Technology and Education

[1999, revised 2004, 2007, 2014]

Technology and Educational Change

As within the broader society and economy, new information and communications technologies will continue to transform education in profound and largely unforeseen ways. It is vital that the teaching profession actively participate in the process of shaping educational policy and practice in this area.

Skill sets of today's multi-literate students in the area of technology cannot be ignored. Technology offers teachers a new range of opportunities to enhance the learning environment of students; however, rapid change makes it challenging to establish which pedagogical strategies are most effective. This is compounded by the fact that there are few longitudinal studies regarding technology implementation with significant sample sizes for comparison purposes, especially at the elementary and middle levels.

Innovative teaching and learning with technology is a dynamic, challenging and creative act. Just as educators adapt emerging technologies to enhance student learning, new technologies come forward. Compounding this complexity is that emerging technologies can influence almost everything from infrastructure to classroom teaching, and educational policy almost always lags behind the implementation of technology. Amidst these changes, for example, is growth in the movement towards "Big Data" whereby individuals (and their data) become "atomized", with behaviours tracked in real time and then compared with millions of other individuals. Issues of privacy, data access, and who actually owns student and teacher data will grow enormously in the near future, along with the many moral and ethical issues raised by the use of data analytics and data mining of student information.

Since teachers are most aware of the complex circumstances in which implementation of a technology occurs, they have a unique and essential perspective that must be considered in the public discussion in terms of the place and purposes of technology in schooling. Teachers are in the best position to determine the value of an emerging technology in terms of its potential for the enhancement of teaching and learning.

In addition, teachers are committed to a vision of public education that must be vigorously defended at a time when the trend toward growing disparity, inequity, privatization and corporate interest in the "education industry" can exert a powerful influence on the way that technology affects educational change.

There is an increasing tendency in public life to see the world and ourselves solely in economic terms, and education is no exception. Included in such a perspective, technology is advocated as a necessary lever of change that will adapt education to the needs of globalization, restructuring and the marketplace. In responding uncritically to the imperatives of a digital age, this view emphasizes the need to bring schools more into step with the world of work, so that students will possess the skills to survive in a changing society and be prepared to meet the needs of employers. This drive towards an economic imperative is amplified by a global educational reform movement (or GERM, as coined by Pasi Sahlberg) that threatens to sidetrack meaningful educational change in Alberta. The GERM movement is characterized by a focus on standardization, growing bureaucratic interference in teachers' professional practice and zealousness for technology as the simplistic solution to the complex challenges school communities face.

In the context of the growing impacts of the GERM, the profession is concerned that focusing predominantly on preparing children in K–12 education for the world of work has begun to distract from the broader goals of education, causing society to lose sight of the social and developmental needs of children and how they can develop into informed and engaged citizens empowered for democratic life. To succeed in a globally competitive workforce, students will need to be not only confident and competent in the use of digital technologies, but also capable of dealing with the enormous challenges posed by such issues as climate change, water shortages, overpopulation, economic destabilization, urbanization and pollution.

The teaching profession is committed to a more balanced vision of public education—one founded on the principles of universality and equity, the fostering of the potential of individuals and the development of citizens in a democratic community. The profession understands that our future successes must be built on a shared goal of excellence through equity in our education system. It is within this context that the Association sees potential for the new technologies to enhance the humanistic, engaged enterprise of public education and to provide a sense of connectedness with community and civil society. The Association believes that integration of emerging technologies should be supported in a way that respects these ongoing values and traditions of public education.

Technology, Teaching and Learning

As professionals, teachers use their knowledge and experience to analyze the classroom context as they make decisions about the teaching strategies, learning experiences and assessment practices that are best suited to the needs, interests and motivation of students. It is not technology itself but the professional decisions that teachers make about technology and its use in the classroom that will determine its impact on student learning.

The essence of teaching is a pedagogical relationship between teacher and student that may be assisted but not replaced by technology. It is evident when teachers are able to seize the teachable moment, to communicate their passion for learning and to develop students' individual gifts and talents. Technology must be used in ways that are compatible with this understanding of the nature of teaching and learning.

Teachers are required to be flexible, responsive, innovative and creative in working with all students. Technology must support, not constrain, these aspects of the teaching process. In all learning situations, emphasis must be placed on the pupil–teacher relationship, since the most advanced technologies will never replace the need for human interaction in the development and construction of knowledge. Teachers should embrace technological innovations based upon their potential to expand and extend the educational experiences of students.

