Bring Your Own Device: A Guide for Schools

Alberta

This document is available on the Internet at:
http://education.alberta.ca/admin/technology/research.aspx

Copyright © 2012 Crown in the Right of the Province of Alberta, as represented by the Minister of Education

Permission is hereby given by the copyright holder to use, reproduce, store or transmit this material for educational purposes and on a non-profit basis. However, Crown copyright is to be acknowledged. If this material is to be used, reproduced, stored or transmitted for commercial purposes, arrange first for consent by contacting:

School Technology Branch
Alberta Education
10th Floor, 44 Capital Boulevard
10044 – 108 Street, Edmonton, AB T5J 5E6
Telephone: 780-427-9001 (toll-free in Alberta by dialing 310-0000 first)
Fax: 780-415-1091

ALBERTA EDUCATION CATALOGUING IN PUBLICATION DATA

Bring your own device: a guide for schools.

Also available online: http://education.alberta.ca/admin/technology/research.aspx

ISBN 978-1-4601-0337-1 (Print)
ISBN 978-1-4601-0338-8 (Online)

1. Educational technology. 2. Education – Effect of technological innovations on.
3. Mobile computing. 4. Laptop computers. 5. Cell phones.
I. Alberta. Alberta Education.

LB1028.3 B858 2012 371.33

DEFINITIONS

Bring your own device (BYOD) refers to technology models where students bring a personally owned device to school for the purpose of learning.

A personally owned device is any technology device brought into the school and owned by a student (or the student's family), staff or guests.

"Learning is complex work and like other forms of skilled and technical work it requires that the person performing the job understand and be comfortable with his or her tool set."

-Alberta Teacher, 2011

Table of Contents

The Guide i

Introduction 1

Section 1: Why Bring Your Own Devices? 3

Section 2: Bring Your Own Device Models 11

Section 3: School Authority Policy Considerations 18

Section 4: Establishing a Culture of Digital Citizenship 24

Section 5: Teaching, Learning and Assessment Using a Bring Your Own Device Model 30

Section 6: Digital Content 40

Section 7: Access and Infrastructure Considerations for a Bring Your Own Device Model 46

Section 8: A Framework for School Authority Readiness 55

Section 9: Community Interaction 57

Appendix A: Bring Your Own Device - A Vision for Education in Alberta 60

Appendix B: Definitions 66

The Guide

This guide examines the use of Bring Your Own Device (BYOD) models in schools. It looks at the potential opportunities and benefits, as well as the considerations, risks and implications that arise when schools allow students and staff to use personally owned devices in the classroom and school environments. Strategies, tips and techniques are included to address the considerations and manage the risks.

The guide is NOT a step-by-step manual for implementing models that enable students to use personally owned devices in school. While teachers, parents, community members and other stakeholders may find the guide informative, it is written with school and school authority administrators and leadership teams in mind. It is meant to inform their decision making and strategic planning should they decide to support a BYOD model in their schools.

The guide provides a roadmap for embracing a BYOD approach in Alberta schools. It identifies issues related to personally owned devices, discusses various perspectives on these issues and leaves the reader with definitions, a knowledge base and a series of questions school authorities should ask and answer prior to making a decision. The guide is divided into three sections:

1. **Policy**
    a. What value do personally owned devices bring to student learning?
    b. What BYOD models are school authorities adopting?
    c. What policies are needed to ensure high quality use?

2. **Practices**
    a. Will students be ready to learn using personally owned devices? Will they be good digital citizens?
    b. What pedagogies fully leverage personally owned devices for teaching and learning? What types of professional development help teachers leverage such pedagogies?
    c. How can digital content be used effectively through personally owned devices?
    d. What infrastructure will be required to support student use of personally owned devices?

3. **Planning**
    a. What are the key school readiness indicators that ensure effectiveness of a BYOD model?
    b. What are the BYOD implications with the community?

The guide was written by a province-wide group of educators including representatives from 10 school authorities, Alberta Education, stakeholder groups and the Metiri Group. The 18-month process was launched in the fall of 2010 with a day-long meeting in Edmonton. At that meeting the school authorities shared their vision for and experiences to date with personal devices in their schools. They also established the parameters and scope of the guide, including: purpose, audience, section topics and research questions for each section. The Metiri Group then conducted teleconferences on the topics, seeded questions on the online community of practice and established a system by which the school authorities' team members contributed ideas, critiques, written passages, diagrams and vignettes. In the spring of 2011, a second all-day meeting of the group was convened, where small groups reacted to the latest version, re-drafted sections and added other content. After additional rounds of drafting, commenting and revising, the guide was finalized and published by Alberta Education.

Authors

Representatives from Alberta Education, teams from 10 school authorities and representatives from other stakeholder groups worked with Metiri Group in the writing of this guide:

School Authority Teams from:

- Calgary Board of Education
- Calgary Roman Catholic Separate School District
- Canadian Rockies Regional School Division
- Edmonton Catholic School District
- Edmonton Public School District
- Northern Lights School Division
- Red Deer Public School District
- Rocky View School Division
- St. Paul Education Regional Division
- Wolf Creek Public Schools

Stakeholder Groups:

- Alberta Teachers' Association
- University of Alberta
- University of Calgary

Alberta Education Staff:

- Karen Andrews, Alberta Education, School Technology Branch
- Lynda Burgess, Alberta Education, School Technology Branch

Writer:

- Cheryl Lemke, Metiri Group

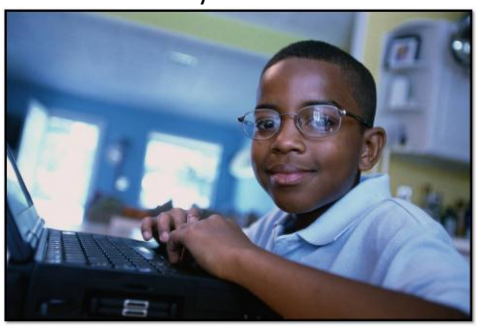
In addition, we are grateful to the many individuals and organization representatives who reviewed the drafts of the guide and provided feedback.

Introduction

This Bring Your Own Device (BYOD) guide is intended to provide information related to launching a BYOD model. It identifies issues related to personally owned devices in schools, discusses various perspectives on such issues and leaves the reader with definitions, a knowledge base, and a series of questions school authorities should ask and answer prior to making a decision.

