Class, Take Out Your Tablets

The Impact of Technology on Learning and Teaching in Canada
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Study Scope

Class, Take Out Your Tablets examines the impact of digital technology on learning and teaching in Canada.

The report includes the following:

- How tech is perceived in the classroom
- Current state of technology in education
- Opportunities, challenges and methods for technology adoption
- Case studies

Class, Take Out Your Tablets draws on 16 interviews with educators across Canada and an extensive review of existing research on the use of digital tech in education.

Study Context

Artificial intelligence (AI), Augmented Reality/Virtual Reality (AR/VR), robotics, and other digital technologies are transforming society, the economy—and school classrooms. In transitioning to an increasingly digital workplace, students will need to be comfortable with many of these digital technologies. But the next generation of leaders will also face complex global challenges, requiring students to become more than mere users of technology.

Tech-aided learning is expected to potentially change the way students think, interact with the world, and tackle problems while encouraging lifelong learning.

Educator Perceptions

The study’s respondents widely support the use of tech in the classroom. If implemented in a well-considered manner, teaching digital competencies is an important dimension of modern K-12 education.

- Asked if “Technology can enhance education, make learning more fun as well as more effective,” the majority agreed (some provided qualifications and some neither agree nor disagreed)
- Asked if “Technology in the classroom is a must-have for students to be prepared for almost any career today,” the majority agreed (some noted that technology doesn’t have to be part of every subject and that the extent of technology integration should vary from subject to subject)
General Study Findings

The inclusion of digital technology in the classroom enables more interactive, collaborative learning, and stronger learning outcomes in areas such as engagement, creativity, agility, teamwork, and flexibility while strengthening interest in these pivotal technologies.

- Multimedia learning, for example, which combines in-class instruction with a screen projection of the subject material, has also led to better retention.
- Reading program models that integrate computer-assisted instruction with in-class instruction have demonstrated improvements in reading scores.

Educators are increasingly moving beyond simple learning outcomes based on test scores to include less-tangible measurements such as student engagement, classroom interactions, critical thinking and problem solving.

Criticism of Technology in the Classroom

A recent report from the Organization for Economic Cooperation and Development (OECD) found that technology has a mixed impact on education, citing its potential for distraction if not used and implemented properly.

- ICTC study respondents noted distraction and “off-task” behaviour as potential drawback of technology in the classroom.
- Too much digital exposure—especially on devices that allow access to gaming, texting and social media—can weaken overall academic performance.

Educators are looking for guidance on how technology can be managed effectively in the classroom.

Methods of Technology Integration

Technology integration into education follows two predominant models:

1. One-to-one projects—each student is provided individual access to a school tech device (as opposed to shared access or students providing their own device).
   - One-to-one initiatives have proven useful for lower-income students, allowing for the uptake of digital fluency and skills in the absence of personal technology ownership.

2. Bring Your Own Device (BYOD)—students are encouraged to bring their own smartphones, tablets, or laptops to school and work with them as needed.
   - A 2019 study by People for Education showed 62% of elementary and 74% of secondary schools in Ontario encourage BYOD in some way.
ICTC does not endorse one approach over the other. Both have advantages and drawbacks. The one-to-one is costly for schoolboards, especially in the absence of effective procurement strategies. Whereas BYOD potentially introduces more off-task distraction, integration challenges with other operating systems, and issues that require tech support. More importantly, BYOD can draw attention to socioeconomic differences among students and financially stress some families.

Current State of Technology in the Classroom

Digital technology increasingly plays an important role in Canadian classrooms. Different tech platforms are part of the mix, including the following examples:

Chromebooks—Essentially laptops that use Google’s Chrome Operating System (OS).
  - Chromebooks have gained in popularity in classrooms because of their similarity to laptops, seamless integration with the Google classroom suite of software, stability, and low cost ($250).
  - A key challenge is the web-based nature of Chromebooks, which requires reliable high-speed internet connectivity to take advantage of the built-in cloud-based operating system.
  - iPad—Quebec has been working with 6,057 students and 302 teachers to understand the benefits and challenges of using iPads in schools.
  - This initiative has found that the benefits outweigh the drawbacks, with students showing higher motivation levels, improved collaboration, teamwork, and creativity. However, educators require sufficient training to effectively manage tech implementation.
  - Apple offers educational pricing for school programs, but an iPad remains relatively expensive at $400+.

