to truly meet the needs of learners, a foundational approach or mindset that weaves STEM throughout all subject areas is crucial. This orientation creates a comprehensive curriculum that utilizes a transdisciplinary approach with an objective that "resolve[s] real world or complex problems . . . provide[s] different perspectives on problems" (Choi & Pak, 2006, p. 351), and requires insights and perspectives from more than one discipline (Davis et al., 2019).

This chapter will consider the ethical implications of STEM education (silo versus mindset approach) in the US and its impact on learners, with special consideration for gender, ethnicity, and socioeconomic standing. When determining how to define STEM education, who should be responsible for determining best practices and the future direction that education should take? Decisions need to be made to meet the needs of the learners themselves, not based on funding nor global positioning. There are multiple ethical implications when creating a standardized curriculum for STEM without considering all of the stakeholders (i.e. students, parents, and educators). This standardization could create a larger achievement gap among minority groups, girls, and those in lower socioeconomic districts. The push for a standardized definition of STEM as a silo, with standardized testing being the gauge of effectiveness, has illustrated the disparity between gender, socioeconomic, and ethnic groups. In the US, various programs have been designed to promote STEM education for girls [New Tab] and minority groups [New Tab]; however, males and the privileged classes still continue to dominate in STEM careers and industries (Building America's Future, n.d.; Chang, 2019; Maclean, 2017).

Full Disclosure

STEM is an umbrella concept that incorporates Science, Technology, Engineering, and Math. How STEM education is actually incorporated into different schools and districts varies. The original implementation of SMET in the US was led by the National Science Foundation (NSF); the acronym was later changed to STEM (Bybee, 2013; Sanders, 2009) in the 1990s in response to a need to strengthen science and math education. Until the early 2000s, few people understood the term STEM and many linked it to stem cell research and plants (Bybee, 2013; Sanders, 2009). STEM, when taken verbatim, refers only to the four subject areas. For the purpose of this chapter, the focus will be on STEM education, which is an important distinction.

One impetus for the growing STEM education trend came in reaction to the results of the early PISA [New Tab] test results. The scores on these tests, in addition to a belief in a shortage of people to work in STEM-related fields, prompted the implementation of STEM education in K-12 schools around the world (Williams, 2011). In the US, STEM education became a focused trend to shift "American students from the middle to the top of the pack [internationally] in science and math over the next decade" (The White House, 2009, para. 1) by raising test scores. Another priority was to meet the perceived STEM crisis – a lack of skilled workforce to fill the growing specialized job market (Jadav, 2013; The STEM Crisis & Our Solution, 2020; Xu, 2015). The Partnership for 21st Century Skills (2008) claimed that STEM education was the key to success in the 21st Century, and that without a "charge to action," the US would be left behind in the global market. This charge to action has led many schools in the US to focus primarily on teaching each subject as a silo, with small pockets of schools and districts forging their own mindset path (Cherry Creek School District [CCSD], n.d.). This push for STEM education raises many ethical concerns regarding privacy, autonomy, and best practices for our students.

STEM as a foundational way of thinking focuses on students iterating; collaborating; and using science, technology, engineering, math, and humanities in an interdisciplinary way to solve real-world problems (Davis, 2019). STEM as an inquiry-based integrated method of teaching these subjects is not necessarily a new concept. In the 1990s, the American Association for the Advancement of Science (2009) published a series of benchmarks for science literacy. They believed that:

The common core or learning in science, math, and technology

should focus on science literacy, not on an understanding of each

of the separate disciplines. Moreover, the core studies should include

connections among science, math, and technology and between

those areas and the arts and humanities and the vocational subjects. (p. xii)

Sanders (2009) argues that STEM should be taught with the mindset of "purposeful design and inquiry" (p.21), which incorporates all areas within the STEM umbrella. The integration of the disciplines can provide students with the opportunity to explore and develop potential solutions to global issues, such as renewable energy sources and climate change (Davis, 2019). In districts such as Cherry Creek Schools in Centennial, Colorado, this remains the focus of their STEM program. They see STEM as a focused way of teaching that "instills a deep and extensive understanding of STEM content applied in real-world contexts" (Cherry Creek Schools District, n.d., para. 2).

The term STEM has been used and reused so many times that its meaning has become ambiguous (Bybee, 2013; Sanders, 2009). One school's STEM program can look very different from another. One school can have access to robotics, 3D printers, and one-to-one student laptops. Their program can focus on the T of STEM but have little to no incorporation of design thinking or science and math (indicating a silo approach). Another school can have very little technology

but has students ideating, building, and conversing about real-world problems (foundational thinking). As there is no universal definition of STEM, there is a wide variety of ways in which it is being incorporated into schools. From this ambiguity emerge several ethical issues that need to be considered.

Connection of STEM Education in Teaching and Learning to Privacy, Data Security, and Informed Consent

When determining a standardized definition for STEM, the agenda of stakeholders can greatly influence the direction this standardization takes. One way of influencing how STEM is defined is through funding. Funding from sources such as Google, Code.org, and other companies in Silicon Valley has been influential in pushing STEM education in the US (Caperton, 2012), as illustrated by the most recent $300 million of funding in 2017. The motives behind a companies' investment in STEM education can be considered from an ethical perspective. Some argue that Silicon Valley and subsequent tech giants are pushing their own agendas and have ulterior motives for this funding. One such agenda focuses on the money that can be made by pushing the T in STEM education, which in many iterations refers only to computing. When schools focus on the T in STEM, they essentially buy into the programs and products on the market. This push for technology can lessen the time spent in the collective work needed to unify STEM as a foundational way of thinking, and can create a market in which money must be spent in order to ensure that schools have the latest and greatest technology – technology that continually changes and requires constant upgrading.

Through its ease of use, more affordable devices, and an easily manageable platform, Google for Education [New Tab], which includes Google Classroom and G Suite, has been adopted by many school districts around the US, as well as other countries around the world. It has been marketed as a platform that "focuses on creating the best educational experience for over 70 million students and teachers in more than 180 countries" (Google for Education, n.d.). However, some critics consider whether this accessibility is really free. Tech giants, such as Google, have digital dominance and can effect the economy, society, and politics (Moore & Tambini, 2018), and education (Villapaz, 2014). For example, teachers can use Google to manage classes, share homework, and create shareable, collaborative projects for students without any cost to the school or parents. Ethically, it is important to consider the possible benefits Google might receive with the "free" access provided to students and teachers. Google has faced many lawsuits over the years due to its data mining without parental consent. In September 2019, Google paid out $170 million to the state of New York [New Tab] in response to allegations that Google and YouTube "earned millions by illegally collecting personal information from children without their parents' consent" (Elias & Feiner, 2019, para. 1). More recently, new lawsuits have been filed by New Mexico's state attorney general [New Tab] alleging that "the tech company is illegally collecting personal data generated by children in violation of federal and state laws" (Bryan, 2020).

Ethical Considerations of Privacy, Data, and Security When Schools and Districts Focus on the T (Computing) in STEM

When considering the emphasis of the T in STEM education from a deontological ethical perspective (Farrow, 2016) or in term of moral obligation, the T could be considered a money-making strategy employed by big business, most notably big business out of Silicon Valley. Through the use of its devices and free apps, Google has been collecting information from and about students under the age of 13. Their data mining includes [New Tab] "search history and which results students click on, videos they search for and watch on YouTube, usage data and preferences, Gmail

messages, G+ profiles and photos, docs, and other Google-hosted content, and content that flows through Google's systems" (Electronic Frontier Foundation, n.d., para. 7). The means through which Google is learning about future consumers are justifiable, as they are a money-making enterprise. They are using this information to build profiles and to focus advertisements on non-education suite websites such as YouTube. Through these profiles, Google can expand its database and focus advertisements to target consumerism; this, in turn, brings in revenue for the company. This mining of children's data could be considered a justifiable means to an end. The revenue that companies like Google earn far outweighs the ethical implications of collecting this data.

From a consequentialist ethical perspective (Farrow, 2016), the consequences – the invasion of student privacy with and without parental consent by these companies – far outweigh the financial gain. There are state and federal acts, such as the Family Educational Rights and Privacy Act of 1974 (FERPA) and the Children's Online Privacy Protection Act of 1998 (COPPA), in place that work to protect minors from the collection and use of their private information. However, these policies are limited in their scope and can at times be ineffective at protecting students (Regan & Jesse, 2019). The lack of transparency from big data companies regarding their collection and use of the data makes it extremely difficult for lawmakers to prove probable cause (Regan & Jesse, 2019). The nature of technology and the tightly guarded algorithms that companies use have created a new world, where laws and acts to protect children are ultimately ineffective. The continually changing nature of technology and the sophistication of big data algorithms make it difficult for parents and minors to truly know what they are agreeing to when they click "agree" below the terms of use. The legalese and sophisticated language mask the underlying agreement. When students and parents agree, do they truly understand what they are agreeing to? Not only are minors being tracked and profiled within Google's education suite, they are also losing their autonomy. With access to photos, emails, Google maps, etc. – student anonymity is being lost.

Is it ethical for companies to use information garnered from minors to earn profit and nudge them towards particular brands or advertisements? From a virtues perspective (Farrow, 2016), it is an individual's right to full disclosure, privacy, and autonomy, especially when considering those under the age of majority. Parents, schools, and government bodies are morally obligated to protect those who cannot protect themselves, and to act ethically. Children essentially lose this protection when the door is opened for big data companies to access a their data, parents, schools, and government bodies. Educational use of software and hardware, such as ChromeBooks and Google for Education, invites these companies into our schools under the guise of supporting learners. However, there are potential conflicts of interest as edtech companies work with the schools and teachers while at the same time working with districts, researchers, and shareholders. Is this conflict of interest working to protect our students?

Implications

When STEM is defined with the T as its focus, students become vulnerable to considerable issues around privacy, consent, and autonomy. Through the use of programs such as Google Education, students and teachers receive easy access to a wealth of free online apps advertised to make online learning simpler and more collaborative. These apps grant students and teachers the ability to access a plethora of online programs for free. However, through signing up and clicking "I accept" to the terms of use for each of these programs, students unwittingly give access to companies to data-mine and track every click. When we focus on the T, money is continually funnelled back to companies in Silicon Valley and to other tech giants through the purchasing of licenses, laptops, iPads, and robots. In addition to school spending, these companies profit from advertisements are driven by clickbait and tracked student searches. If STEM is defined as a mindset, however, the use of and reliance on technology becomes lessened, as students look at real-world problems from an interdisciplinary lens, not filtered through technology.

Connection of STEM Education in Teaching to Educational Integrity by Avoiding Harm and Minimizing Risk

Since the early 2000s, government funding programs aimed at improving test scores and deepening the teaching of STEM in K-12 and postsecondary institutions (President's Council of Advisors on Science and Technology, 2010). To meet these needs, the federal government has viewed STEM not as a mindset, but rather as the strengthening of each individual subject under its own umbrella (as a silo). Defining STEM as separate subjects allows for a greater focus on the core subjects and creates a standardization of practice. This standardization can lead to a standardized assessment tool (tests) that have been used historically to track student progress and could lead to gradually increasing sanctions and/or school closures (Duignan & Nolen, 2019; Famularo et al., 2013).

This standardization of practice does not always consider gender, ethnicity, or socioeconomic status. When responding to multiple-choice test questions, students are unable to bring their social narratives or real-life experiences to bear. Rather, only one answer is correct, thus limiting diversity of thinking and providing no option for students to think outside of the box to solve the problem. Examining these initiatives reveals that they have not changed teaching of STEM subjects much at the classroom level, nor have they greatly increased student interest in the subjects (Breiner et al., 2012). When considering these initiatives and the limited improvement of test scores on a global scale, there appears to be a disconnect between these policies and the reality of teaching 21st-century students. This raises the question of who should be making these policy decisions.

Ethical Considerations When Determining a Standardized Definition of STEM as a Silo

From a deontological ethical perspective (Farrow, 2016), this standardization of practice and assessment will allow the US to track students and educators which will then help determine who is underperforming and what sanctions are needed to improve individual schools and districts. The intention of these sanctions (Duignan & Nolen, 2019) is to push educators to better prepare their students in the core subjects (science, math, and reading). This view argues that the means to which test scores are improved outweighs the moral implications.

On the other hand, if we look at the standardization of STEM into its component subjects from a consequentialist ethical viewpoint (Farrow, 2016), data from the 2018 Programme for International Student Assessment (OECD) shows that there has been no major improvement in science and math test scores in the US even with massive federal funding over the past twenty years for STEM education. From this perspective, pushing STEM education as separate core subjects has not resulted in improved of test scores, and the US continues to rest solidly in the middle of the pack.