Section 1 presents a general background in the use of technology in learning and teaching, a list of devices often included in BYOD models and five key reasons why some school authorities in Alberta made the decision to institute a BYOD model. The latter includes: 1) the heightened student familiarity, transparency and facility with the devices; 2) the bridge between formal (in-school) and informal (beyond classroom) learning; 3) currency and immediate traction; 4) social creation of knowledge; and 5) cost and sustainability.

Section 2 focuses on five BYOD models that emerged across the 10 school authorities that served as contributors to the guide. The five models described in **Section 2** represent hardware specifications along a continuum from standardized (limited to specific brands/models) to flexible (any device is fine as long as it is Internet-ready), with the remaining models in between those two. Pros and cons for each model are discussed in this section. The section ends with recommended action steps and considerations in identifying an appropriate BYOD model for your school authority.



Section 3 includes four key policy considerations for school authorities related to the BYOD model. The four considerations are: responsible/appropriates use, equity of access, network access and bandwidth and the readiness of schools and school authorities for a BYOD model. Whereas these four considerations are also discussed in other sections of the guide, this section provides a comprehensive summary of such policy considerations.

Section 4 focuses on digital citizenship. A key message from the 10 school authorities that contributed to this guide is how critical the development of a school culture of positive digital citizenship is to the success of a BYOD implementation. Section 4 describes the digital citizenship required for successful technology use in general. It notes that the immediate traction of most BYOD models quickly ramps up the number of devices in schools, and, in turn, magnifies the importance of digital citizenship. The table included in this section identifies key elements of digital citizenship and descriptors of what students and teachers/schools should do in creating a culture of positive citizenship in a digital world.

Section 5 focuses on pedagogy. It outlines three key avenues for teaching, learning and assessing using technology and how each changes the role of the teacher and learner. Those key avenues include personalization of learning, participation in learning and productivity. Vignettes bring these key ideas to life.

Section 6 extends the pedagogical discussion to digital content. Access to digital content is an important impetus for reaching toward ubiquity through a BYOD implementation. Section 6 provides perspective

on the range of digital content now available and how it provides the vehicle for personalization of learning, motivation to learning and social construction of knowledge through communities. Each of the major issues related to digital content and personal devices are discussed in this section: accessibility, license, privacy of students and faculty, Internet access, standards/media literacy, context, curation and copyright.

Section 7 addresses the access and infrastructure considerations of a BYOD model. The section provides an overview of the infrastructure and bandwidth required to connect large numbers of personally owned devices securely to a network. It also addresses the segmentation of networks required to provide such access safely and securely and the restructuring of school authority budgets necessary to support robust, high-speed access. Along the way it provides insights from technology directors on strategies that have worked for their school authorities.

Section 8 provides school authorities with a BYOD readiness checklist. In an effort to provide a process for addressing all the considerations that need to be taken into account during the selection and implementation of a BYOD model, a framework for school authority readiness is provided. The framework is presented as a set of questions to be asked and answered by a school authority considering such an implementation.

Section 9 focuses on community support, a key aspect of BYOD readiness. This includes a discussion on how to fully engage parents and community members before, during and after a BYOD implementation. An important focus in this section is sustainability.

Two appendices provide background and context to the report. Appendix A presents the Alberta Education vision for 21st Century learning with discussions as to how that vision can be furthered through the use of technology. Appendix B provides a glossary with definitions of key terms.

Section 1: Why Bring Your Own Devices?

Why digital technologies in learning?

The promises, pitfalls and results associated with technology in schools have been researched, discussed and debated for many years. What educators have found is that the range and effectiveness of technology use in augmenting learning varies considerably depending on the types of tools and software used, the context within which they are used and the degree to which student interest, motivation and engagement is triggered.

Over the last few years, laptops and handheld mobile devices have become affordable and provide users with 24/7 access to ideas, resources, people and communities. Individuals may use different devices depending on their needs. The devices fall into six basic categories and all represent personally owned devices that may show up in classrooms or may be purchased by school authorities for school use:

- *Laptop computers* are portable computers that can be used with or without the Internet
- *Netbook computers* are portable computers that gain most of their functionality through the Internet
- *Smartphones/handhelds*, some of which blur the lines between the Internet and cellular networks (e.g., Blackberry, android, iPhone, personal digital assistants, iPod Touch)
- *Tablet computers* fall along a continuum from laptop-like to large size smartphones *(e.g.,* iPad, android tablet, etc.)

Classroom Devices in Action

Carter, a Grade 12 student at Springbank Community High School (SCHS) in Rocky View School Division, sits down in his first period Biology class. As his peers trickle in, he opens his laptop. He knows from reviewing the class site on Moodle from home that the essential question for today's class centres on the ethics of stem cell research. He opens the Google doc he shared last night to see what feedback and contributions his peers made to the questions. His group will be asking the researchers from the University of Alberta these questions over Skype in the class.

His best friend, Brock, sits down in the desk next to him and asks him how he studied for the Social Studies performance assessment they have in period 2. Carter explains that he mostly watched the videos on RVSTube because he found the text arduous and as he had taken adequate notes he did not review the teacher's podcasts posted in Moodle. Brock tells him that he cannot decide between creating a photo essay or the mind mapping option. Carter is sure he is going to produce an audiocast as he finds it easier to express his thoughts verbally. The bell rings and Mr. Lawrence starts the synchronous part of their class. Any time, any place, any path, any pace learning is the norm for Carter, Brock and the other students at SCHS – in this case, made possible by one-to-one personal devices.

Source: Rocky View School Division

- *E-book readers (e.g., Kindle, iPad)*
- *Audio MP3 Players (iPod, etc.)*

Combined with the right pedagogy and used responsibly, technologies in learning can serve as:

1. The means for students to pursue lines of inquiry and interest in the academic disciplines and beyond.
2. The opportunity for learners to collaborate with teachers and peers and to express themselves and their ideas most effectively.
3. A vehicle for personalizing learning in ways that ensure each student is fully engaged in learning and is successful in attaining established learning standards.
4. Opportunities for student choice in the use of multimedia to explore, research, think, synthesize, analyze, evaluate, communicate and express ideas in high quality products.
5. A platform and forum for students' voices.
6. Access to digital content and digital learning environments that provide multiple pathways to learning.
7. Connections locally and globally that add authenticity to school work. This will enable students to learn while pursuing real-world issues and topics of deep interest to them, both individually and collectively, within their communities of interest and beyond.
8. Platforms from which to learn about and attain high standards in digital citizenship.
9. Opportunities for students to construct ideas, opinions, arguments and evidence-based reasoning collaboratively.