Although teachers may be personally committed to this pedagogical interpretation of how technology should be used, it would be a mistake to assume that teachers can be fully in control of its influence in our classrooms. Teachers must use critical judgment when determining how technology should be integrated into the curricular and pedagogical dimensions of their teaching practice. Teachers must be vigilant in ensuring that technology is used to enhance, not displace, the human dimension and purposes of education.

Technology in the Learning Environment

Teachers support the use of technology as an instructional tool that enables new forms of communication, inquiry, discovery and the creation and sharing of knowledge. The teaching profession needs to proceed carefully and responsibly in integrating technology into learning environments.

Teachers should use technology for its unique attributes and not in ways that replicate what face-to-face teaching can do as well or better. To adequately support social and emotional development, face-to-face instruction is the preferred option for most students in K–12.

Information and communications technology can, for example, expose students to real-world problems and place learning in a relevant context. Students can safely and easily manipulate variables in complex experiments and observe the results. The new technologies also make it possible for students to represent and communicate their knowledge using multimedia. Many students can edit their work more effectively and are able to produce professional-looking assignments.

With the developing minds and bodies of children and youth there is an increasing need to be cautious of the impact of online digital activities for offline health and mental well-being. When implementing technology, teachers, as pedagogical leaders, should take into account such factors as the age, gender and education level of students, the socioeconomic status of the community and the beliefs that a student's parents and peers hold about the value of technology both in and outside a school setting.

Children now spend more time with television, movies, computers, Internet, cellphones and video games than they do with their parents, teachers, or any other influence in their lives. Several research studies have confirmed that children and youth in Canada spend an average of seven-and-a-half hours a day in front of screens. Evidence-based decision making must be brought to bear on the choices of the media that students engage with in classrooms and the overall time in front of screens above and beyond the seven-and-a-half hours a day already occupying their lives. As media use and screen time continue to climb for students in and out of school, evidence and policy must guide the extent of students' screen time in schools to protect their health and development.

Research by Magee et al (2014)[1] has identified long-term associations between the length of screen time at younger ages and a predictable decrease in sleep at older ages. This decreased sleep at younger ages further predicted an increase in media use as children got older. The circular relationship between screen time, media consumption and sleep also has many other implications, including childhood obesity and declines in readiness to learn as students increasingly arrive at school with poorer sleep quality and quantity. As digital technologies are engaged to enhance student learning, achieving a healthy balance, cognitively, socially and physically for students, across screen media, becomes increasingly important.

The growing number of students with special needs, in particular, stand to benefit from new technologies, especially if the trial-and-error process is less threatening when done through interaction with the computer. Individuals with learning difficulties can be assisted by distributed learning, digital and/or e-learning activities which suit their learning needs. It is important that special education teachers are able to understand the potential of assistive technologies to facilitate learners with disabilities. It is important that assistive technologies be reviewed by teachers and that special education teachers be supported in the development of resources.

Distributed learning, digital and/or e-learning may offer new forms of choice for students, and may address some small and rural school issues specifically by expanding educational options and providing greater access to courses for some learners. Interaction between student and teacher is the key variable to success in the effective use of technology in learning environments. Face-to-face communication improves the likelihood of a successful educational experience for the student.

Learning environments and activities need to be informed by sound educational theories and should be developmentally appropriate. These theories suggest that children may lack the rich experiences needed to construct knowledge of the world around them, and distributed learning activities will need to be tailored to provide slowly increasing levels of independence. These must be developmentally appropriate and respect differentiation of students.

Based on diagnosis, teachers can make decisions regarding combining content and tools that can complement aspects of traditional face-to-face instruction. Teachers can mix online or video-conferencing with face-to-face and other modes of instruction in ways to benefit and maximize student learning.

By contrast, software that merely provides an online workbook is perhaps the most ineffective and costly use of the technology. As a research tool, the Internet not only offers students access to vast new material but also raises important concerns. Unlike text-based resources, this material is not refereed or censored, creating a tension between free speech and offensive content. As a result, teachers will need to focus more than ever on the exercise of critical judgment and address the need for media awareness.

Students must know how to respond to aggressive advertising, racist and offensive content, cyberbullying, and to strangers they may meet on the Internet. Cyberbullying on the Internet is a growing concern for the safety of students in and out of the school. Many students experience the threats and humiliation that are associated with cyberbullying or cybersmearing, and there is an increased need for school divisions to develop policies to deal with this issue. In addition, teachers must advise students on how to become discerning with respect to digital communication, and how to respond appropriately when they are targeted by inappropriate online activity. All students using the Internet must be supervised by a teacher, and younger students should only use the intranet or sites on the Internet that a teacher has previewed. These concerns aside, it may well be that, of all the technological applications, the Internet offers the most potential for unique and novel enhancements to good pedagogical practices.