According to ethical virtue theory (Farrow, 2016) the standardization of STEM education is detrimental to our students' learning. By narrowing the definition of STEM to its component subjects, students are not encouraged to tackle real-world problems from an interdisciplinary standpoint. Students are relegated to a number on a paper that does not take into consideration diversity, culture, nor gender. Should one test written each year determine the future educational trajectory of a student? From this perspective, students should be assessed using a variety of tools and instruments that can effectively account for multiculturalism, ability, and diversity of thinking. A standardization of STEM and subsequent assessment has limited ability to bring in multiculturalism and divergent thinking. This brings to light a need for more culturally responsive education (CRE). CRE is defined as, "a student-centred approach to teaching in which the students' unique cultural strengths are identified and nurtured to promote student achievement and a sense of well-being about

the student's cultural place in the world" (Lynch, 2016, para. 2). Culturally responsive education provides students with the opportunity to use their own experiences and backgrounds to guide their learning.

Figure 6.1 TEDx talk by Isael Torres focused on cultural pedagogy and educational access and equality

A YouTube element has been excluded from this version of the text. You can view it online here: https://openeducationalberta.ca/educationaltechnologyethics/?p=43

Implications

The use of standardized tests to assess capabilities has worked against creating a cohesive, accessible curriculum. Instead of unifying STEM into a foundational way of thinking and creating a curriculum that honours it, STEM continues to be rather ambiguous in its definition, resulting in a heavy reliance on teaching the individual subjects. The tracking of students through a standardized test format has not resulted in an improvement for the US in global standings, nor has it unified the diverse groups of students that make up US schools. Rather, it has disaggregated students based on ethnicity, English language proficiency, socioeconomic status, and gender (Ansell, 2011; Miller, 2013). Failing to consider the diversity of thought and experience negates of the human side of the student population. Test scores are being used as the benchmark for policy decisions (Duignan & Nolen, 2019), which does not necessarily align with what is best for students. The use of standardized testing "has become entrenched in our society, and the collection of such data has exploded in its frequency, in its undue influence on the curriculum, and in its use for making life-impacting decisions about children, teachers, administrators, and schools" (Miller, 2013, para. 5). Foundational thinking and innovative teaching pedagogy provide the opportunity for CRE to be integrated into teaching practice. Teaching in a silo limits the capacity for divergent thinking and students' cultural strengths to be utilized.

Connection of STEM Education in Teaching to Respect for Participant Autonomy and Independence

Though STEM education at the K-16 level has continued to expand, and numerous programs have been created to promote STEM with girls and women, there continues to be a gender gap in STEM fields and careers (Archer et al., 2012; Chang, 2019; UNESCO, 2017). Research has noted numerous reasons for this gap, not limited to gender stereotypes (Shapiro & Williams, 2011; UNESCO, 2017), earning discrepancies (Xu, 2015), teacher bias, and a lack of female voice in STEM programming. Figure 6.2 highlights the "ecological framework of factors influencing girls' and women's participation, achievement and progression in STEM studies" (p. 40).

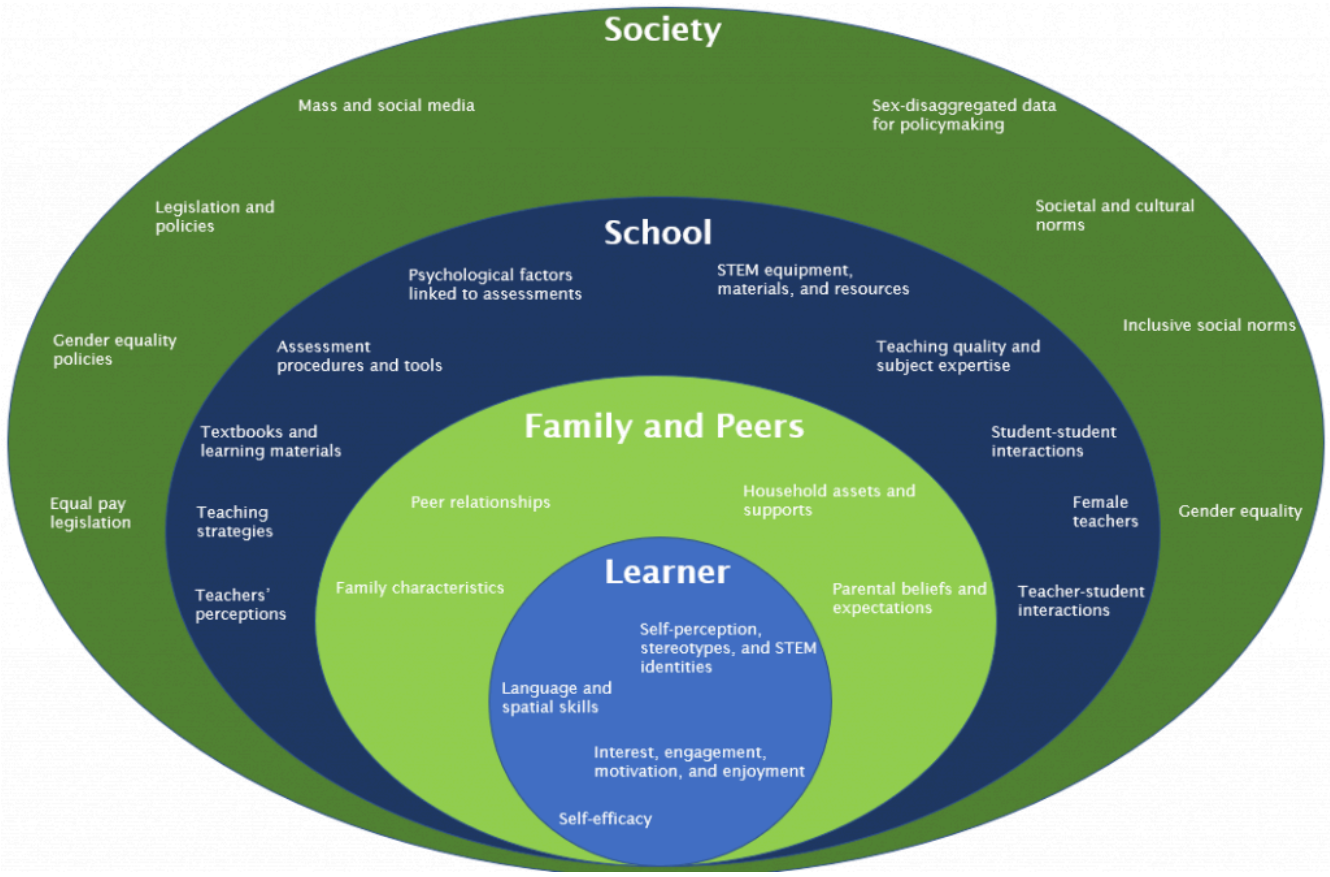


Figure 6.2 Framework of the factors influencing the participation, achievement, and progression of girls in STEM, adapted from "Cracking the code girls and women's education in science, technology, engineering and mathematics (Stem)" (United Nations Educational, Scientific and Cultural Organization, 2017)

Children are exposed to gender stereotypes in the STEM fields from a early age. These stereotypes inadvertently lead to a tendency to associate science and math skills as male-dominated skill sets, which in turn lead to stereotype threat (Gunderson et al., 2011; Shapiro & Williams, 2011). Stereotype threat is defined as "a concern or anxiety that one's performance or actions can be seen through the lens of a negative stereotype – a concern that disrupts and undermines performance in negatively stereotyped domains" (Shapiro & Williams, 2011, p. 175). Even though neuroscience research shows that there are few differences between the structures and functions of the brain between girls and boys (UNESCO, 2017) these stereotype threatspersist in US schools (Gunderson et al., 2011). Gender stereotypes are so entrenched in society that this research does little to dispel the negative impacts of bias on girls'

interest in and pursuit of STEM-based fields (Archer et al., 2012; Ertl et al., 2017; Shapiro & Williams, 2011; UNESCO, 2017). As Shapiro and Williams (2011) state, "stereotypes can undermine women's and girls' performance and interest in STEM domains even when women and girls have positive math attitudes" (p.175). Developing a STEM identity, a form of social identity where one develops a sense of belonging and social acceptance as part of that community begins in adolescence (Kim et al., 2018; Martin-Hansen, 2018; Seyranian et al., 2018). Family, peers, and teachers can greatly impact a girl's sense of STEM identity (Eccles et al., 1990; Gunderson et al., 2011).

STEM PROGRAMS DESIGNED FOR GIRLS

Girls Inc. "Operation SMART"

Girls Who Code

Techbridge Girls

National Girls Collaborative Project (NGCP)

Girlstart

Girl Scouts

Society of Women Engineers: "Invent It. Build It"

STEM for Her

~74%

of middle-school girls show an interest in STEM, but only 0.3% choose computer science as a major

3 REASONS WHY GIRLS TEND TO DISCONNECT FROM STEM:

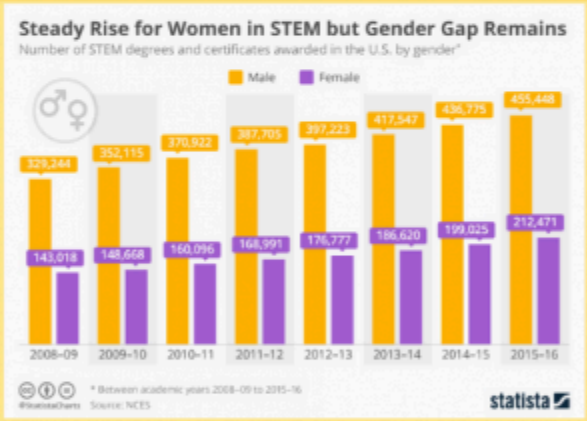
1. Inherent Bias- male dominated
2. Lacking early exposure to STEM activities
3. Less Confidence in STEM Subjects

8%

of females take engineering courses versus 21% of males.

Women make up half of the total U.S. college-educated workforce

But only 28% of the science and engineering workforce



https://www.statista.com/chart/16970/women-stem/

WOMEN EARNING CS DEGREES:

~12%

THIS HAS DROPPPED FROM 37% IN 1984

1 in 7 are engineers

Of **100** women graduating with a bachelor degree, **12** graduate with a STEM major, but only **3** continue to work in a STEM field 10 years after graduation

Girls Who Code reported that although **74%** of middle-school girls express interest in STEM topics and careers, only **0.4%** of high school girls choose pursue them in college.

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- https://girlswhocode.com/2013/04/03/opening-a-gateway-for-girls-to-enter-the-computer-field/
- https://www.splearning.com/stem/women-in-stem-2/

Figure 6.3 STEM Programs Designed for Girls

When determining best practices for STEM education, one could consider a female perspective when designing a curriculum. From a social justice perspective, one could look at the recognitive justice of female representation in STEM education and instruction (Lambert, 2018). Is there an equal representation of females in textbooks, curriculum, etc., to ensure that girls feel a sense of community in their learning?

Currently, STEM education as a silo approach is predominantly taught from a male perspective, which limits many girls' capacity to develop a STEM identity (Archer et al., 2012; Calabrese Barton & Brickhouse, 2006; Haussler & Hoffmann, 2002). Education requires a shift in how STEM classes are taught at a K-12 level. A foundational approach could be beneficial to aiding girls in developing their STEM identity (Baker, 2012; Haussler & Hoffmann, 2002; UNESCO, 2017). Research has shown that girls have responded favourably to a curriculum that incorporates ". . . a strong conceptual framework, [and is] contextualized and relevant to real-world situations" (UNESCO, 2017, p.67). Additionally, a foundational approach to STEM creates an environment that could build girls' interests, as the curricula can provide a "varied experience, which integrates social and scientific issues, provides opportunities for genuine inquiry, involves real-world experience, as well as opportunities for experimentation, practice, reflection and conceptualization" (UNESCO, 2017, p. 67).

Ethical Considerations of a STEM Identity for Girls in a Silo Approach

From a consequentialist ethical perspective (Farrow, 2016), STEM education thus far has been known to limit autonomy and independence of women. By focusing on a silo approach, teachers and policymakers propagate pre-existing gender stereotypes. These stereotypes may contribute to expanding the gender gap in STEM-based fields and careers. When pedagogy focuses on a foundational way of thinking, thus prioritizing inquiry and real-world problems, girls demonstrate greater interest in pursuing STEM fields. Gender bias and stereotyping have limited women's self-identity and their pursuit of STEM-based fields. These biases, through teachers, parents, and society as a whole, inadvertently, and at times intentionally, impact girls from a young age.

From a virtues perspective (Farrow, 2016) a shift in educational standards is required in order to meet the needs of all learners. The bias towards males as scientists and mathematicians is antiquated, and research has shown that gender plays little role in the learning of individual subjects. These biases cause harm to girls developing a sense of identity in the STEM subjects. Every student has a right to learn and to gain education free from stereotypes and bias.

Viewing women's roles in STEM from a deontological ethical perspective (Farrow, 2016), women and men are equal neurologically. Research has demonstrated that gender bias and stereotypes are not founded in science and fact, as the human brain is designed in much the same way regardless of male or female genetics (UNESCO, 2017). Eradicating these stereotypes can lead to an equality of learning and provide more freedom for women to focus on STEM subjects. Providing equity and promoting women's pursuit of STEM-focused programs could expand the depth and breadth of innovation.

Implications

Gender bias and stereotypes have greatly affected female STEM identities. These biases have limited their pursuit of

STEM fields/careers. Research has shown that these stereotypes are not grounded in fact, but rather on assumptions made of male and female capabilities and skillsets (UNESCO, 2017).