Sphero—A cost-effective line of products that offers physical robotics, application platforms, and exposure to coding.
  - The Sphero SPRK robot (Students, Parents, Robots and Kids), for example, introduces coding and robotic concepts. These devices connect to smartphones or tablets via Bluetooth and can receive instructions for movement.
  - Sphero can also be used to demonstrate concepts in math, geography, language and art.
  - Emerging Opportunities for VR/AR
  - VR/AR are technologies present significant potential in education.
  - VR headsets can generate an interactive simulated image or environment that uses expensive, high-end equipment, or simple hardware, or even smartphones.
  - VR can facilitate virtual field trips (following scientists, for example, to distant locations to learn about plants, animals and human culture) or help students gain a more spatial understanding of the solar system.
• AR superimposes a computer-generated display on a user’s view of the world through either a dedicated headset or a smartphone.
• AR storybooks have been found to produce positive results in recall and reading comprehension, and support students who have difficulty with text-based materials.
• The physical movement component of AR can help engage students with ADHD.
• Immersive visualization technologies have been useful to students facing challenges with sensory-based experiences and anxiety.

These technologies also have the potential to help students understand global issues such as the refugee crisis. By providing an immersive experience of the lives of people fleeing Syria, students can better interpret their plight and ultimately become more engaged global citizens.

**AI – Smart Education**

AI can be used for anything from simplifying administrative tasks to altering and improving educational resources.

• Smart Content—Factors in behavioural, contextual, and demographic data of users to make learning more digestible and valuable.
• AI capability is in its infancy and more research is required in the coming years to evaluate and measure outcomes, obstacles, and opportunities.

**Guiding Concepts for Technology Implementation**

Accessibility, equity, diversity, connectivity, teacher training and support were recognized as foundational concepts for largescale implementation of technology in the classroom.

• Teacher training is one of the most commonly cited barriers to the implementation of technology.
• A 2018 PwC study surveyed 2,000 K–12 teachers and found that only 10% reported feeling secure in their ability to incorporate “higher-level” technology into their classrooms.
• Collaboration and partnership between academic institutions and industry, and effective procurement policies for digital tools are essential for the effective implementation of technology.
• Costs and internet access were also highlighted as major barriers, exacerbated by the rapid pace of technological change.
• Effective procurement policies can drive down the costs of acquiring, maintaining and operating new technology.
Broadband Connectivity

In 2016, the CRTC ruled that broadband internet access is a basic telecommunication service that should be available to all Canadians. Internet access is a basic pillar of any future-oriented education system.

• Provincial governments are working to bring high-speed internet to schools. In 2017, for example, the Ontario government announced its plan to provide all students in the province access to high-speed internet by 2021.

Access to internet in Canada, however, is far from universal or uniform. Smaller or more isolated communities, particularly in the North and on Indigenous reserves, often suffer from limited bandwidth, slow satellite internet technologies, or intermittent service.

Case Study: Indigenous Communities and Connected North

Connected North, operated by TakingITGlobal, is a leading-edge program that provides opportunities for educators, industry professionals and members of government from across Canada to connect through digital technology with Indigenous youth in remote communities.

• Leveraging Cisco’s two-way TelePresence video technology, this technology facilitates virtual “field trips,” in-person discussions, tours and training that would otherwise be unavailable in remote locations.
• Connected North recently connected students to representatives from Scotiabank in downtown Toronto who explained mortgages, financing and credit cards.

Technology Helping Students with Disabilities

Technology is providing individual learning programs to students with disabilities so they can work at their own pace, ensuring the material is fully understood and digested. Ten years ago, technology in a classroom may have been an identifier of a student with a disability, but today technology integration in the classroom removes that stigma. These are some examples of assistive technologies that help students with disabilities:

• Text-to-speech software can help manage difficulties reading standard print
• High-contrast modes and screen magnifying/resolution options can offset visual impairment
• Live captioning can assist with auditory impairments
• Physical impairment or dexterity challenges can be mitigated with mouse features such as automatic clicking
• Guided Access helps those with autism or sensory challenges by limiting distractions
• One report found that between 80% and 85% of special education students can meet the same achievement standards as other students if they are supported by specially designed instruction, appropriate access, and accommodations.