Greater access to information does not equate with knowledge and practical wisdom, but when teachers have thoughtfully constructed a purposeful and appropriate learning experience for and with students in which the Internet plays an indispensable part, it can be a valuable addition to the total repertoire of teaching practices.

Resources

While teachers normally use their professional judgment in selecting resources, they now face new and special problems concerning the quality and suitability of technology-based resources. Schools are currently being bombarded with sophisticated sales promotions for material of questionable merit. Since the development and marketing of technology-based educational resources is expensive and because there are a limited number of publishers for this material, there is a danger that unsuitable materials will be used in classrooms.

When technology-based resources are evaluated for authorized use in the Alberta curriculum, they must be vetted for Canadian content and adherence to the principles of tolerance and understanding by the department of education. Procedures must also be created to involve certificated teachers in the ongoing review, approval and evaluation of the education suitability of distributed, digital and e-learning resources not produced by Alberta certificated teachers. A government-supported centralized clearinghouse could ensure that these resources meet the same standards as other authorized learning resources, and teachers would be able to make their selection from a list of screened resources, saving time and money at the school level.

Professional Development

Effective technology integration requires three major components: training for professional staff, timely technical support and access to hardware and software.

Underutilization or poor utilization of existing technology in schools inevitably results from inadequate attention to professional development. The positive effects of computer-based technologies in facilitating student learning and performance will be seen only when teachers have the knowledge and skill to use it appropriately.

Teaching methodologies in distributed learning, digital and/or e-learning are significantly different from traditional teaching, and teachers require substantial professional development to be effective in online environments. Access to professional development and ongoing support are required and must be in place. Also, to be effective, professional development must reflect the context of classroom teaching and curriculum rather than be restricted to skills training.

Teachers require significant professional development to adjust to the pedagogical needs of teaching in distributed learning environments. However, distributed learning also has the potential to provide new and flexible professional development opportunities for teachers.

Engaging in reflection and dialogue about the relevance of learning activities in distributed learning, digital and/or e-learning environments will be paramount to professional growth. Time must be allotted to enable teachers to become familiar with available software, to design lessons and to discuss technology use with other professionals. Teachers must have primary involvement in the design, development and selection of instructional materials, including educational technologies and digital resources, and must receive adequate time and compensation for work involved in the development of related materials.

Funding for the True Cost of Ownership

The initial expenditure on technology infrastructure is only the tip of the iceberg when all the other associated costs are considered. Schools must budget to include the costs of acquisition, maintenance, upgrading and replacement of technology for schools. As well, the costs of software, licencing agreements, network infrastructure, Internet access, technical support and personnel, and professional development must be ongoing.

Keeping up with changing technology is almost an impossible task for schools with limited funding. To support the technology budget, some schools may reduce funding or cut staff in other programs. The long-term effects of these decisions will result in a narrowed curriculum and diminished educational experiences for students unless there is an increase in funding for education.

Introducing distributed learning, digital and/or e-learning initiatives with the expectation of reducing costs to the district or school is inappropriate. When working in distributed learning environments, enhancing and improving student learning must be the primary objective. In order to establish environments conducive to providing quality learning experiences for students, teachers must be provided with adequate time and resources, and teachers must be assigned reasonable work.

In the context of present funding levels and with the increased cost of technology, teachers must be judicious in identifying the most appropriate uses for technology.

Automation

With new advances in artificial intelligence, robotics or advanced computer algorithms, many human activities will be at risk of automation or computerization in the future. An Oxford University (Martin School) research study (2013) provides a probability ranking of 702 North American occupations (including many within the education sector) where automation and displacement will occur and put close to half of North American jobs at risk of computerization by 2030. Transport, logistics and office roles are most likely to come under threat while professions such as teaching, which are involved in creative work, social perception and promoting the development of fine motor manipulation, will have a low probability of being increasingly automated.