STEM education requires shifting teaching pedagogy from a curriculum focused on the individual subjects or disciplines to one that incorporates inquiry, real-world problems, and a contextualized approach. Shifting the teaching of STEM can open up more opportunities for females to develop a stronger STEM identity. There is a need for recognitive justice in the STEM world. Women are woefully underrepresented in textbooks and learning materials. Through mentoring opportunities and more visibility of women in STEM, girls can begin to develop a better sense of their role and identity in the STEM subjects.

Conclusion

When considering a standardized approach for STEM education, it is vitally important to consider all of the stakeholders and their voices. When we teach STEM subjects as silos, many ethical issues arise that limit the efficacy of the learning, most notably for girls and minority groups.

When focusing on the T in STEM, students become trackable and reliant on technology for their learning. This tracking leads to an invasion of privacy and issues around consent. The reliance on technology for learning leads to more money being funnelled to tech giants, and further issues emerge regarding dependence on technology for achieving curricular outcomes.

The standardization of STEM into silos limits assessment and culturally responsive teaching. Any standardized assessment tool limits the diversity of thinking and culturally relevant curricula.

As there is a pronounced gap between women and men pursuing STEM careers, there is a limitation on diversity. Gender bias and stereotypes have negatively impacted female pursuit of STEM careers. It has led to a stereotype threat that propagates girls' belief that they are just not as strong as boys in the STEM subjects.

STEM education is an important component of teaching practice. The focus of STEM as a curricular component should not be up for debate, only how it is to be defined. How it is taught should be of the biggest concern to all stakeholders. Those who are impacted the most by this ambiguity should be the ones whose voices are considered in this definition. Ensuring a program that is rich in diversity and that focuses on a foundational way of thinking could pave the way for equity and a voice for all.

Note: Using Farrow's (2016) framework, Appendix A summarizes key ethical considerations when determining best practices for the integration of STEM education in K-12 schools. The impact of a misguided definition for STEM has numerous repercussions as noted in the framework.

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Appendix A

Table 6.1 Completed ethical framework for standardizing STEM education in K-12 based on Farrow's (2016) *Uncompleted Framework*

Principle	Duties & Responsibilities (deontological)	Outcome (consequentialist)	Personal Development (Virtue)
Full disclosure	• Those who choose educational practice and policy are not always from the educational sector. • Teachers have little voice in determining policy and funding. • Big business and global positioning are large decision-makers in policy. • How would education be impacted if teachers had a decision-making voice? • Decision-makers are being swayed by big business and by educational ranking on the world stage • STEM is touted as the needed skill set for future jobs; without extensive STEM education are we letting our students down? • What pieces of STEM and the 3 R's are needed to fulfill students' needs? Can we meet their needs with one and not the other?	• If teachers are not making decisions on trends, is the push for STEM biased from the start? • Is STEM education hurting our students and the economy in the long run? • Pros and Cons of STEM education.	• Is STEM education truly the best direction for our students, or does it just make the majority of US students look better from a world perspective? • What are the teacher perspectives on STEM education?
Privacy, data security, & informed consent	• Money-making strategy employed by giant tech firms. • Providing free access to students and teachers gives tech companies an ability to track and mine information with and without the consent of minors.	• The mining of student data invades their privacy and opens them up to risk. • The invasion of student privacy with and without parental consent by these companies far outweighs the financial gain. • The continually changing nature of technology and the sophistication of big data algorithms makes it difficult for parents and minors to truly know what they are agreeing to when they click "agree" below the terms of use. • With access to photos, emails, Google maps, etc. student anonymity is being lost.	• It is an individual's right to have privacy and autonomy, especially for those under the age of majority • Parents, schools, and government bodies are morally obligated to protect those who cannot protect themselves. • Potential conflicts of interest arise, as edtech companies are work with the schools/teachers, but at the same time work with districts, researchers and shareholders.

Principle	Duties & Responsibilities (deontological)	Outcome (consequentialist)	Personal Development (Virtue)
Avoiding harm & minimizing risk	• Standardization of practice and assessment will allow the US to track students and educators, which will then help determine who is underperforming and what sanctions are needed to improve individual schools/ districts. • These sanctions are intended to push educators to better prepare their students in the core subjects (science, math, and reading).	• There has been no major improvement in science and math test scores in the US, even with massive federal funding over the past twenty years for STEM education. • Pushing STEM education as separate core subjects has not resulted in the improvement of test scores, and the US continues to rest solidly in the "middle of the pack."	• Standardization of STEM education is detrimental to the learning of our students. • When we narrow the definition of STEM to its component subjects, we do not allow students to tackle real-world problems from an interdisciplinary standpoint. • Students are relegated to a number on a paper, that does not take into consideration diversity, culture, nor gender. • Standardization of STEM and subsequent assessment has limited ability to bring in multiculturalism and divergent thinking.
Autonomy & independence	• Minority groups and girls are being left behind when it comes to STEM education. • Shouldn't the definition of STEM be inclusive? • It is our duty to ensure that we do not standardize STEM; otherwise, yet again, we take the diversity out of the programming.	• Even with a push for STEM towards girls, there remain fewer woman and people of minorities entering STEM professions. • Is the push for STEM education still targeting white males? • Do cultural norms and gender bias deter girls from going into STEM classes/activities? • There persist a stereotype for girls and minority groups when it comes to the higher-level academics; societal norms do get in the way of choosing certain subjects.	• Societal norms should not sway a person from following their interests or heart. • Why do gender and ethnicity bias play such a large role in education? • We owe it to our students to provide them with access to a variety of activities without fear of recrimination, teasing, and/or avoidance of diversity.

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Chapter 7: Considerations of Equitable Standards in the Implementation of Assistive Technology

TERRI MARLES

Introduction

The creation of Alberta Education's (2010) *Inspiring Education Policy* has helped to promote a shift in the focus of teaching towards student-centred learning, the expansion of traditional methods of instruction, and more license for creativity in instruction and programming. Within the guiding principles of *Inspiring Education* exist specific initiatives conducive to this shift. One of these initiatives, the Learning and Technology Framework Policy, provides a guide for educators in understanding how technology in the classroom increases opportunities and support for students (Alberta Education, 2010). This initiative has helped increase understanding among educators of the importance of technology in providing students with opportunities in the classroom that might not otherwise exist. With the increase of educational and instructional technology in classrooms, the need for technologies that assist and support students with special needs has become more obvious.

The interest among educators in using technologies to support students with disabilities has promoted the implementation of assistive technology in classrooms. Assistive technology is defined as "any item or piece of equipment or product system either acquired commercially, off the shelf, modified, or customized and used to increase, maintain, or improve functional capabilities for individuals with disabilities" (Johnston et al., 2007, p. 4)**.** Many educators have a simplified understanding of assistive technology as technology and tools that support student learning by removing barriers and obstacles, increasing engagement, and promoting a feeling of success. The Alberta Government's (2020) Inclusive Education Framework outlines the principles of inclusive education, including assistive technology as a key factor in supporting students with exceptional needs. The Alberta Government's (2010) *Inspiring Education Policy* was created to provide pedagogical and ethical standards that outline inclusive education practices. These practices promote a sense of belonging through positive learning experiences for students, and address the need for educators to understand the importance of using assistive technology. These policies provide guidelines for supporting students with disabilities; however, no set educational government mandate ensures that the needs of students are met (Inclusive Education, 2020). Within these principles, guiding questions are asked around the implementation of assistive technologies in school. These questions consider issues such as how data is being used to inform the selection, implementation and evaluation of assistive technology for learning at the classroom, school and authority level, and what expertise and resources are available to support implementation of assistive technology for learning (A Guide to Support Implementation: Essential Conditions [New Tab], Edmonton Regional Learning Consortium, 2016).

Vignette

Decisions around implementation of assistive technology in K-12 settings are made at the school level. The implications of this can be both negative and positive, as administration at schools may not view assistive technology as a necessary tool for students and may decide to allocate funding to the resources instead. For example, in my current role as an assistive technology consultant, I help make decisions about allocation of devices and equipment for students with

special needs in the school district. Other schools may not have a specialist or consultant, or may not include them in decision-making.

During my time in this position, I have developed a process to determine which students receive assistive technology. When I started the position, there were no specific guidelines for this process. My experience as a special education teacher and special education consultant, using a multitude of assistive technologies to support students in their learning, guided my decisions on student access to assistive technology. To create a pedagogically sound policy, it was necessary to work with a multidisciplinary team to ensure that the needs of students were met. I collaborated with school psychologists, teachers in the field, learning consultants, and the educational technology team to develop a series of questions that outline a student's learning needs, the professionals involved with the student, and how a device and applications would support their learning. Using a Google form, responses are collected in such a way that priority students can be identified. This process provides the information that I need to determine the device and programs that will best support a given student.

The struggle is that this process is sustainable only if the funding and the budget allow for it. With recent cutbacks and the possibility of the assistive technology budget diminishing, I have had to reimagine a different process that will still provide the necessary assistive technology to students with special needs. I have spoken with other school districts around the topic and about how they support students with assistive technology. Every school district seems to have a different process, and, in some cases, there is nothing in place. The question then arises, how should school districts implement a model of assistive technology for students with diverse needs that supports equitable standards?

Full Disclosure

Using Farrow's (2016) framework for ethical perspectives, this paper will address the question above and consider why ethical perspectives need to be part of the implementation of assistive technology in classrooms, taking into consideration deontological, consequentialist, and virtue ethics.

There is a vast amount of research on the benefits of access to assistive technology for student learning. Assistive technology educator and researcher Joy Zabala is known for her work in this area, advocating for the successful implementation and evaluation of assistive technology in classrooms. Zabala et al. (2005) created the Student, Environments, Tasks, and Tools (SETT) framework as a guide for educators in using assistive technology. The SETT framework can guide educators in carefully assessing the needs of students in these areas and in making informed decisions in implementing and evaluating assistive technology tools (Zabala et al., 2005). The framework helps educators answer questions about individual student learning needs, such as who is involved supporting these students, what prior experience they have with students using the same or similar devices, and what comfort level they have with students using devices (Zabala et al., 2005).

The answers to these questions provide important insight into programming for a student's unique learning needs. However, who within the school holds responsibility for using the SETT framework and assessing the assistive technology needs of a student? How is funding determined and allocated for students receiving support, and who ensures that the process is based on equitable standards? Equitable standards that should be considered are:

- sustainable process that provides equal access for all students,
- learning technologies that provide additional supports (not substitution of professional expertise for student's assessment and achievement), and
- informed decision-making policies that are grounded in best practice and that consider student voice.

Privacy and Data Considerations with Using Supportive Technologies

Among the concerns raised about equitable standards in implementation and student use of assistive technology are the ethical issues related to privacy and informed consent with users. In the last decade, educational and assistive technologies have exploded, and teachers are using a myriad of educational programs to support student learning across the curriculum (Regan & Jesse, 2018). Assistive technologies have become popular among teachers as a way of increasing access to curriculum materials, and of adapting and differentiating instruction for students with exceptional needs. Many of these programs employ a personalized learning system, which is geared at providing students with lessons and activities based on their current academic levels. For example, programs such as Mathletics have built-in assessment, whereby students respond to a series of math questions, and their responses are used to identify their current math ability and grade level. A-Z Learning is a reading program that works in the same way, assessing students through standardized questions in order to determine a grade level for them to begin at and work through.

Deontological Theory

There are several ethical considerations related to the use of educational and assistive technology applications, specifically with personalized learning systems. These programs are intuitive, and the end result of initial and then ongoing interactions is a snapshot of a student's ability, which informs how questions and activities are generated to focus on increasing the student's skills. However, there is little information available on how a student's information is used to determine their ability, and even less information on student demographics. In the case of students with special needs, their learning style may be quite different from the average student, and their achievement in certain areas may be lower than their capabilities if the program does not consider the accommodations that need to be in place for learner success.

Regan and Jesse (2018) state that "a critical ethical concern raised with personalized learning is whether such programs constitute tracking and sorting of students that might be considered discriminatory" (p. 168). They caution that in the United States, the tracking and sorting of students has led to divided classrooms of race, gender, and class. Today, tracking is happening behind a screen, hidden from students and parents (Regan & Jesse, 2018). When examined from a deontological perspective, which focuses on "responsibility, intention and duty" (Farrow, 2016, p. 102), attention should paid to understanding the intended use of these programs and to ensuring that teachers recognize that personalized learning systems collect student information without any consideration of their exceptional needs. These systems should be considered an additional or supplemental learning resource and not an authentic assessment of a student's learning ability or needs. Furthermore, students and parents should be made aware of how these systems collect information and whether and how this information is used by teachers in planning and programming.

Consequentialist Theory

Most teachers use educational and assistive technology programs as an alternative means to support student learning. Personalized learning systems provide opportunities to provide students with engaging one-to-one learning. Bulger (2016) describes personalized learning systems as having the "potential to revolutionize learning" (p. 3) despite vague research findings on whether and how these systems do improve learning outcomes for students. This raises the question of how teachers are using these programs to improve students' academic skills and whether they are an appropriate measure of achievement.