The reality is that web-based tools and resources have changed the landscape of learning. Students now have at their fingertips unlimited access to digital content, resources, experts, databases and communities of interest. By effectively leveraging such resources, school authorities not only have the opportunity to deepen student learning, but they can also develop digital literacy, fluency and citizenship in students that will prepare them for the high tech world in which they will live, learn and work.

Much of the progress to date in the effective uses of technology in Alberta school authorities has been with school-owned devices. It has only been within the last five years that school authorities have attempted to leverage for learning the devices that enter their schools in the backpacks of students. School Authorities should consider how the BYOD model can support other initiatives. A device in the hands of every student through a BYOD model could extend and enrich learning by:

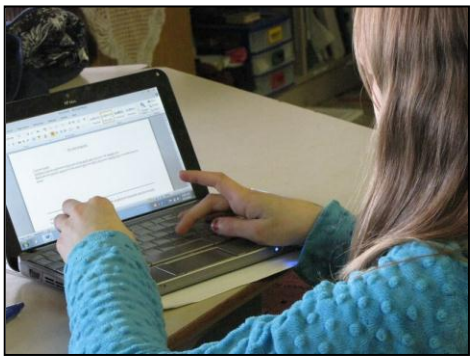
- Shifting instruction towards more student-centered learning, where inquiry and authentic learning are emphasized.
- Aligning with the school authorities current Alberta Initiative for School Improvement grant.
- Providing flexibility through inclusive practices, the use of assistive technologies, universal design for learning (UDL) and instructional understanding by design.

- Focusing on 21st Century learning, including critical and creative thinking, collaboration, communication, self-direction, global awareness and cultural literacy.
- Using online and embedded assessments in formative and summative capacities.
- Increasing student engagement

Why did Alberta school authorities open their schools and classrooms to personally owned devices?

Schools in Alberta have been exploring the use of personally owned devices for up to five years. A look across the province indicates that the schools that are currently using a BYOD model were typically those that piloted one-to-one laptop learning and found it of value. These school authorities reported that students with one-to-one access were more engaged and invested in their own learning. In addition, they found that one-to-one access facilitated inclusion, increasing the success of all students. At the same time, Alberta school authorities found that a BYOD model, while opening up new opportunities for learning, also introduced new considerations, as the following section reveals.

Why personally owned devices?



A personally owned device is just that – personal. The student who owns it typically invests time, thought and energy in customizing the device, in setting it up to optimize communication, productivity and learning. As a result, the student is typically quite proficient with the device and will use it anytime, anywhere to learn. Such devices, in the hands of every student, afford seamless learning opportunities that bridge the formal learning in schools, with the informal, outside of classrooms and schools.

The type of personally owned device that students might be allowed to bring to school in a BYOD model includes: laptops, netbooks, tablets, smartphones, e-book readers, and MP3 players.

Some might ask the question, is it not possible to accomplish the same goals with school-owned devices instead of personally owned devices? The answer lies in five key differences between student use of school-owned versus personally owned devices. Some of what school authorities are able to accomplish through the use of personally owned devices is similar to what they might have done with school-owned devices. That said, there are some significant differences between a BYOD model and school-owned devices. Those include: the level of student familiarity, transparency and facility with the devices – which can reduce the amount of basic training on the device for teachers; the ease of bridging between formal learning in school and informal learning outside of school; the immediacy with which schools can reach near ubiquity of devices for students; and the learning return on school technology investments.

The *five* key differences between personally owned and school-owned devices are described below, along with the opportunities and considerations they present. The ten Alberta school authorities that have been involved in the writing of this guide have found such considerations to be manageable.

1. *Familiarity, transparency and facility with the device by the students*

The Opportunity: A device owned by students and their parents/families is typically a device that the student is already using and has already customized with applications, software and organizational tools. Its use in schools adds to that knowledge base, providing opportunities for students to become facile, expert users of a fuller set of capabilities of the device (Shapley, et al. 2009). The device becomes another tool in the learning repertoire of students. Some school authorities have found that when multiple devices are being used by students in classrooms, teachers recognize that every device is different and they will not be able to teach students to use specific applications step-by-step. Instead they can concentrate on what they want the student to accomplish with the device, providing or securing support through the IT department or through support from other students.

The Considerations: In order for personal devices to be used effectively, teachers and students must learn to use, manage and secure the devices as they move from class to class and as they engage in in-school and after-school activities. School authorities have found that the first year students use their personally owned devices, the schools need to either offer formal support, perhaps through student-led support teams or dedicate some time to technical training on devices. Beyond that first year, the technical considerations decrease, although they are always a consideration, especially in school authorities with high mobility.

School authorities implementing BYOD models that allow a range of devices need to consider how to ensure students have sufficient facility with the device to meet the requirements of the classroom. In the first years of any BYOD model that raises issues related to how to teach students at school to use basic functions and features required for productivity, communication and digital functionality, given the range of types of devices. School authorities report that often the timeliest support is provided by fellow students.

BYOD models also require the negotiation of licenses for digital content, software and applications that include home and school use. It also raises management issues related to such topics such as charging stations, printing options and security of the devices. In some cases (especially in the upper grades), school authorities are revising their digital citizenship policies to shift more of the responsibility for management of and expertise with the devices to the students.

2. *A seamless bridge between formal and informal learning*

The Opportunity: If the devices the students use beyond the school day are the same ones they use for school, the students can seamlessly switch from personal use to learning anytime, anywhere. The learning activities on the device are accessible to the students 24-hours-per-day, 7-days-per-week (24/7), enabling them to pursue personal interests associated with such learning. The students are literally carrying around accessibility to academic learning that can be called up at a moment's notice. The device also provides a single platform for the student's learning and productivity in school and beyond. When the school provisions the computers for 24/7 access by students some of the same values can be accomplished.

Personally owned devices however, enable the school to extend that impact far beyond the one-to-one implementations that schools can afford. Often, when a school-owned device is checked out to a student, the student still views the machine as educational and will often still use their own device for personal use, negating the bridging between formal and informal learning on one device.

The Considerations: If the device is to serve as a bridge between formal and informal learning, access to the Internet beyond the school day is important. While not a school authority responsibility, many schools stay open longer hours to provide such access, partner with community centers and join partnerships working toward community wide public access. The 24/7 student access often requires the licensing of software, tools and digital content for use by students. In addition, many school authorities provide secure, remote access for students.