However, one area in the education sector that is being explored for increased automation, as a means of reducing costs, is the machine scoring of qualitative writing. Machine-learning algorithms that predict scores for student writing are now being used across North America to save costs for the marking of large-scale standardized testing. It is, however, an innovation where students can easily be misled to focus more on structure and grammar than on the essay's content. While these technological tools may promise consistency, they warp the very nature of writing as a deeply contextualized interaction between human beings. Alberta teachers oppose the use of machine-scoring writing as a substitute for teacher-based assessment and evaluation of students' written responses.

The move to machine-scored essays also has the potential to direct funding toward technology investments and away from teachers and their professional development. The Association relentlessly advocates for adequate funding, support, resources and time for teacher professional development related to the infusion of technology into pedagogy, along with curriculum, assessment and digital reporting.

The Association believes there is a place for technology in educational assessment, but with the clear recognition that its mechanized and standardized valuations are no replacement for the sound judgment and ability to interpret context and meaning that teachers bring to the equation. Governments and school systems must invest in building the assessment capacity of Alberta teachers rather than supporting a distorted focus on automation or investing in digital technologies as a substitute for teacher-based assessment and evaluation of students' written responses.

Distributed Learning

Distributed learning, which is defined as "an instructional model that allows instructor, student, and content to be located in different, noncentralized locations so that instruction and learning occur independent of time and place" (Saltzberg and Polyson 1995), is on the rise. Distributed learning, digital and/or e-learning can augment traditional classroom lessons, replace traditional correspondence courses, and create virtual classrooms through the use of video conferencing and a variety of online tools. It has the capacity to extend and expand the educational experience for students and further enhance technology literacy. Distributed learning may include assessment tools, such as quizzes and self-assessment, and facilitate assignment submission and return. Online learning environments may also include collaborative and communication tools that expand learning opportunities, enable interaction with outside agencies and facilitate virtual field trips.

Distributed learning can be blended with the traditional classroom environment to combine traditional teaching methodologies with online activities to produce rich learning opportunities. To authentically enhance the learning, teachers must ensure that the use of technology is rooted in the curriculum and the needs of the learner.

The Association believes that distributed learning, digital and/or e-learning can augment and enrich traditional delivery methods and has the potential to extend learning opportunities for some Alberta students. Teachers recognize that distributed learning can address the learning needs of some students, and it provides opportunities for collaborative work spaces that are highly engaging.

Distributed learning has the potential to shift the emphasis towards greater learner-centered pedagogy and highly personalized learning. This can only be achieved if appropriate monitoring and supervision of students is in place and if workloads for distributive teachers are realistic and driven by educational goals rather than financial targets.

Teachers at remote sites cannot be responsible for protecting the safety of students in a distant classroom, and adequate supervision of students must be provided for by caring and responsible educators at all times. Implementation of distributed learning environments requires proper monitoring and supervision of students in the school.

Decisions about whether distributed learning programs are appropriate must be based on the professional knowledge of teachers within the context of that learning environment and informed by educational research. Younger learners may be less successful in distributed learning environments because they lack the ability to work autonomously in a learning system that requires more independence. Teachers need to be aware of supervision requirements, especially with younger students, to facilitate learning. Although technology-based learning activities can augment and enrich the learning environment, face-to-face instruction is preferable as the primary mode of instruction, especially in younger grades. In the formative years, foundational skills such as literacy and numeracy need to be developed, and it should be left to the professional judgment of the early childhood teacher to determine the developmentally optimal time and place for technology to be introduced.

Visionary leadership is needed to encourage flexible learning environments that will provide opportunities for distributed educational programs that are relevant to students becoming responsible caring citizens in a democratic society while at the same time safeguarding the learning environment.

Data Privacy and Protection

In a digital age many companies are beginning to look at ways to profit from student and teacher data that can be easily collected, stored, processed, customized, analyzed and then, ultimately, re-sold. In turn, school districts across Alberta have adopted educational technologies faster than they have instituted policies to oversee vendor collection and use of current or former student or preservice, active and retired teacher data.

As packaged technology solutions are sold to school districts as achieving educational objectives and taking advantage of new opportunities for choice, personalization, cost savings, and flexibility, they are also at risk of transferring increasing quantities of student information and data to third-party providers.

This practice has turned into a billion dollar industry in North America, where private equity investors, education technology companies and transnational corporations are rushing to stake a claim and make a profit. However, school districts across the United States have recently become the subject of lawsuits as they fail to properly protect massive collections of sensitive student and teacher data. Data and privacy issues are significant and will certainly become more contentious as school districts rush to adopt new online systems pitched by private companies without instituting clear policies in advance.