A second ethical consideration for the use of educational and assistive technologies for personalized learning is whether the use of these systems is replacing expertise available through school districts. Even the most intuitive and customized personalized learning system cannot replace the expertise of school professionals, whose responsibility and role is to assess, adapt, and help identify the best way to support students in their learning.

Virtue Theory

The use of personalized learning systems in K-12 classrooms is increasing at a rapid rate. School districts have an increased responsibility in deciding what educational applications can be used without the breach of student privacy. However, teachers have access to a vast range of free educational programs that can be downloaded and used without exploring the consequences. Very similar to the focus of virtue ethics on individual character and a strength on "making good choices," teachers may unknowingly expose their students to programs that collect student's data without consent and increase the risk of privacy concerns. The use of these programs in education has become mainstream, and the potential for personalized learning has been noted by Facebook developer Mark Zuckerberg. Zuckerberg and his wife, Priscilla Chan, invested US$45 billion into advancing personalized learning and establishing the Chan Zuckerberg Education initiative (Bulger, 2016). It is not surprising that educators are turning to technology to enhance and engage students when it is so widely supported by influential people in the digital world. Teachers want to make a difference for their students and to provide opportunities for personalized and individualized learning; however, they may not recognize the risks involved.

Summary

The use of personalized learning systems as digital tools to support diverse students' learning needs requires close examination. Educators cannot rely on the results or scores that are often embedded in personalized learning systems as authentic assessment for student learning. All students – not only those with diverse learning needs – have unique learning abilities, approaches, and needs. Educators are responsible for understanding the abilities and needs of their students and for providing classroom experiences that tap into students' strengths and help address needs.

Avoiding Harm and Risk in Implementation of Assistive Technologies

Vignette

The current COVID-19 crisis caused a major uprooting and shift for educators across the globe. When Premier Jason Kenney announced school closures on March 7, 2020 for most school districts across Alberta, superintendents and educators across the province responded to the situation with a plan for K-12 education to take place at home.

For many school districts, this meant a shift from in-class teaching to delivering curriculum content and connecting with students online. It also meant a complete reimagining of assessment and feedback for students. For some educators, this has proved a daunting shift – one for which they were not at all – while other teachers are adjusting to this change, having had some experience in the digital world of teaching and learning.

One of the major concerns for districts has been to ensure that students have access to technology at home in order to access the delivery of online content and to connect with their teachers. In my role working with assistive technology, the shift to remote teaching brought about many questions concerning how best to support students with diverse learning needs. I had to ensure that students had access to their assigned devices and also had support in using these devices at home. Some of questions that emerged as a result of the shift to online learning were as follows:

- How will students who are supported by assistive technology in schools gain access to their one-to-one device at home?
- Who is responsible for ensuring students' continued support from assistive technologies?
- How will the one-to-one devices be distributed for home use and how will I manage their return?
- How much will it cost to ensure that students have access to technology?
- What about students who are not coded, and who use assistive technology at school, but do not have access to these technologies at home? (Reasons vary and include financial constraints, parent's level of understanding of assistive technology resources, and so on.)

One of the many challenges that educators face in today's classroom is ensuring that the unique needs of every student are met. Some students have mental health needs, and also social, behavioural, and emotional needs. For others, struggles in specific areas of learning pose cognitive support needs. The dynamics of a classroom can be overwhelming for many teachers, with pressure to meet provincial standards, combined with the need to support the emotional, physical, and learning needs of all students, and also to remain attuned to parent involvement and demands. Research findings from the Alberta Education's Severe Disabilities Profile Review revealed that only "56 percent of the files related to students with severe disabilities met the ministry's policy requirements" (Alberta Teacher's Association, 2011, p. 1), which means that just over half of the needs of students with disabilities were being funded. As a result, the mandate Setting the Direction for Special Education in Alberta was launched in 2008, along with a framework for special education from Grades 1 through 12.

In 2009, a committee brought their concerns and suggestions to the Alberta Minister of Education. Informed by these concerns, a new framework was established based on the principle to create "one inclusive education system where each student is successful" (Alberta Teachers' Association, 2011, p.1). The Inclusive Education committee's vision was to ensure that the educational needs of students would be recognized as changing, and therefore so would their opportunities for success. The framework identifies three areas of priority – "curriculum, capacity and collaboration – and recommends a vision of an inclusive education that repositions education within the broader education system" (Alberta Teachers' Association, 2011, p.1).

The inclusive education system is guided by fairness and equitable standards; however, issues can arise when resources and technology support come with a high price tag to districts, combined with varying levels of government funding. Although most educators are vigilant in reaching for the goal of fairness and equality for every student in their classroom, they are often met with the harsh fiscal reality that the educational and assistive technology that can better support students is simply not available.

Fast forward to the current situation in which educators are dealing with instruction and assessment for all of their students using some means of online delivery, and the issue becomes even more complex. How can educators ensure an equitable standard for all students now that they are teaching online, and students are learning from home?

Deontological Theory

The deontological theory "emphasizes moral obligation and the rule-based nature of morality" (Farrow, 2016, p. 101),

which is the foundation for inclusive education practices both in the classroom and in the current 'at home' learning state. For some students, ensuring their needs are met requires adjustment to instructional methods and flexibility in the way they produce and show their work. Accommodations through technology can assist and support these students in a multitude of ways by removing barriers and obstacles to learning so that they can reach outcomes and goals. For some students with diverse learning needs, the shift to online learning has been positive, as lessons are delivered digitally, and assistive technology are in place to support students with areas of weakness, such as reading and writing. Some students have reported that they like learning at home and using Google Classroom, because they do not feel the same time constraints to complete their work that they sometimes experience in the classroom. However, the negative impact is also present, as some students struggle with attending to tasks and require more one-to-one support with learning strategies. Such students may become frustrated and anxious with the daunting task of independently managing their work. Furthermore, teachers are now faced with their own challenge of ensuring the success of students with assistive technologies. Rather than working with students and assessing their assistive technology needs at school, they are supporting students' use of these technologies through online instruction.

Consequential Theory

In order to achieve a process for implementing assistive technology that ensures equity among students with diverse learning needs, all stakeholders must be involved. Both budget roadblocks and the need to train teachers in implementing technology in the classroom must be addressed and discussed with key individuals, such as administrators, parents, and district support service personel.

Bugaj and Norton-Darr's (2010) *Guide to Assistive Technology in Public Schools* notes that "the 'Education for All' concept spreads from the top down as an administrative philosophy as well as from the bottom up with teachers working together within classrooms to ensure that every student is successful" (p. 124). The message surrounding the implementation of assistive technology in the classroom must come from school districts leaders and must communicate a universal commitment to supporting students online using a range of learning technologies.

Virtue Theory

Alberta Education's Action on Inclusion framework (Alberta Teachers' Association, 2011) promotes a universal understanding of inclusive classrooms. Therefore, it is imperative that teachers take on the responsibility for all their students in a value-based approach. Such an approach requires a shift in mindset, as teachers are ultimately responsible for ensuring the success of each student. A virtuous approach recognizes the importance of inclusive practices for students, while high expectations are put on teachers to provide differentiated instruction and accommodations that may include technologies they have no experience using.

Summary

When implementing assistive technologies in support of students with diverse learning needs, a collaborative approach between school administration, instructional leaders, learning coaches, and teachers must be taken. The approach must consider teachers as key in implementation, while also recognizing their different levels of comfort and experience when it comes to using technology. Now more than ever, as learning shifts completely online, teachers are experiencing increasing demands on their role. Building capacity by providing training to teachers has also shifted to online

instruction; this approach to professional development works well for many teachers, but has proved challenging for some who are more comfortable with in-person training. Online professional development for teachers requires interactive instruction and participation in order to personalize learning and make it more meaningful (Francis & Jacobson, 2013). Interestingly, Francis & Jacobson (2013) found that teacher experiences with an online learning platform were consistent with the "inquiry approaches to learning" (p. 335) that exists in Alberta's current curriculum. Francis & Jacobson (2013) found that participant engagement increased through collaboration and inquiry (using interactive whiteboard activities) which in turn sparked conversations amongst teacher participants around the important of discovery in learning with their students.

Although classrooms are now digital, educators and leaders are still required to carefully research digital resources and provide support and assistance to teachers in using them so they can ultimately do the same for their students. Learning communities, demonstrations, and hands-on activities need to be provided for teachers using effective approaches to online professional learning (citations needed here, see notes).

Implementing and Connecting Assistive Technology to Personal Autonomy, Multiple Perspectives, and Finding a Voice

Vignette

With the recent turn of events due to COVID-19 and learning at home, the question for many school districts was how to ensure that students with diverse learning needs had access to technology. In my role, I had to make plans for students to gain access to their assigned assistive technology devices to use at home. However, there were many students who did not have access to technology at home to engage in online learning. A process for administrators was determined for the families that required technology and did not have assigned assistive technology devices. These students may not be coded and therefore are ineligible to receive one-to-one assistive technology devices; however, these are very much in need given diverse financial dynamics and constraints at home. Leaders had to come together to explore the possibilities of using resources to support diverse student needs, including collecting older devices for students who did not have access to suitable technology.

There are certainly concerns around participant autonomy and independence when implementing assistive technology for students with diverse learning needs. For all matters, including education, parents and guardians are the voices and advocates for their children. Ultimately, parents make the final decision regarding programming and supports that will best meet the learning needs of their child and ensure their social and emotional wellbeing. Many factors can impact programming and the use of assistive technology, and these need to be discussed between schools and parents.

Deontological Theory

Ideally, when planning for a student's education needs, teachers and parents work together to ensure a child's learning needs are met. However, there can be obstacles and concerns that keep equitable access from being achieved. For example, there may be cultural or linguistic perspectives or beliefs about learners with special needs that prevent children from receiving such support. There may be resistance to specialized programming, including assistive technology. In other cases, there may be resistance to a child receiving specialized support for fear that the child looks different than their peers and becomes socially isolated. In situations like this, how does the school support the

student through adaptation, modifications, and accommodations if the parents are resistant or do not agree with the recommendations? Is it the teacher's duty and responsibility to implement support for a child even when a parent is not in agreement? Or, do parents make the final decision in such cases? Complex issues and situations and ethical decisions like this are amplified for schools, teachers, and parents during a pandemic and during a shift to remote instruction.

Consequential Theory

Within the consequential theory of ethics, "responsibility, intention and duty" (Farrow, 2016, p. 102) lie at the forefront. School districts that adhere to government mandates in this situation, such as Alberta's Education Act (2020), behave according to the premise that educators are bound by law and respect "clear moral boundaries" (Farrow, 2016, p. 102). Alberta's Education Act (2020) states that teachers are obligated to provide students with instruction and learning at their level as outlined in the curriculum and consistent with the goals outlined by the act. The Education Act (2020) also states that teachers must "encourage and foster learning in students" (p. 130) in a safe and caring environment. In the present context, educators may feel pressured by policy and less willing to adhere to a parent's concern (voice). It becomes a balance between keeping a relationship with parents and respecting their rights and authority with their child, and also supporting a child's right to education.

In situations concerning parent disagreement of supportive services for their children, it is important to keep an open and communicative relationship. Farrow (2016) describes how, according to the consequential theory, the balance between parent and teacher relationship represents the voice of a child by "incorporat[ing] multiple perspectives" (p. 102) and using "a practical approach" (p. 102). School boards are obligated to provide a safe and nurturing environment for children that encourages active learning, and this must include ensuring that students are supported in their academics and experience success. This legal and pedagogical responsibility involves addressing the role that parents play in their child's education and supporting parents in understanding this responsibility. According to Alberta's Education Act (2020), a parent's responsibility in their child's education includes "co-operat[ing] and collaborat[ing] with school staff to support the delivery of supports and services to the child" (p.38). For parents who may be hesitant due to cultural differences, this means including the multicultural team in helping parents understand the benefits to implementing supports, specifically assistive technologies. For parents concerned about their child standing out, the conversation should focus on how technology is used universally in the classroom as a digital resource that supports all students in their learning.

Virtue Theory

From a virtue ethics perspective, the key principle is that every student is entitled to the support they need to experience success in school. This perspective considers teachers and parents as the voice for a child with diverse learning needs. Furthermore, the equitable standards within the virtuous theory considers those students who may not have the voice of a parent to advocate for them. Unfortunately, there are students who do not receive support through assistive technology because their parents may not be involved in their schooling. The question then needs to be addressed, who is the voice for these students? Not all students who need support are coded, and if parents are not their voice to advocate for their child, then how can equitable standards be put in place to ensure these students receive the supports that they need to be successful?

Educators can be the voice for students and can help to advocate for the supports that will enable a student's learning to occur. This is difficult when a student is not coded, as funding supports and resources are often established under these parameters. Teachers turn to their administration for support in purchasing devices and programs, but schools are also

limited by budget constraints. In some cases, a solution may be to ask to reuse older devices for students who need them. While a viable option, this can snowball into other concerns, such as who maintains and supports these devices, if anyone does, and who determines which students receive them, and how (Floyd, 2010).