3. *Currency and Immediate traction*

The Opportunity: Encouraging personally owned devices can, overnight, result in unprecedented levels of access to technology in the classroom. The reality is that many students have devices that are more current, powerful and flexible than those currently offered to them in their schools. There can be immediate traction even when not all students and their parents opt into the BYOD model. In such cases, teachers can leverage the technologies that are available in class by organizing student work in teams that require a single device. When such levels approach ubiquity, teachers are able to embed innovative uses of technology in lesson designs and homework, confident that students will have access. When a device is required for each student, school authorities typically have school-owned devices for check out by those students who do not own a device.

The increased number of devices enables schools to increase opportunities for students to:

- Engage in inquiry learning
- Communicate effectively with peers, experts and their teachers
- Personalize learning
- Demonstrate their learning through media of their choice
- Express their ideas in public forums
- Access libraries of digital content that provide multiple pathways to learning
- Pursue real-world issues and topics of deep interest
- Attain digital citizenship
- Provide equitable learning opportunities, especially for students with special needs
- Explore and construct ideas, opinions, arguments and evidence-based reasoning collaboratively

There is also an opportunity to use these technologies – both personally and school-owned devices—to level the playing field for students with diverse learning needs.

While these same outcomes are possible with school-owned devices, many schools will not be able to get close to ubiquity anytime soon without introducing BYOD models. School authorities recognize that even with a BYOD model in place there may be specialized uses of technology

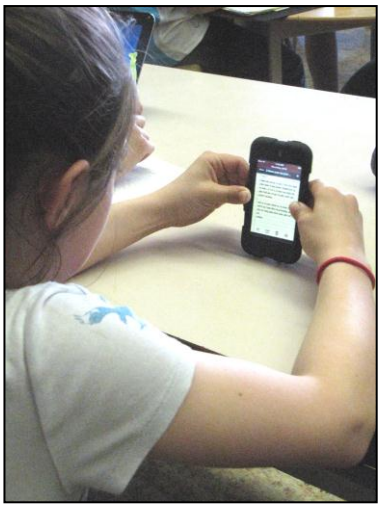
that need to be resident in schools and on school-owned devices (e.g., multimedia production and editing, group videoconferencing, computer assisted drafting, color printers).

The Considerations: Immediate traction means that the number of devices simultaneously accessing the network will increase significantly. School authorities find that once a BYOD model is in place, they can also expect that number to increase even more after the winter break, since many students receive devices as gifts during that time period. Some school authorities are discovering that students have two and three devices accessing the network at a time. Both the initial increase and incremental increases thereafter need to be anticipated. The school authorities need to be ready with sufficient capacity on their wireless system and adequate bandwidth to support student learning with these devices. See Section 7 for a discussion of both topics.

As a BYOD model is developed, the concept of equity must be considered. Equity does not necessarily mean one size fits all, but rather that all students have pathways available to accomplish established tasks, activities and goals. While school authorities need to ensure that all students have access, that can be accomplished through the provision of school-owned devices to those whose families cannot afford them, by offering such devices for periodic checkout or by ensuring seamless login to school learning environments from remote sites to enable students to use family computers, computers from community centers or libraries, as well as mobile devices.

Access is only one element of digital equity. Many schools are realizing that equity is not only defined in terms of access to a device and the Internet. It is also defined in terms of the type, quality and frequency of learning opportunity made available through such access. Again, this stems back to teachers and pedagogy – what matters is how the devices are used. This translates into a need for increased professional development to ensure that all teachers are facile in the integration of technology into teaching and learning. In addition, support structures must be in place to ensure seamless integration of personally owned devices into curriculum, instruction and assessment.

4. *Social creation of knowledge*



The Opportunity: The use of personally owned devices can promote co-construction of knowledge through social learning (Lewis, Pea, & Rosen 2010). The cognitive sciences research reveals that students learn more when they are actively collaborating and cooperating with peers, their teachers and other experts (Bransford 2000; Johnson & Johnson 1994). One of the common uses of personally owned devices by students is in online collaborations with peers after school, about their school work. While such collaborations could be done on home computers, it is much more convenient to use the same computer in and out of school. It facilitates access to work in progress, files, sign on processes to communities and groups, calendars and digital content and learning environments located on the school authority's servers.

The Consideration: The use of personally owned devices for social learning interactions requires a flexible, easy to use platform for chats, threaded conversations and exchanges of files. Once in place, students and teachers will need to learn how to work online, in collaborative teams and communities of interest. Teachers will need to learn how to redesign lessons, instruction and assessment to integrate collaboration, communication and social creation of knowledge.

5. *Cost and Sustainability*

The Opportunity: The impetus for considering a BYOD model often includes the potential for cost savings. Faced with the lack of budgetary capacity to provide adequate numbers of up-to-date devices to meet teaching and learning needs, school authorities began to consider BYOD models. However, most school authorities have found that their costs are not reduced, but rather redirected to network reconfigurations and the increased bandwidth required to support the BYOD model. Thus, what many have found is that for the same investment, student access can be substantially increased. The shift from investments in devices to investments in network infrastructure and bandwidth, combined with the increased number of devices available to students for learning, translates into increased access.

The Considerations: The shift in investment from devices to network infrastructure and bandwidth is not the only investment required for a successful implementation of a BYOD model. The school authority also needs to consider the immediate need for more professional development for teachers, staff time for redesigning learning, increased technical support and support for programs that build digital citizenship. These considerations are addressed in this guide.

The opportunities listed above have significant pedagogical, curricular, technological and policy implications. They will require new approaches to teaching and learning. Incorporating personally owned devices into the learning will require a paradigm shift on behalf of all involved – educators, students, parents and community. This is not a trivial endeavor and one that will take time, but according to Alberta educators, one that is worth the investment.

Section References

Bransford, J. (2000). *How people learn: Brain, mind, experience and school*: National Academies Press. http://www.nap.edu/openbook.php?isbn=0309070368

Goodwin, B. (2011). Research says: One-to-one laptop programs are no silver bullet. *Educational Leadership*, *68*(5), 78-79. Accessed 12/29/11 from http://www.ascd.org/publications/educational_leadership/feb11/vol68/num05/One-to-One_Laptop_Programs_Are_No_Silver_Bullet.aspx.

Greaves, T., Hayes, J., Wilson, L., Gielniak, M., & Peterson, E. (2010). *Project RED key findings*. Shelton, CT: MDR. Retrieved from One-to-One Institute at www.one-to-oneinstitute.org/NewsDetail.aspx?id=85.