The Association opposes the use of current or former student or preservice, active and retired teacher data for profit or secondary uses for commercial purposes. Therefore to ensure that data privacy and protections are in place, the following twelve necessary conditions should be supported by school jurisdictions and the Government of Alberta as they enter into agreements with technology service providers or vendors:
1. Specification of the purpose of current or former student or preservice, active and retired teacher data collection and the authority of the public school district to enter into the agreement
2. Specification of the types of current or former student or preservice, active and retired teacher data to be transferred or collected
3. The prohibition or limitation on disclosure of current or former student and preservice, active and retired teacher data
4. The prohibition or limitation on the sale or marketing of current or former student or preservice, active and retired teacher information without express parental and or teacher consent
5. The assurance that public school districts will have exclusive control over data access and mining
6. The prohibition on new or conflicting privacy terms when parents are required to activate an account for their child
7. The allocation of responsibilities for granting parental access and correction capabilities
8. The specification of whether foreign storage and processing is allowed
9. The specification of whether other government agencies in Alberta may have access to the current or former student and preservice, active and retired teacher data
10. The specification of data security and breach notification obligations.
11. The prohibition on unilateral modifications of contractual obligations.
12. The inclusion of a right for the public school district to audit/inspect vendors for compliance with contractual obligations

In terms of protection, students must also know how to respond to aggressive advertising, racist and offensive content, cyberbullying, and to strangers they may meet on the Internet. Cyberbullying on the Internet is a growing concern for the safety of students in and out of the school. Many students experience the threats and humiliation that are associated with cyberbullying, and there is an increased need for school divisions to develop policies to deal with this issue. In addition, teachers must advise students on how to become discerning with respect to digital communication, and how to respond appropriately as citizens living in a digital age when they are targeted by inappropriate online activities. All students using the Internet must be supervised by a teacher, and younger students should only use the intranet or sites on the Internet that a teacher has previewed. These concerns aside, it may well be that, of all the technological applications, the Internet offers the most potential for unique and novel enhancements to good pedagogical practices.

Necessary Conditions

The appropriate integration of technology cannot be achieved simply by decree and the provision of hardware in schools.
The following conditions are necessary to ensure that technology serves to enhance the goals of education and schooling:
• A vision of the role of technology in public education based on humanistic and democratic principles
• Proactive leadership to achieve the vision
• Commitment to the central importance of the teacher's professional judgment in decisions about the use of technology
• Identification of appropriate curriculum linkages
• Access to technological resources that are specific to learner needs
• Access to appropriate technology and connectivity
• Timely access to technical support
• Time for teachers to learn about technology and to develop technology-supported curriculum
• Public funding that addresses the total cost of ownership for technology
• School organization and culture that support effective teaching and learning
• Policies at the system and school level that support the appropriate integration of technology
• Acceptance of the teacher as final arbiter in the use and application of technology
• Consideration for the well-being of students

Conclusion

The Association believes that the integration of technology in our schools where all students can learn should occur in a way that enhances the potential for engaged, pedagogical relationships as the secure foundation of children's education.

Technological trends will emerge and some will have immediate educational relevance or impact. The relevance of other technologies in terms of their potential for improving the learning and teaching process will be marginal or non-existent. Teachers should ask questions in regard to teaching and learning outcomes, available content, cost-effectiveness, leadership and vision, student acceptance, parental support, risk, professional development, applicability and sustainability. The Association believes that developing and implementing digital-age educational activities has the potential to revitalize schools and engage stakeholders in new ways that will require educators to be thoughtful and reflective in an ongoing and embedded way.

In order for the integration of technology to be effective, it must serve curricular objectives and be consistent with a vision of public education that is committed to creating a great school for all students where democratic principles can be advanced and social cohesion embraced across an increasingly diverse and complex society. Alberta schools offer vibrant and creative learning environments in which the teaching profession decides how best to use digital technologies in meeting the learning needs of students and recognizing their individual talents and gifts. In pursuit of this vision, teachers must assert their professionalism and ensure that, in the great rush to implement change, technology does not become an end rather than a means.

This is especially important since the necessary conditions of adequate funding, equal access for schools and children, and appropriate investment of time, resources and support for professional development are not yet in place. The Association encourages the government, school districts, schools and teachers to communicate about these realities and to find solutions that will benefit students and public education into the future.

Note
1. Magee CA, JK Lee, SA Vella. 2014. "Bidirectional relationships between sleep duration and screen time in early childhood." JAMA Pediatrics: published online (March 3).