Summary

The key to ensuring students with diverse learning needs have a voice in their learning is establishing an educational support team of expertise for students, including teachers, parents, technology leaders, and therapists. The common interest among this team should focus on providing the student with the learning conditions and digital technologies that best support learning and also promote independence.

Conclusion

Over the last decade, there has been a major shift in schools toward including and supporting students with diverse learning needs in regular education instruction settings. This inclusion is a visual representation of society's desire for progression in social justice. The extent to which inclusion exists from province to province is an indication of society's willingness to embrace and promote fair and equitable social policies in education.

Implementing assistive technology into the classroom provides students with diverse learning needs with the opportunity for positive classroom experiences by removing barriers to learning and by providing tools for success. Ensuring equitable standards for all learners should be the foundation of any model of implementation of assistive technology. In recognizing these standards, teachers must be aware of obstacles that may exist with using assistive technology. Simpson et al. (2009) explain that "a 'one size fits all' approach is never appropriate for assistive technology selection. All students are different, and therefore their assistive technology needs are different" (p. 174). An effective and equitable model of implementing assistive technology for inclusive education will address and overcome budgetary constraints, involve meaningful and appropriate training for educators, consider and address parental concerns, and implement assistive technologies that are inclusive and universally accessible.

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Appendix A

Table 7.1: ***Completed ethical framework for use of assistive technology in education based on Farrow's (2016) Uncompleted Framework***

Principle	Duties & Responsibilities (deontological theory)	Outcomes (consequentialist theory)	Personal Development (virtue theory)
Full disclosure	• Decisions are made from the top-down and educators are not often included in these decisions as key stakeholders.	• If decisions are made by individuals not directly involved in the classroom, are these decisions based on an accurate representation of the state of today's classrooms?	• Policies should promote a shift in the focus of teaching away from traditional methods to provide more license for teachers to be creative in their instruction and programming.
Privacy, data security, and informed consent	• Attention should be paid to use of these programs and the understanding that teachers recognize that personalized learning systems collect student's information without any consideration of student's exceptional needs. • They should be considered an additional resource and not an authentic assessment of a student's learning needs.	• Are these systems replacing the expertise available through school districts? • There must be some awareness that even the most intuitive and customized personalized learning system cannot replace the expertise of school professionals whose job is to assess, adapt and help identify the best way to support students in their learning.	• The use of personalized learning systems in K-12 classrooms is increasing at a rapid rate. School districts have an increased responsibility in deciding what educational applications can be used without the breach of student privacy.
Avoiding harm and minimizing risk	• For some students, ensuring their needs are met requires adjustment to instructional methods and flexibility in the way they produce and show their work. Accommodations through technology can assist and support these learners in a multitude of ways by removing barriers and obstacles and supporting learning to reach outcomes and goals.	• For assistive technology to ensure equity among students with diverse learning needs, all stakeholders must be involved. • Budget roadblocks and training for teachers in implementing technology into the classroom must be addressed and discussed with key individuals.	• Imperative that teachers take on the responsibility for all their students in a value-based approach. This approach requires a shift in mindset and teachers are ultimately responsible for ensuring the success of each student.
Autonomy and independence	• Parents may be resistant to their child receiving specialized support for fear of their child standing out from their peers and being socially isolated. • How does the school support the student through adaptation, modifications and accommodations if a parent is not in agreement?	• Focus on how technology is used universally in the classroom as a digital resource that supports all students in their learning.	• Focus on the principle that every student is entitled to the support they need to experience success in school. This perspective considers teacher and parents as the voice for a child with diverse learning needs.

PART III: NURTURING ETHICAL AWARENESS IN INSTITUTIONAL CONTEXTS: ADMISSIONS AND COMMUNICATIONS

Chapter 8: Who Gets In? Examining Ethics and Equity in Post-Secondary Admissions

EMMA LOCKYER

Introduction and Full Disclosure

Post-secondary admissions are rife with ethical issues, on both the part of the applicant and the admitting institution. Admissions are a high stakes game, in which students are seeking entrance to increasingly competitive programs that will define the course of the next several years of their lives (at a minimum). Meanwhile, institutions are seeking students that they perceive as desirable to fill the limited number of seats available. These pressures can cause parents, students and institutions to behave in unethical ways to fulfill their own needs.

Unethical behaviour by both applicants and institutions in the admissions process can create an unequal playing field for all applicants, and especially those from disadvantaged backgrounds. This inequity in access to education can serve to perpetuate socioeconomic inequality within our society. It is important to note that discussion around these issues is emerging, and as such, there is limited scholarly research around this topic. However, significant investigations and discussions have taken place in the media. For example, the extensive coverage of the 2019 Operation Varsity Blues admissions scandal, that included celebrities Felicity Huffman and Lori Loughlin, saw a number of parents facing fraud-related charges in a massive college admissions scandal. Admissions fraud in this case involved paying test administrators to change grades and paying bribes to athletics coaches to admit students as recruits for sports that they did not play (Reeves, 2019).

Along with the FBI's Operation Varsity Blues investigation, other cases have involved international students paying third party services to have someone else complete their language tests (Reuters, 2018) or to compromise international testing centres (Keung, 2018). While the behaviours that these individuals engage in are both unethical and illegal, there are many other tactics that parents and applicants may use to increase the chance of admission that are legal but may still be unethical. This can include the use of college admissions coaches and making large financial donations to the institution their child is interested in attending.

Post-secondary institutions can also be engaged in unethical admission practices, which can include policies of legacy admissions (Daniels, 2020), admitting the children of major donors and considering a student's socioeconomic background (Weissbourd, 2019a) and need for financial aid (MacMillian, 2019). Institutions may also prioritize the admission of athletes based on their athletic – rather than their academic – capabilities (Jump, 2019). Institutions justify these decisions on the basis that they are looking for the best students who will be the right fit for their institution, although these practices can sometimes equate to overrepresentation those who are white and wealthy (Reeves, 2019).

In targeting students for recruitment and admission, institutions may also engage in unethical behaviour by using applicant data obtained from test administrators such as College Board (Selingo, 2017), internet cookies that track an applicant's browsing history (MacMillan and Anderson, 2019), or an applicant's social media posts posted in private Facebook groups (Homayon, 2017) to make decisions about which applicants to admit, even if the applicants have not provided this information to the school directly.

Table 8.1 demonstrates the ethical issues associated with post-secondary admissions using Farrow's (2016) Uncompleted Framework.

Table 8.1 Ethical issues associated with post-secondary admissions based on Farrow's (2016) *Uncompleted Framework*

Principle	Duties & Responsibilities (deontological)	Outcomes (consequentialist)	Personal development (virtue)
Respect for participant autonomy & independence	Institutions have a responsibility to respect student privacy and not use data obtained in unethical ways.	Institutions should use ethical data to make equitable admission decisions.	Parents have an obligation to behave ethically and to not put their child's education at risk.
Avoid harm / minimize risk	Students have an obligation to provide factual and honest information to post-secondary institutions. Students and parents must follow the laws.	Post-secondary institutions have an obligation to train staff on the security features of test scores and transcripts. Institutions have an obligation to try and prevent students from being admitted using fraudulent methods.	Assumes that applicants will act honestly and provide factual information.
Full Disclosure	Institutions should be transparent about data used in admissions decisions.		Applicants should disclose honest and factual information.
Privacy, Data Security & Informed Consent	Institutions have a responsibility to respect student privacy.		Applicants should disclose honest and factual information.
Integrity	Institutions and students have a duty to act in ways that promote equity.		Institutions should act to admit students in a way that is equitable.

While unethical behaviours in post-secondary admissions predate many modern technologies, technology has created additional avenues in which these behaviours can flourish (Selingo, 2017). Technology has also created opportunities to highlight and expose these behaviours. These behaviours have the ability to create inequity within the post-secondary system by giving undue advantage to those with financial privilege. This chapter will explore equity in North American post-secondary education, and how unethical behaviours aided by technology threaten the equitable admission of eligible students.

Equitable Access to Education

Equitable access to post-secondary education is an issue across North America. Many admissions practices used by institutions favour students of particular backgrounds, whether that be implicit or explicit. For example, wealthy individuals with the means to make large donations (typically $500,000 and up) to institutions may have their child pushed to the top of the waitlist (Reeves, 2019). Daniels (2020), citing Arcidiacono, Kinsler and Ransom (2019), notes that students admitted under legacy policies (those who are admitted because they are the child or grandchild of an alum) are disproportionately more likely to be white and come from a wealthy family. Kingkade (2019) discusses, policies surrounding donor and legacy admissions are much more common at US institutions than they are at Canadian institutions. However, affluent families in both countries are able to pay for tutoring and other similar resources, which allows those students to score higher on exams and school work than their less privileged classmates and puts them at an advantage when it comes to grades-based admissions (Reeves, 2019).

Speaking on the Harvard EdCast podcast, high school students Nicolas Burgess and Dequan Franks noted that, coming from economically disadvantaged backgrounds, students like them struggle to afford the costs associated with writing standardized tests, let alone paying for test prep courses (Weissbourd, 2019b). Burgess and Franks discussed the other barriers that prevented them from excelling in their high school courses, noting that they had to work to contribute to

household expenses which took them away from their studies and gave them less time for homework than their more affluent peers.

Student-athletes are also given privilege when it comes to admission at some schools (Desai, 2018; Fox, 2019). As Desai (2018) notes, over 65% of NCAA athletes are white. Desai (2018) discusses that many of these students come from affluent families that are able to pay for the costs associated with playing sports in order to get these athletes to the NCAA level. This provides an advantage to these students in the admissions process, as Fox (2019) notes that athletes have the opportunity to be admitted with lower grades than their peers. Arcidiacono, Kinsler and Ransom (2019) use Harvard University as an example, where seats are reserved for athletes and the applications of recruited athletes are reviewed separately from other applicants. It should be acknowledged that, as noted by Desai (2018), there are some student-athletes (primarily basketball and football players) who come from disadvantaged backgrounds, and for whom admission as an athlete does give access to education that they otherwise would not have. However, the vast majority of student-athletes have an advantage in the admissions process as a result of their socioeconomic status (Desai, 2018).

The privilege that student-athletes are given in the admissions process was demonstrated in the Varsity Blues scandal, in which actress Lori Loughlin had her two daughters admitted to the University of Southern California under the guise of being rowing team members by paying bribes to the coaches (Kahlenberg, 2019). Because her daughters were recommended for admission by athletics coaches, they were offered admission despite having lower grades and test scores than other students (Kahlenberg, 2019). While the Varsity Blues scandal is an extreme example of parents and students engaging in unethical behaviour to gain admission, there are many methods of cheating that are used by students and parents who are desperate to gain admission to their chosen school.

Many of the admission policies and tactics discussed in this chapter offer advantages to students of certain racial and socioeconomic groups. In an attempt to combat this gap, some policies have been implemented. In the United States, Affirmative Action was introduced in 1961 (Webster, 2017). As Webster (2017) notes, Affirmative Action was originally intended to "to improve the educational opportunities for minority groups (including minority races, genders, and sexual orientations) that are commonly and historically discriminated against" (para. 2). However, the use of Affirmative Action at US institutions is declining, and DeSilver (2014) notes that eight states have banned the use of Affirmative Action, in favour of other policies.

Similar equitable access programs exist in Canada, where admission has commonly been based on grades, without consideration for race or other demographic factors (Kingkade, 2019). Many institutions have created policies regarding Indigenous student admission in response to the Truth and Reconciliation Commission recommendations (Cote-Meek, 2017) that seek to level the playing field for those who have experienced discrimination in the education system. Institutions walk a fine line trying to balance equity in admissions processes with serving students who may typically struggle to access education without denying access to other students. From a deontological perspective (Farrow, 2016), post-secondary institutions have a responsibility to offer education to students from a variety of backgrounds, which can make the engagement in practices that favour those from certain racial or socioeconomic backgrounds unethical. However, in cases where these practices seek to level the playing field, they may be considered ethical behaviour by the institution if they seek to end legacies of discrimination from the education system.

Privacy and Data Security

Privacy and data security have become major issues in admissions with the increase in data tracking and analytics tools available to institutions. As MacMillan and Anderson (2019) reported, many institutions are using internet cookies to track prospective students before they have even applied for admission. Selingo (2017) notes that there are several tools available tailored to educational institutions that track prospective student's browsing history on both the institution's

website and across the internet, using this data to build a profile that predicts, among other things, a student's location, race and if the student will require financial aid. These profiles can be traced to the student's identity and eventually attached to a student's application, thus providing admissions officers with information about the applicant that the applicant did not supply themselves.

Homayon (2017) discusses an example of admissions being impacted by information that prospective students did not supply to an institution. A group of students had their offers to Harvard rescinded after screenshots of racist, sexist and homophobic memes shared in a 'private' Facebook group surfaced. As Hu (2020) explores, many people want more private spaces on the internet where they can interact with others. However, as Hu (2020) discusses, a space on the internet is never truly private; screenshots can be taken and shared beyond the intended audience.