Johnson, D.W., & Johnson, R.T. (1994). Learning together and alone: Cooperative, competitive and individualistic learning, 4th Edition. Needham Heights, MA: Allyn and Bacon.

Lewis, S., Pea, R., & Rosen, J. (2010). Beyond participation to co-creation of meaning: Mobile social media in generative learning communities. *Social Science Information, 49*(3), 351.Shapley, K., Sheehan, D., Sturges, K., Caranikas-Walker, F., Huntsberger, B., & Maloney, C. (2009). *Evaluation of the Texas Technology Immersion Pilot: Final outcomes for a four-year study (2004–05 to 2007–08)*. Austin: Texas Center for Educational Research.

United Kingdom Higher Education Academy (UKHEA). (1992). Deep and Surface Approaches to Learning. [Definitions compiled from Biggs,1999; Entwistle, 1988; & Ramsden, 1992.] Accessed on October 1, 2008 from http://www.engsc.ac.uk/er/theory/learning.asp.

Section 2: Bring Your Own Device Models

The BYOD models used to direct and manage the personally owned devices used in schools are just as varied as the type of devices that students bring into classrooms.

The BYOD models in Alberta generally fall into four distinct models, plus a fifth general model that represents various hybrids of the first four models:

1. Limiting personally owned devices to a specific brand/model of device.
2. Limiting personally owned devices to those that meet specific technical specifications (e.g., specific versions of operating systems, minimum amount of storage space, Internet ready, etc.).
3. Limiting personally owned devices to those with specific functionality (e.g., compatibility with software, compatibility with online testing requirements, etc.).
4. Accepting all personally owned devices, provided they are Internet-ready.
5. Hybrids or combinations of the four models listed above.

The models, based on the range of acceptable devices, fall naturally onto a continuum ranging from high standardization to high flexibility. At one end of the spectrum (standardization) is the identification of a single type of device that all students must purchase. At the other end of the spectrum (flexibility), is an open-ended model that encourages students to bring any device into school. The models in-between limit the personally owned devices to specific technical specifications or capabilities. A fifth model is a hybrid or combination of one or more of the four models identified below.

FIGURE 1: BYOD MODELS ALONG THE CONTINUUM FROM STANDARDIZATION TO FLEXIBILITY

Standardization ⟷ Flexibility

1	2	3	4
Limit personally owned devices to specific brand/model	Limit personally owned devices to specific technical specifications	Limit personally owned devices to specific capabilities re: software, tools, apps, etc.	No limitation on personally owned devices , provided they are Internet-ready

The decision as to which BYOD model is adopted has major implications for students, teachers, parents, administrators and school authority policymakers. One of the key strategic steps each school authority should take, prior to making this decision, is to clearly articulate its goal(s) for opening up schools and classrooms to personally owned devices. The policies that are established about which devices are

acceptable as personally owned devices, in turn, impact what teachers and students can do with these devices in the classroom. For example, selecting the fourth BYOD model, where all personally owned devices are acceptable, may limit the assignments teachers can give, since some personally owned devices may not be capable of word processing, processing images or production of presentation slides.

In some cases, variations across schools and grade levels within a school authority will lead to the development of a policy that provides the educators and parents in each school and across grade levels with the flexibility they need to accommodate diverse needs and goals. As educators consider the BYOD model that is right for their school authority, they should also consider the tradeoffs between standardization and flexibility related to the BYOD models, as outlined in the tables below.

1. **Limiting personally owned devices to a specific brand/model of device.**

   Examples:

   "Students are expected to have an iPad to be used in their daily learning. All other personally owned devices are not allowed in the classroom."

Pros	Cons
The pros relate to standardization: • As a community, teachers can figure out the capabilities of the device and share practices. • Because teachers can count on the devices being in the classroom, there is ease to planning and teaching with the devices. • Technology departments only contend with the same configuration on each device. • Ease of technical troubleshooting. • Charging stations can be standardized. • Loaners can be used with minimal disruption to learning because the student will know how to use the device. • Students are not using the type of device as a social status symbol.	The cons relate to lack of flexibility: • There will be a lack of options available to the students and their families. • The challenge of annually updating the brand/model. • The difficulty of controlling, monitoring and/or enforcing the policy. • Students may or may not prefer the chosen model, so they have to buy a computer they use only for class.

2. **Limiting personally owned devices to those that meet specific technical specifications (e.g., specific versions of operating systems, minimum amount of storage space, Internet ready, etc.)**

   Examples:

   - Example 1 (Generic): "Students require a laptop that runs Windows 7, has a DVD R/W drive and has a video card."
   - Example 2 (Rocky View School District): "Students require a PC laptop with a Pentium 4 processor, 160GB Hard Drive, 2GB RAM and wireless "g" or "n" capability; or any Intel-based Macintosh laptop." (see http://springhs.rockyview.ab.ca/our-school/one-to-one/important-documents/Minimum%20Requirements.pdf/view/).

Pros	Cons
The pros relate to standardization of capabilities, offering some flexibility: • Students and their families are offered some flexibility and choice in providing laptops. • When planning lessons, teachers can check the requirements for PC/Mac versions and capabilities and know if their students' laptops will be able to run the software, applications or tools or show videos/images. • Since a range of brands of laptops are used in the classroom, students may gain digital literacy as to similarities and differences as they work collaboratively with students who have devices different than their own.	The cons relate to the level of flexibility: • Different platforms or brands may cause challenges for teachers in terms of technical support during class. • Teachers may have to check to see if specific software and tools run both on a Macintosh and a Windows platform. • The challenge of annually updating the brand/model. • The difficulty of controlling, monitoring and/or enforcing the policy. • The flexibility offered students may result in the use of the device as a social status symbol. • Lack of standardization does not allow for standard charging stations.

3. **Limiting personally owned devices to those with specific functionality (e.g., compatibility with software, compatibility with online testing requirements, etc.).**

   Example:

   "Students are encouraged to bring a personally owned device regularly to class that meets the following minimum functionality:

   - Connects and interacts with the school authority Learning Management System (e.g. Moodle).
   - Allows students to create full text documents or contribute fully to online collaboration places.
   - Runs online interactive software or simulations hosted on LearnAlberta and based on the Flash platform."