Even before prospective students apply, or consider applying to, an institution, it is possible that their data is already being evaluated to determine if they are a suitable candidate. Selingo (2017) discussed the practice of purchasing lists of names from test administrators. Lists of names of students who have recently written a standardized admissions test, such as the SAT, are purchased from the test administrators based on demographic criteria such as location, test score, and parent's income level (Selingo, 2017). Once an institution purchases a student's name from a test administrator, they are allowed to market to that student for a certain length of time (usually 1–2 years). This process can decrease equity in the education system from the start of the recruitment process, as the names purchased are more likely to be of students from higher socioeconomic classes (Selingo, 2017). That means that some applicants will receive tailored communication from institutions providing them with information that may not be as readily available to other applicants.

From a consequentialist perspective (Farrow, 2016), institutions are acting to promote the best outcomes for themselves, by using any data they can access or purchase. For institutions, these practices often focus on the recruitment and admission of students who meet the socioeconomic and demographic profiles the institution is seeking to bolster, including targeting certain race and gender statistics, as well as to attract students who do not need financial aid or scholarships to pay tuition (Selingo, 2017). However, these best outcomes for the institution are not aligned with the best outcomes for all students, or for society. From a virtue ethics perspective (Farrow, 2016), the behaviour of the institutions is unethical, as the institution (and thus those making decisions at the institution) are not acting in a fair and ethical manner.

Educational Integrity and Minimizing Risk for All

Newcomb (2017) identifies a need for admissions staff to be trained on the security features of documents and how to spot fraudulent transcripts, test scores and suspicious documents, as part of the role of admissions staff is to be a "gatekeeper" for admission to the institution (p. 39). Several parents indicated in the Varsity Blues scandal paid to have their children's SAT scores fraudulently inflated, many without their children even knowing (Kircher, 2019). In 2018, Niagara College identified that English language proficiency test scores coming from certain testing centres in India had been compromised (Keung, 2018).

Tyre (2016) describes the online network that some international students use to obtain fraudulent scores on standardized admissions and English language tests. Using online brokers, students are able to hire what are referred to as "gunmen" (Tyre, 2016), or a proxy test-taker. Students specify the score range that they need on the test, as well as provide a photo of themselves or information about their appearance. Gunmen who have a similar appearance to the student are vital, as ID is required at most testing sites, and many testing agencies take a photo of the test-taker and include it on the test results. Tyre (2016) notes that exceptionally high scores or having the test taken at a North American testing centre (rather than a Chinese location) costs extra. Brokers can be in North America as well; in 2019,

a TOEFL fraud ring was discovered at the University of California Los Angeles (Beam, 2019). In 2018, a Chinese student studying at Pennsylvania State University was deported from the United States following fraud charges after using a paid test taker to write her TOEFL exam in 2016 (Reuters, 2018). These are only a few recent examples of test-taking fraud.

As technology has advanced, so have the methods of both engaging in and detecting fraudulent behaviour. As discussed by Jenks (2019) on the podcast Gangster Capitalism, the Varsity Blues scandal was built almost entirely electronically, with text messages, emails, photoshopped pictures, and wire transfers for funds connecting this fraudulent network. Tyre (2016) examines how these agencies attempt to keep ahead of the security features implemented by test administrators, such as hiring test takers who have a similar appearance to the person on whose behalf they are writing the test. Beam (2019) notes that face and voice recognition software are being considered by some testing companies as additional security measures.

The concern with the admission of students who have been granted admission on the basis of fraudulent application documents and test scores is that they are taking the spot of a more deserving student. The commonality of those who are admitted by cheating the system is the use of financial resources. From a virtue ethics perspective (Farrow, 2016), this is a challenge as it demonstrates that not all of the students are acting virtuously. From a consequentialist perspective (Farrow, 2016), this behaviour is unethical as it does not promote the best outcomes for all parties.

Student Autonomy and Independence

In the post-secondary admissions process, there can be a lack of consideration for student autonomy and privacy. In order to write the SAT exam, which is required for admission to most universities in the United States (and may be used to admission to many Canadian institutions as well), students are required to provide the following information to College Board (the private company that administers the exam): full name, date of birth, mailing address, phone number, email address, gender, race, and information about their high school (College Board, 2020). The College Board then uses this data to track students, as well as selling this data to colleges and universities through their Student Search Service (College Board, 2020). Students may 'opt-out' of having their data included in the Student Search Service (College Board, 2020), but they cannot 'opt-out' of providing their information to College Board in the first place. The sale of this student data means that students may receive communication from schools that they have never heard of, or that they are not interested in. While the schools have the choice of which student's data they purchase, based on demographic and academic information, students do not have a choice of which schools contact them (Selingo, 2017).

Not only are students tracked by data they knowingly provide (such as the data they give to College Board), they can also be tracked by data they do not realize they are providing. As discussed earlier in this chapter, both MacMillan and Anderson (2019) and Selingo (2017) note that many institutions use internet cookies to track students before they have even applied for admission. The information gleaned from the student's web browsing history may then be factored into that student's admission decision (MacMillan & Anderson, 2019). This means that the student does not have a choice in regards to the information they are providing to an institution and may be evaluated based on information they did not want to disclose. As discussed previously, targeting and evaluating students based on this type of data may decrease equity in the admissions process, as this data can disclose information about a student's race or socioeconomic status that may make them less likely to receive an offer of admission.

In 2019, College Board announced plans to introduce an "Adversity Score", which would accompany a student's SAT score when reporting to post-secondary institutions (Allyn, 2019). This score was designed to provide context about a student's background based on their zip code and school, and would index things such as crime rate, median income, and average educational attainment into a numeric "score" (Allyn, 2019). The intent of this score was to demonstrate to institutions the factors that may impact a student's ability to score as high on the SAT as their more affluent

peers and allow them to be evaluated in the context of their situation (Rim, 2019); however, critics quickly noted that this information could be used to discriminate against students of lower socioeconomic backgrounds who may be regarded as less desirable by institutions (Allyn, 2019). Following this backlash, College Board redesigned this concept as the "Environmental Context Dashboard", which is a series of metrics (rather than one single number), provided to institutions along with a student's SAT score (Rim, 2019). However, Rim (2019) notes that this still provides institutions with information about a student's background that they did not disclose themselves, which may be used against them in an admission decision.

It is not only institutions and data that strip students of their autonomy; as discussed by Kircher (2019a), many of the students who were admitted to top universities as a result of the Varsity Blues scandal did not know about the actions their parents had taken and were not aware that their admission was fraudulent. Kircher (2019b) notes that some of these students had their admission offers revoked (for those who had not started at the time of the arrests), and others were expelled or had their programs put on hold while schools conducted their own investigations.

From a consequentialist perspective (Farrow, 2016), College Board was trying to promote the best outcomes for students by providing institutions with a holistic view of a student's background. Similarly, the parents involved in the Varsity Blues scandal were acting to promote what they felt were the best outcomes for their child, in this case, being admitted to a prestigious university. However, from a virtue ethics perspective (Farrow, 2016), these actions do not value the well being of the individual students.

Conclusion

The challenge with determining equity in post-secondary admissions is that there is not truly one "right" answer. In many cases, there are more interested prospective students than there are available seats in many programs, and it is up to institutions to determine the best and most fair way to fill these seats. While it is clearly unethical when prospective students and or their parents present fraudulent documents or engage in other illegal activities to gain admission, other situations are not as obvious.

In the play Admissions (Dunsdon, 2020), the lead character, Sheri Rosen-Mason, grapples with this conundrum. After spending her entire career advocating for diversity in admissions at the college prep school where she works, her son does not get admitted to his dream ivy league school, although his minority friend with lower grades does. Sheri recognizes the delicate balance of considering both circumstance and achievement, and the role of race, class, and privilege in these decisions.

As institutions consider how they admit students, they must consider the criteria they use for admission and how that is impacted by an applicant's individual life and education circumstances. At the time of writing this chapter, institutions worldwide were considering admission criteria as a result of the COVID-19 pandemic. Standardized tests traditionally used for admissions such as the SAT and provincial diploma exams were cancelled (Adams, 2020; Edwardson, 2020) and testing centres that administer English language tests were closed. In some cases, institutions moved towards alternate forms of assessment such as online English language tests (University of Calgary, 2020) and eliminated the requirement for standardized tests and final grades (Hess, 2020).

As Hess (2020) notes, the COVID-19 pandemic has highlighted some of the issues with equity in education, as students from less affluent backgrounds, or students in remote and rural communities or areas of the country, struggle to access online resources due to lack of access to appropriate technology and or internet connections. The impacts of COVID-19 will be felt in the admissions process for several years to come, as prospective students apply with lower or non-traditional (such as pass/fail) grades or without earlier opportunities to write standardized tests (Hess, 2020). With

these new challenges in admissions, institutions will need to be flexible and work with prospective students based on their individual circumstances. What remains to be seen is if this pandemic will change the way that institutions make decisions about admissions in the long-term, or whether institutions will revert to their previous ways of doing things as the pandemic becomes a memory.

While a student's individual circumstances should be considered in the admissions process, institutions must carefully consider the source and credibility of information. While there is a great deal of information provided by prospective students to institutions in the admissions process, institutions must also consider a student's right to privacy when considering the use of data gleaned from social media, internet cookies or third-party sources, as the student did not make the conscious decision to disclose that data to the school (Rim, 2019).

In the end, no matter what information is used and how admission decisions are made, there are applicants who will not be offered admission, as there are simply not enough seats for everyone who wants admission. This is the heartbreaking challenge of admissions work. No matter if admission is based on test scores, grades, or personal circumstances, there are applicants who will be denied admission. The ethical challenge is deciding which applicants will and will not be offered admission, without unfairly advantaging or disadvantaging any groups of prospective students in the process.

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Chapter 9: To What Extent Does Fake News Influence Our Ability to Communicate in Learning Organizations?

DEAN PARTHENIS

The proliferation of fake news has seen rapid growth in its ability to spread quickly due to the access to, and convenience and ease of, digital technology that provides users with the option to share and receive instantaneous communications to and from millions of people globally. This process lends itself to many ethical challenges for all of the end users of digital technology and various platforms. It also has impact within educational, professional, and personal contexts. Due to limitations, my chapter will only focus on selected aspects of fake news relevant to education, such as understanding and identifying it, the role technology and citizens can play in the distribution of mistruths, AI detection tools, and taking steps to better navigate and protect against fake news.

The quickest way of spreading fake news is via social media channels. The most popular media include – but are not limited to – Twitter, Facebook, Instagram, WeChat, Tumblr, WhatsApp, Snapchat, Reddit, and YouTube. Recent research confirms just how quickly misinformation can spread among an information-hungry society. Aside from social media, many people use search engines (Google, Yahoo, or Bing) or depend on various mainstream news media, left- or right-wing websites, or community journalists to receive information. The sheer volume, immediacy, and combination of information sources only adds fuel to the fire by blasting out false news at unprecedented speeds. According to Rheingold (2012), "the average American consumes thirty-four gigabytes of information on an average day" (p. 99).

Defining what fake news is and identifying potential implications of the increase in fake news will help to provide a base-level understanding of the current situation. However, we must also understand that there are tools and techniques one can use to detect fake news, protect oneself, and avoid making the situation worse by spreading it. By examining the impact of fake news on the COVID-19 (coronavirus) outbreak, we can gain some insights into how this information phenomenon has become what I refer to as a "digital information virus" and what others – such as the World Health Organization (WHO, 2020) – refer to as an infodemic. Conversely, to counter fake news and help to create a factual, credible, and timely source of information, I will provide a snapshot of my overall experience in risk and crisis communications, including the messaging process that helped to keep key audiences accurately informed at an Alberta based post-secondary institution at the point and time of this writing.

Ultimately, fake news causes a chain reaction effect in society, and this has several ethical implications that may result in unexpected potential outcomes. Based on my real-time and participatory emergency and pandemic-related communications experiences, I will suggest an easy-to-use matrix tool to help people detect fake news and offer a new strategic communications approach for organizations to establish consistent and credible sources of information that will help to offset fake news and prevent it from spreading.

What is Fake News?

It is important to gain a basic understanding of what fake news is and how it is distributed. While the definitions may vary, fake news is essentially information that is not true and is intended to misguide, fool, provide mistruths, or deceive people into believing the stated falsehood(s) (Charlton, 2019; Dulhanty et al., 2019; Watters, 2017). Other terms used to

refer to fake news that have been used in public forums include: hoax, misinformation, and disinformation. Additionally, Collins Dictionary labelled "fake news" the word of the year in 2017. Rheingold (2012) suggests that performing more than one search query and going beyond the initial search page results can reduce the chances of getting fooled by fake news. While it may seem as though fake news is a more recent informational phenomenon – most notably during the 2016 presidential election campaign in the United States – this is not actually the case. According to Heidi Tworek (2019), a historian and author from the University of British Columbia, disinformation likely had its origins in the 16th century with the establishment of the printing press and early newspapers. She explains that the earliest form of fake news came from groups who spread anti-Semitic information about Jewish people.

Fast forward to the present day, and we find ourselves thrust into a seemingly endless stream of information flowing through social media channels, the traditional news media and other rogue and less than credible sources. To gain a greater sense of the severity of the problem on a global scale, the Organization for Security and Co-operation in Europe and the United Nations Human Rights Commission issued a Joint Declaration on freedom of expression, focusing on fake news, disinformation, and propaganda (OSCE, 2017). But it is the public's insatiable appetite for information and the ease in which it can be shared, viewed, and liked via the use of various forms of technology that makes it even more difficult to discern fake news from credible and reliable information and news.

Is Technology to Blame?

While there has been a rapid evolution in the type of communication-related technology that can be used by consumers, we have to remember that someone is responsible for preparing the message. According to Cybenko and Cybenko (2018), the current state of technology and social media helps fake news thrive in a so-called 'petri dish'. Another expert suggests a direct linkage between fake news and Artificial Intelligence (AI). Samuel Woolley (as cited in Powers & Kounalakis, 2017) states that "security experts argue that more than 10 percent of content across social media websites and 62 percent of all web traffic is generated by bots – pieces of computer code that automate human tasks online" (p. 19).

Conversely, a study from MIT shows that humans are the key culprits when it comes to releasing fake or misleading information. Using the process on Twitter as an example, Vosoushi et al. (2018) surmise that a cascading effect occurs when information is posted (tweeted). "A rumour cascade begins on Twitter when a user makes an assertion about a topic in a tweet, which could include written text, photos, or links to articles online" (p.1). Furthermore, the authors' key findings reveal that false news stories are more likely to be retweeted seven out of 10 times compared to true stories. To make matters worse, it has become extremely easy to send messages and spread mistruths via the use of smartphones, among other digital devices (such as tablets).

Coronavirus 'Infodemic'

The COVID-19 (coronavirus) worldwide pandemic is a great example of how difficult it has been for health organizations not only to help prevent the spread of the virus to humans, but also to manage the rapid explosion of disinformation, which can exacerbate the situation. The World Health Organization (2020) declared COVID-19 a global pandemic. The spread of misinformation can cause unnecessary panic. Here is a brief summary of examples that were uncovered by the BBC News Reality Check team (2020) in relation to misinformation in Africa:

- **Dettol can be used to protect against coronavirus.** An image of a bottle of the disinfectant (Dettol) was shared on

social media, and it was implied that it could prevent the spread of COVID-19. *This statement was FALSE.*

- **Shaving a beard can protect against coronavirus.** An old graphic from US health authorities about facial hair was incorrectly used to suggest shaving beards would help men avoid contracting the virus. It was even attributed to the CDC. *This statement was FALSE.*
- **A preacher posted a video claiming that pepper soup could cure coronavirus.** This information quickly spread after being shared on WhatsApp. *This statement was FALSE.*

These fake news items, along with numerous others, caused the World Health Organization to state that the outbreak has caused not only an epidemic but an infodemic of false and misleading information. The goal is to ensure everyone has accurate information to help prevent the spread of the disease (Zaracosta, 2020). Tech giants, such as Facebook, Google, and Twitter are leading the fight to mitigate mistruths on the Internet. But as Holmes (2020) suggests, "the bigger threat is speculation and false rumours about coronavirus that spread organically on online forums" (para. 4). The nature of this threat is primarily due to the speed at which news can travel. To make matters worse, the spread of false information during COVID-19 has been exacerbated by a few world leaders, including Brazilian President Jair Bolsonaro (Garcia & Benitacanova, 2020) and most notably US President Donald Trump when he falsely touted chloroquine as a drug that could treat COVID-19 (Liptak & Klein, 2020).

Detecting and Protecting Against Tall Tales

The first step towards protecting oneself against disinformation is to know what to look for in order to sort fact from fiction. This can be a daunting task; however, there are some basic questions one can ask and tools one can use to help make the detection process easier. Rheingold (2012) suggests learning key skills like "learning attention and crap-detection skills" (p. 114). There are also several fact-checking organizations that people can utilize including Snopes, Politifact, and the Media/Bias Fact Check website, which is made up of a team of fact-checkers who review and assess the accuracy and biases of dozens of news sites.

University of Waterloo researchers recently developed a new artificial intelligence (AI) tool to help social media networks and news organizations flag fake stories (2019). Based on what the researchers call "deep-learning AI algorithms, they can scan thousands of social media posts and news stories and make relevant links to other sources of information" (Dulhanty et al., 2019). Similarly, researchers at MIT developed a new system that uses technology (machine learning) to determine if a source is accurate or politically biased (Baly et al., 2018).

Some news organizations are providing their viewers and listeners with key fact-checking advice. CBC News has developed a chatbot tool for Facebook messenger. This tool is accessible online and provides users with several weeks of "learning about misinformation and disinformation, from deep fakes to suspicious articles" (CBCb, 2019, Image caption section).

Rheingold (2012) suggests asking a key question when viewing or watching information updates: "once you've searched, you need to determine how much you should trust the info your search has yielded" (p. 89). CBC (2019a) suggests asking key questions such as:

- Are the details of the story thin or unavailable?
- Does the story seem too bad or too good to be true?
- Have I heard of this organization before?
- Can I find another source that confirms and counters this information? (How do I know if it's disinformation? section)

Within educational circles, there is a growing effort to provide relevant learning resources to students to fight the spread of fake news within Canada, such as mediasmarts.ca. In the US, the Digital Literacy Resource Centre (DRC) has provided key learning opportunities for students and staff online (Jackobson, 2017). According to Manzini (2015), digital platforms provide enabling solutions for organizations (p. 168), and students can certainly broaden their learning opportunities under the right set of circumstances and safety considerations. There is certainly an opportunity to develop more consistent educational resources for students and teachers in Canada for K-12 and post-secondary institutions.

Risk and Crisis Communications

With over 20 years of experience in risk and crisis communications, including as a sessional instructor in continuing education at a post-secondary institution, I realize the importance of audiences receiving timely and factual information from credible sources. The act of disinformation could have reputational health and safety ramifications for end-users and receivers of information. Regan and Jesse (2018) advise that there are a range of ethical issues that should be considered in regards to the use of edtech and data. To help add some further context to this area of communications within the realm of fake news, it is important to delineate the differences between risk communications and crisis communications.

The process of risk communications deals with things that might go wrong (Telg, 2019). According to Fearn-Banks (2017), it is an ongoing program of informing and educating various publics (usually external publics) about issues that can negatively or positively affect an organization's success. Based on my work experience, relationships between an organization and its key publics need to be established before a situation escalates into a crisis.

The process of crisis communications deals with things that do go wrong (Telg, 2019). Crisis communications is the dialogue between the organization and its public(s) prior to, during, and after the negative occurrence (Fearn-Banks, 2017). Effective communications consist of preparing a crisis communications plan with supporting tactics, of involving the team in training scenarios to help mitigate any reputational harm against the organization, and of being strategic in enacting the crisis communications plan.

Experience and Strategic Audience Engagement

As a former media relations manager, trainer, and spokesperson for an Alberta-based police service (1999-2011), I was involved in disseminating daily, accurate information to internal audiences and the public through various digital platform technologies including news, social media, and organizational communication channels (email, website, Intranet, conference calls, news conferences, so on), which helped to contribute to the overall well-being, education, and safety of citizens, and employees. Any mistruths would have a negative effect on how seriously people would take any information they received from police. This could also impact the effectiveness of educational school programs such as the D.A.R.E. program.

It is not unusual for fake news to escalate during a time of crisis. During the flood of 2013 in a southern Alberta city, I was employed as a Public Affairs Manager, and I noted that disinformation would flare up and hinder efforts to have the public follow safety instructions. Our approach was to correct and address any mistruths as soon as possible to prevent their further spread. Some disinformation was centred on the actual importance of having a 72-hour emergency preparedness kit. Some fake information resulted in people doubting its importance, leaving them vulnerable to not

being properly prepared to survive the situation. Any type of mistruth only serves to work against emergency services personnel, who only have the health and safety of the public in mind.

A more recent example is based on my participatory role and perspective regarding the communications process at a post-secondary institution during the COVID-19 outbreak from the period of January-March 31, 2020. As the senior manager of media and issues management, I led an effort to establish the trusted communications channels to share relevant and timely informational updates with the campus community and to help prevent the spread of disinformation. I prepared a communications plan with tactics and specific communications drafted in conjunction with executives and teammates in various departments during the early risk communications phase and in advance of COVID-19 being declared a pandemic by the WHO. The plan was fluid and adaptable to audience needs as the outbreak became a crisis; this included the creation of a central hub of factual information and relevant links by colleagues (a COVID-19 themed website). To help mitigate fake news, an institution needs to provide strong and consistent internal and external communications, including the news media.

In this digital age, the use of social media has also amplified the amount of information being shared in general during the worldwide pandemic. Dr. Peter Chow-White aptly described its impact in the *Saanich News*: "social contagion operates very similarly to viral contagion; there is a network effect, and social media amplifies this" (Mclachlan, 2020). Additionally, Powers & Kounalakis (2017) support research findings that indicate people are actually relying on digital platforms like Twitter and Facebook for their news. This increases the "level of exposure they have to a multitude of sources and stories" (p. 4). More importantly, Rheingold (2012) suggests that people need to learn how to participate effectively online to help reduce the spread of disinformation.

Tips to Detect Fake News

My own experience and research suggest a solution to help safeguard and protect against fake news. I have developed a simple process to verify the information one encounters via social media and news media circles (Figure 9.1).

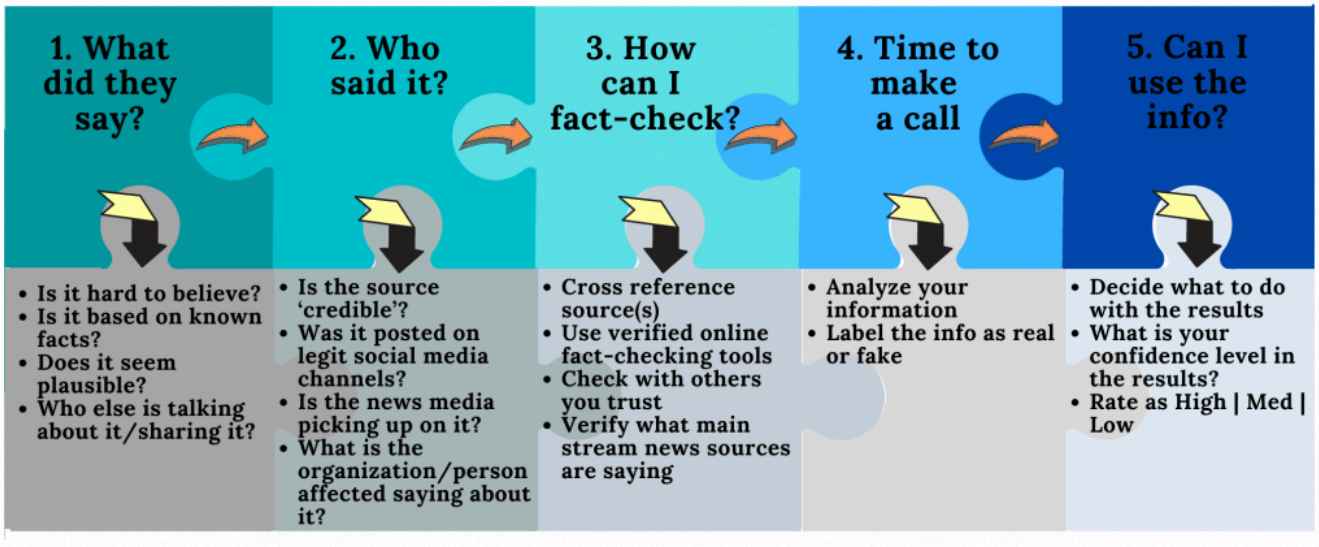

Figure 9.1 Five-step source assessment process for fake news

Individuals can also create an easy-to-follow chart based on the above themes in a word document, PDF or Excel format. This information is meant to help guide people as they identify, track and assess fake news.

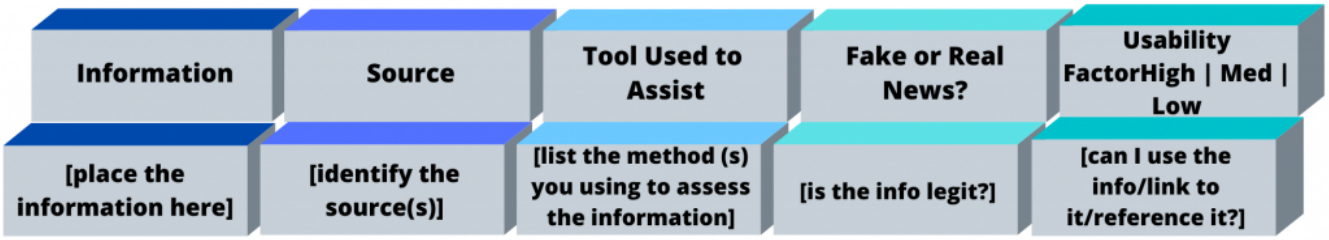

Figure 9.2 Source assessment matrix tool

Effective Communications Process During a Pandemic

Equally important for organizations and professional communicators is to have a strategy in place prior to and during a time of crisis to provide a source of credible information and to also protect against disinformation. This new eight-step model is informed by action research, my personal industry experience, digital technology, creativity, design principles, and best practices. This process can help to offer guidance during the planning process (risk and crisis situations).