Pros	Cons
The pros relate to standardization of functionality, offering some flexibility: • Students and their families are offered some flexibility in providing laptops or notebooks. • Since teachers cannot be sure of exactly what the devices will run (except for those in the specifications), they may become less directive about which software, applications or web tools students use – leaving that to the students' discretion – and simply set standards for the outcomes. • The access to the Learning Management System has facilitated teacher planning and posting of digital options online. • Since a range of brands of laptops are used in the classroom, students may gain digital literacy as to similarities and differences as they work collaboratively with students who have devices different than their own.	The cons relate to the level of flexibility: • Students and their families may feel uncertain as to how to select a computer to meet these criteria. • More students own handheld devices than notebook or laptop technologies. Thus students and their families may have to purchase additional equipment. • Other than the functionality required, teachers cannot be certain that all the tools and software they plan to have students use will actually work on the personally owned devices. • The difficulty of controlling, monitoring and/or enforcing the policy. • The flexibility offered students may result in the use of the device as a social status symbol. • Lack of standardization does not allow for standard charging stations.

4. **Accepting all personally owned devices, provided they are Internet-ready.**

   Examples:

   Example 1 (Generic): "Students are recommended, encouraged or required to bring a personally owned device to class that can access Internet resources."

   Example 2 (Wolf Creek Public Schools): "Students are encouraged to bring a personally owned device to school. The school authority maintains a website that allows students/staff/parents to configure an Internet ready device to become a full network device at school: http://www.wolfcreek.ab.ca/cgkagent."

Pros	Cons
The pros relate to standardization of capabilities, offering some flexibility: • Students and their families are offered tremendous flexibility in their provision of the devices. • With the variety of devices in any classroom, the teacher cannot know every device, thus he will be required to focus on the learning and leave the technical challenges to the student, who knows (or must learn to know) his own device. • A message is conveyed that all devices have advantages and disadvantages based on their application in the learning process. • Since a range of brands of devices are used in the classroom, students may gain digital literacy as to similarities and differences as they work collaboratively with students who have devices different than their own.	The cons relate to the level of flexibility: • At times, the devices' capabilities may not match the pedagogical requirements and students may have difficulty participating. • Issues of equity may arise given potential differences in the capabilities of various devices. • The flexibility offered students may result in the use of the device as a social status symbol. • Lack of standardization does not allow for standard charging stations.

Hybrids or combinations of the four categories listed above.

Example:

- "Any device with wireless capability is permitted to connect to the school authority network provided the user has a login account (all staff and students) and agrees to behave according to a Responsible Use of Technology Agreement."

The limitation comes at the school level where there are expectations of the functionality of the device. Most (but not all) schools where personally owned devices are encouraged are using a dedicated portal, which requires the use of a full-power web browser. This effectively precludes the use of mobile devices (phones, handheld gaming and media tablets). Many schools also add recommendations on the battery performance, such as quick charge and long duration.

NOTE: The pros and cons for this model vary according to the combination or hybrid selected (see above models 1 to 4).

In some cases, variations among schools and grade levels will lead to variations in the school authority policy that provides the educators and parents in each school and at various grade levels the flexibility and adaptability they need to accommodate such variations in needs and goals.

Action steps in identifying a BYOD model

As school authorities investigate the BYOD model right for them, they should consider the following action steps:

Vision	To clearly articulate the value the personally owned devices will bring to learning and map and align that vision to specific uses of the device. That will help determine the desired capabilities of the devices. To determine the nature of the responsible use policy each student/parent will sign. To establish a reasonable timeline for implementation that is communicated internally and externally in the community. To consider the milestones that will serve as success indicators.
Technical Considerations	To consider the capacity and structure of the existing infrastructure and wireless networks to accommodate this influx of devices, including the determination of what a teacher-owned and student-owned device will have access to on the school network. To consider the technical assistance support structure the BYOD schools will require. To consider the management or “care and feeding” of the devices within a school environment: A. Battery life B. Charging stations C. Loaners D. Location and storage for devices left at school overnight

Training	To secure agreement by staff as to how to collect student assignments, provide printing and adequate storage for student work (see related policies in the responsible use agreement). To consider the training and professional development that should be required of/offered to teachers and administrators to build their capacity to use personally owned devices effectively. To establish the training and preparation students (and their parents) will require initially and throughout the school year to scaffold their digital citizenship.
Content	To identify the basic set of applications (e.g., virus protection, productivity suite, e-mail client, etc.) that will be resident on the devices and who will pay (parent or school) for those applications. Options for licensing agreements for textbooks and digital content.
Affordability	To consider the fiscal capacity of the parents to afford the device (or for some families, afford multiple devices), perhaps considering a lease to purchase option, school loaner options and insurance options through the school.

Section 3: School Authority Policy Considerations

What are school authorities' policy considerations in adopting a BYOD model?

A key question to be asked and answered by school authorities considering a BYOD model is whether they need new policies to govern the use of personally owned devices in their schools. Most school authorities find that the new situations that occur due to the introduction of a BYOD model into the school community are addressed by existing policies. Often that calls for new communiques that explain how existing policies apply to new situations that arise due to the implementation of the BYOD policy. In some cases, this may call for a revision of the school authorities' acceptable use policy or responsible use policy document to clarify the applicability to personal devices or a move toward more comprehensive digital citizenship policies. For example, the policy that outlines consequences for infractions of school rules in general might also apply to infractions related to personally owned devices. In other cases new policies will need to be established to address new or unique issues raised by the use of personally owned devices.

Listed below is a set of policy considerations raised by a BYOD model.

1: Responsible/appropriate use of personally owned devices

2: Equity of access

3: Network access/bandwidth for students

4: BYOD readiness in schools and school authorities

Since each school authority has a unique set of policies, it would be incumbent upon readers to consider the policy considerations described below and then review their existing school authority policies to determine whether they simply need to communicate how such policies apply or if they need to enact new policies. Each of the four areas is more fully described below.

1: Responsible/appropriate use of technology

Pioneering school authorities in Alberta that are implementing BYOD models report emphatically that students' levels of responsible/appropriate use of the personally owned devices determines the degree to which the school authorities have achieved success with their BYOD model. Most school authorities already have responsible or acceptable use policies in place to address the use of technology in classrooms and schools. The introduction of personally owned devices makes it extremely important that all of those policies and practices are being adhered to and that students are becoming responsible digital citizens.

The extension, updating or applicability of a school authority's responsible or acceptable use policy agreement or student code of conduct with respect to the introduction of a BYOD model could include:

- A governance structure to handle emergent issues related to personally owned devices, including documentation of which decisions will be centrally decided and which will be left to the discretion of the school leaders.
- Extending the policies to off-campus use when the student is accessing school servers remotely.
- Making it clear that when the student brings the device onto the school campus, the policies apply to that device, even though the student may have certain applications on the device for purposes other than school.
- Expanding the digital citizenship program to include scenarios, discussions, interpretations of school regulations and their applicability to personally owned devices, including levels of responsibilities and cyberbullying.
- Interpreting the policy instruments regarding consequences for potential violations related to personally owned devices.
- Interpreting school rules (procedures) on responsible/acceptable use related to personally owned devices.
- Interpreting school policy on copyright application to student and staff work (CoSN, 2011).
- Providing parents with information on cyberbullying.

A Vignette – Responsible/appropriate use of technology

Source: Red Deer Public School District

Responsible/appropriate use of technology. The policy on cell phones for students in Hunting Hills High School in Red Deer Public School District has changed over time. Originally, the school had a very prescriptive policy on the use of cell phones in the instructional areas – basically cell phones were not allowed and staff and administration practiced zero tolerance. That resulted in strife with students, parents and teachers over the interpretation of the policy, leading to issues of discord, defiance and in some cases disrespect. Recently, the school revised the cell phone policy and adopted a more moderate approach together with new policies on digital citizenship. The combination has created a positive attitude toward the appropriate use of personally owned devices – and a significant reduction in student, parent and teacher conflict over the issue.

Excerpt of Digital Citizenship Policy: Digital citizenship is the appropriate and responsible behaviour with regard to technology use. Digital citizenship should be practiced in every course, throughout the school and at home. It is an ongoing partnership between teachers, students and parents. Just as

teachers build an awareness of the importance of digital citizenship at school, parents build and reinforce these concepts with their children at home. Students need to approach any use of technology with the digital citizenship components in mind. Electronic devices are permitted in instructional areas with the instructor's permission and inappropriate use may result in a loss of privileges. NOTE: Electronic devices (laptops may be exempt in some circumstances) are NOT permitted during examinations and their use may result in the student receiving a zero mark.

2: Equity of access

If technology is considered an asset in the teaching and learning of the curriculum, then all students will need to have access to devices, as well as the opportunity to engage in educationally sound uses of the devices.

To accomplish this, a school authority may decide to commit to a BYOD model that involves:

- Ensuring that all students have access to a device through:
  - The provision of school-owned devices to be checked out to students whose families cannot afford a personally owned device.
  - Lease-to-own models that make payment/ownership easier for parents.
- Ensuring that teachers are ready to integrate the effective use of technology into the curriculum.

While the BYOD models could advance equity of access, they also have the potential to introduce new inequities. For example, the lack of Internet access beyond the school day might put some students at a disadvantage in comparison to their peers who have access 24/7. Accommodations such as those described above serve to alleviate these concerns.

A Vignette – Equity of access

Source: Edmonton Public Schools

Equity of access to personally owned devices. The intent of the BYOD policy in the Edmonton Public Schools is to encourage students to bring personal computing devices in to schools where there is a platform to which they can connect their devices. However, the policy leaves the day-to-day decisions about where and when students are allowed to use those devices up to teachers.

Teachers know that if and when they require a student to use an electronic device, the school will need to provide one – unless the student chooses to bring his/her own. In Edmonton Public Schools, one of the exceptions to the school provisioning of devices is an optional one-to-one program where Grade 7 students are expected to provide their own device. Students sign up for that program, with the approval and support of their parents. The device provided by students can be anything from a handheld mobile device to a full-featured laptop. The only criterion is that the device must be able to connect to the school wireless network. By winter break of the first year the BYOD model was implemented, only three students were still using school-owned devices – the rest had opted into the BYOD model. The majority of those students participating in that first year continued that practice the next year in Grade 8. Parents

were willing to provide the technology once they saw that it would be integrated into their children's learning on a daily basis.

3: Network access for students

If the BYOD model is to be a success, the technological infrastructure must be configured and enhanced to meet the needs of the personally owned devices on a scale probably not seen in the school authority/school in the past.

Examples of the type of policy considerations and procedures that arise related to network access for personally owned devices include:

- Security and Internet filtering that will apply to devices logged into the school network both at school and remotely.
- School authority-wide strategy for establishing a cost effective and efficient enterprise architecture that aligns to the vision for technology and personally owned device uses in teaching, learning, administration and leading. This is typically accomplished through a strategic technology plan that sets implementation expectations.
- Providing opportunities for student access to the network and Internet before and after school.
- Dissemination of information on programs outside the school that could support home or community access. Those programs might include information on community centers and public libraries where access is available; information to parents on community access programs through cable, DSL or satellite; etc.

An issue that is beyond the purview of the school authority, yet directly affects levels of learning, is student access to the Internet from home. Some school authorities are investigating:

- Support for community-based access points to the Internet.
- Partnerships with community-based Internet service providers to support high-speed home access to the Internet.

Note: See also Policy Consideration 1 regarding Acceptable Use Policies and Responsible Use Policies.

A Vignette – Network access for students

Source: Red Deer Public School District

Network access for students. In 2010, Hunting Hills High School in Red Deer carried out a significant upgrade to its wireless service. It transitioned from 20 access points (802.11g) to 128 access points (802.11n) with full open access to students and guests in the high school building. The use of personally owned devices has increased significantly, with the school now up to 700 devices connected simultaneously. The school population is 1,400, but the school officials report that some students are connecting more than one device at a time. As the use of the school's bandwidth increases, officials may have to implement rules that would allow only one device per individual on at a time.

4: BYOD readiness of schools and school authorities

The success of the BYOD implementation will be determined, in part, by the school authority's commitment to 21st Century learning, the BYOD model and the preplanning and readiness of the school to implement. Section 8 outlines BYOD readiness factors.

The extension, updating or applicability of these policies on readiness in an effort to advance the effective uses of *personally owned devices* might include:

- *A vision*. Revising/updating the vision for learning in the school authority to include the personalization of learning, advanced through personally owned devices for all learners.[1]
- *School improvement processes*. Using the process for school improvement to translate the vision into practice at the schools. Such work should address leadership, school learning environments, school culture, professional development, educator competencies, expectations for integration of personally owned devices into unit/lesson design, redesign of assessment to capture 21st Century skills and ICT skills.
- *Digital content/resources*. Policies may be required that discuss the acquisition of digital resources.
- *Technology readiness*. Ensuring that all school authority/school infrastructure/networks are optimally configured to ensure success with personally owned devices.
- *Funding*. School authorities and schools need to allocate funding for all aspects of BYOD implementation. Part of the process might include the repurposing of existing budget items (such as textbooks or printing) to investment in digital resources.