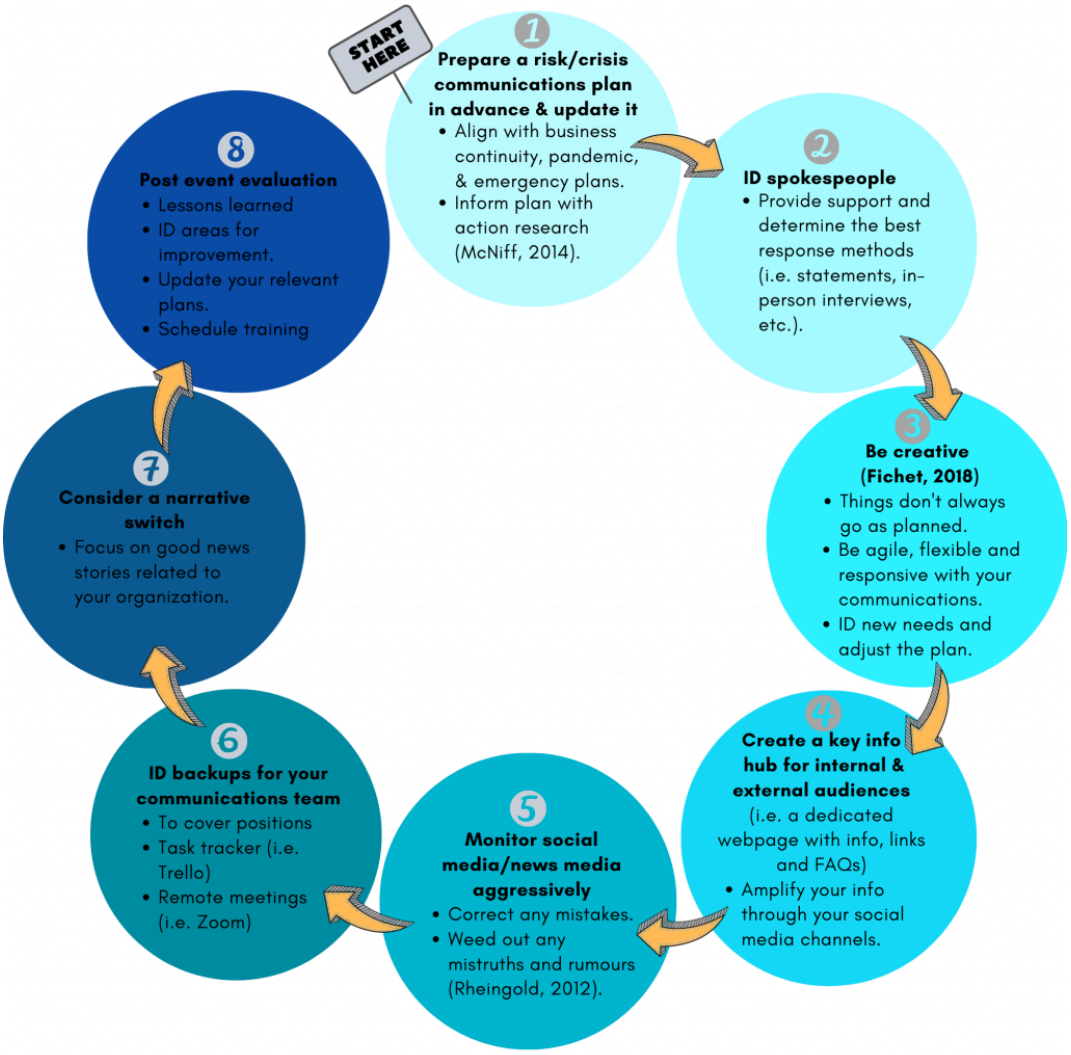

Figure 9.3 Eight-step communications process for risk and crisis situations

Ethical Considerations

From a broader perspective, the onus of responsibility in mitigating the proliferation of fake news requires a complementary effort by a variety of end-users of technology. A study conducted by Gabielkov et al. (2016) reveals that many people share links on Twitter without reading the information first: "out of 10 articles mentioned on Twitter, 6 typically on niche topics are never clicked" (p. 8). This influences what information gets circulated. Moreover, in 2017, the news site *The Science Post* published a block of "lorem ipsum" text. According to Dewey (2017), "nearly 46,000 people shared the post without reading past the headline." This is a concerning trend, as the speed at which people can now create and distribute information globally is unprecedented. The chain reaction cause and effect of fake news as depicted in Figure 9.4 is far-reaching.

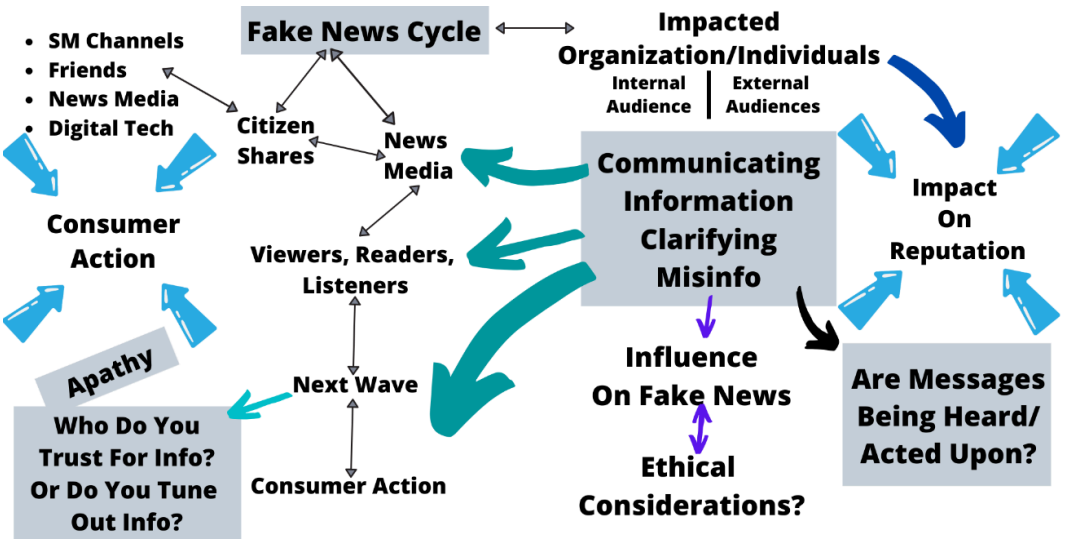

Figure 9.4 Chain reaction cause and effect of fake news

A closer analysis of the 'typical' key players involved in creating and sharing information highlights the ethical challenges for these groups. In table 9.1 , ethical highways for consideration, are based on Farrow's normative theory (2016).

Table 9.1 Ethical highways for consideration (creating, distributing, and receiving fake news) based on Farrow's (2016) *Uncompleted Framework*

Group	Influencer or Impacted	Normative Theory
• Creators of fake news	• Influencer (knowingly)	• Ego consequentialist/ Machiavellianism. • This self-centred approach starts the chain reaction and cascading effect that fake news has on everyone who receives or views this information. • These individuals are not concerned with presenting the facts, nor do they consider the potential negative consequences of creating and sharing this information in perpetual motion.
• Spreaders of mistruths	• Impacted (unknowingly)	• Virtue. • These individuals may be well-intentioned, but their decisions are more instinctual and subjective, without much consideration of the potential consequences of 'clicking and sharing' information. • Studies show this group is more likely only to read the headline before sharing this information.
• Owners of key social media platforms and digital technology	• Influencer and impacted	• Combination of consequentialist and virtue. • From an outsider's perspective, and when it comes to big business, the saying 'hear no evil, see no evil' rings true. • Facebook has had to implement new security measures due to massive data breaches, public outcry, and a government crackdown, while Twitter will now remove any 'bot' accounts or fake users.

• End-users of technology	• Impacted	• Consequentialist. • Users of technology find themselves with the privilege of using state-of-the-art digital tech, only to be bombarded with a plethora of information. • They have to make difficult decisions on what information to believe and what if anything to do with it. • End users can also become key players in the further transmission of fake news (intentionally or not).
• Education system	• Influencer and impacted	• Combination of deontological/ consequentialist. • Education is guided by government legislation, curriculum, and policies, and is also bound to consider the potential consequences of edtech and open learning. • Blindly accepting or being 'fooled' by mistruths can have serious implications for the quality of learning opportunities, and can hurt the reputation and perceived effectiveness of educational institutions and what type of safe learning environments they are capable of providing. • This will place more pressure on educators to come up with new ways of combating the problem of fake news while also encouraging digital learning opportunities.
• Organizations	• Influencer and impacted	• Combination of deontological/ consequentialist. • Organizations have the responsibility to balance the needs of their internal and external audiences. • The onus is on leaders to ensure a source of factual and helpful information is available at all times to mitigate the emergence of fake news. • Organizations are also required to adhere to laws, policies and procedures. • Many organizations and boards may choose to walk the fine line with the information they communicate, thereby contributing to or influencing public conversations. The approach they choose will help to shape its reputation.

• Media/journalists	• Influencer and impacted	• Consequentialist. • The majority of mainstream media outlets and journalists adhere to industry based ethical standards and procedures (such as the Canadian Association of Journalists, CRTC, etc.). Conversely, the CBC has an Ombudsman to address any improprieties or ethical issues. • The media agenda centres on making daily choices on what they report on, at what lengths they go to get the story, and how they source and package the 'stories' for their audiences. Profit and being first are also paramount. They can add 'fuel to the fire' on any topic, and can drive the cycle and spread of mistruths to the public. Isn't the onus on them to provide balanced story coverage?
• Communicators	• Influencer and impacted	• Combination of deontological/ consequentialist. • Similar to journalists, public relations staff or professional communicators are embedded in ethical standards through either the Canadian Public Relations Society or the International Association of Business Communicators. These professionals, who may work in profit, not for profit, private or government settings also have to balance organizational needs. This may include finding creative ways around laws, policies and procedures, and balancing requirements under FOIP among others. Communicators make daily choices on how they shape messages, but the final decision on what is released or shared publicly rests with leadership.

Conclusion

Impact on Education

There are many positive societal implications associated with widespread access to and use of digital technology and platforms. However, some individuals cross the line with their messaging, and, as a result, fake news can go viral very quickly. These actions have impactful ramifications on education – especially for knowledge-seekers scouring online for references and various learning resources. Educators, organizations, and journalists, among others, have a common desire to inform and educate, and to provide factual and helpful information on a variety of topics. One researcher has signified the importance of this, while also recognizing the associated ethical challenges. In his article A *Framework for the Ethics of Open Education*, Farrow (2016) offers the following insight: "as openness increasingly enters the mainstream, there is concern that the more radical ethical aspirations of the open movement are becoming secondary" (p. 94).

Action research provides the opportunity to link theory and practice. In my experience, utilizing this approach to prepare a risk/crisis communications plan is more effective than using the 'traditional' public relations method. The key research steps of planning, acting, observing, and reflecting (McNiff, 2014) offers a pragmatic yet theoretically based and informed approach to strategic preparations. Moreover, when innovating possible solutions, it is equally important to incorporate a design thinking process such as Ostrom's design principles (Rheingold, 2012) in a way that is also applicable and relevant in real-world contexts (Kelly, 2016). The constant cycling method of action research provides regular opportunities to help finetune even the most complex business practices.

Moreover, adopting a relatively new mindset in the field of crisis communications, namely "creative readiness" (Fichet, 2018), was also beneficial to me as a professional communicator. Fichet (2018) describes this approach as "improvising in acute situations based on creativity and earlier experiences" (p.34). The ability to respond more creatively as a particular crisis unfolds is a helpful strategy and can provide another way to mitigate falsehoods and to protect an organization's reputation.

Rheingold (2012) reminds us that when we are navigating in the digital world, the onus of being responsible and ethical end users is something we should not take for granted. Everything we write, say, or do via social media platforms quickly becomes a part of the bigger picture: "if you tag, favourite, comment, Wiki edit, curate or blog, you are already part of the web's collective intelligence" (Rheingold, 2012, p. 148). But unfortunately, presently, and in the amount of time it takes to 'post' or hit 'send,' most people are already being negatively impacted by falsehoods being presented as facts.

Herein lies the importance of being able to appropriately detect fact from fiction when it comes to what we hear or view on the news or via social media circles. A proliferation of mistruths online will only serve to cast doubt on the credibility of information available to learners from K-12 to post-secondary, potentially resulting in a host of other issues. Regan & Jesse (2018) raise the importance of addressing ethical issues initiated by a spike in the use of edtech and big data in school systems. There is certainly a need for more research in this area, as we still have much to learn. The big question moving forward is what else can we do to more effectively navigate and protect ourselves against fake news while reaping the learning benefits of digital technology in our ever-evolving digital climate?

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