A Vignette –BYOD readiness of schools and school authorities

Source: Wolf Creek Public Schools

BYOD readiness of schools and school authorities. Senior leadership from Wolf Creek Public Schools devised a series of readiness questions, through a readiness discussion framework, to guide a conversation between the senior leadership, school-based leadership, technology lead teachers and technical staff. This discussion allowed these stakeholders to critically examine their level of readiness to implement personally owned devices into the learning environment. The questions examined logistical, pedagogical and technical readiness factors, in addition to proactively examining potential implementation dips and roadblocks. Schools were asked to set their own timelines for implementation of a BYOD model and evaluate their own readiness before embarking on a BYOD implementation.

[1] The vision should support one inclusive learning system where each student is successful and where adjustments for learner differences are made for all students.

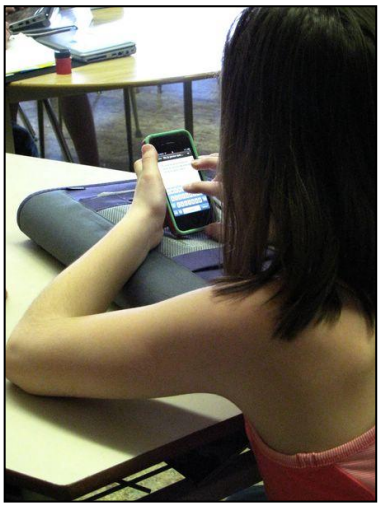
A Vignette – Implication 4: BYOD readiness of schools and school authorities – Provincial Exams

Source: Rocky View School District

Using personally owned devices in provincial exams. Digital administration of exams can be a challenge in many of the schools around the province. Schools are faced with issues related to secure storage and computer shortages that make the written portion of provincial exams difficult. In a school with personally owned devices, especially in a one-to-one laptop school, many of these challenges can be mitigated with the use of Alberta Education's Quest A+ system. It is possible for a school to have students write both their Provincial Achievement Tests and Diploma exams on their own laptops. This is made possible through the installation of a lock down browser, which prevents students from accessing any other programs or information on their devices. Their responses upload to the Alberta Education server and the supervisor of the exam can manage the printing of responses if needed. The students are able to use this program for all of their written assessments during the year to get used to the interface, so when it comes time for the final exam, they are prepared.

In Rocky View School District's one-to-one high schools, this has allowed for the removal of many computer labs and has freed up much needed classroom space. Teachers are very comfortable with the system and there are no more issues with limited lab time to administer exams.

Section References



Consortium for School Networking (CoSN). (2011). Web 2.0/Mobile AUP guide: Acceptable Use Policies in the Web 2.0 and mobile era. Accessed March 6, 2012 at http://www.cosn.org/Default.aspx?TabId=8139/.

Calgary Board of Education. (n.a.) Digital Citizenship site: http://www.innovativelearning.ca/sec-learntech/webaware-index.asp/.

La Rue, F. (2011). Report of the special rapporteur on the promotion and protection of the right to freedom of opinion and expression. *United Nations General Assembly Human Rights Council*. Accessed on 03/10/12 from http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf.

Section 4: Establishing a Culture of Digital Citizenship

Digital citizenship is a comprehensive approach to the use of digital technologies that spans student education from K-12 and into adulthood.

- Calgary Board of Education

Today's digital devices and social media provide opportunities for students to be part of the participatory digital culture that connects people both locally and globally. To participate fully, ethically and safely, students must step up and exercise their rights and responsibilities as digital citizens. That means that the school culture must embrace digital citizenship, which Alberta school authorities have identified as critical to the success of the use of technology in schools. The introduction of the BYOD model extends that culture beyond the school, as students use their devices for learning outside of school.

This means providing guidance to help students to understand and appreciate digital opportunities and responsibilities as they:

- Communicate, publish and interact online. This could include finding their voice, expressing ideas and receiving feedback, using texting, blogs, wikis, microblogs (e.g., Twitter), chats, gaming and visual databases (e.g., Flickr and YouTube).
- Explore new roles and expertise through online interactions.
- Pursue interests by accessing digital resources, participating in communities of interest that might not be available locally and interacting with experts.
- Gain deep understanding of global and local issues by building context through online conversations and interactions; synthesize ideas honed from digital resources, which represent balanced views of issues; and see all sides of an issue from the personal to the social, economic and political, etc.
- Take on new roles in community service globally and locally.
- Learn online and take a diverse range of courses.

***Digital Citizenship in Action**:*

To learn about digital citizenship, students participate in lessons and activities about the importance of digital citizenship designed by their teachers. Resources from http://www.wolfcreek.ab.ca/Digital%20Citizenship are used to assist students at every grade level. Students in older grades will often pair up with students from younger grades to present lessons on certain aspects of digital citizenship. This may involve pairs of Grade 5 students designing and delivering a presentation to all K to 3 classes on one aspect of digital citizenship. It may also involve older students from high school presenting to younger students in junior high on the importance of personal privacy and security or respect for online identity.

- Augment and extend classroom experiences through online, multimodal, digital resources that provide additional explanations and alternative modes of learning.

The International Society for Technology in Education (ISTE) describes a successful digital citizen in terms of nine descriptors: access, commerce, communication, literacy, education, law, rights and responsibilities, health and wellness and security (Ribble, et al. 2004). ISTE suggests that together these descriptors form the basis for digital citizenship for all students – essential if students are to take full advantage of new opportunities via the Internet. In his recent book, *Digital Community, Digital Citizen,* author Jason Ohler stresses the opportunities afforded by activating students' digital access, students' digital rights and students' digital responsibilities. He indicates the need to "help our digital kids balance personal empowerment with a sense of community responsibility" (Ohler, 2010, p. 10). He challenges educators to look beyond issues associated with online use, seize the moment and re-imagine citizenship – i.e., digital citizenship – in light of such opportunity (Ohler, 2010).

Alberta school authorities that are pioneering BYOD models agree. They have unilaterally emphasized the importance of student readiness as a key factor to their success. The areas of interest include: 1) digital access and inclusion, 2) digital communication, 3) digital fluency, 4) digital rights, responsibilities and security, 5) digital health and wellness and 6) informed digital consumerism.

The following chart provides elements of digital citizenship, which Alberta school authorities have identified as critical to the successful use of personally owned devices in school by students and staff.

ELEMENTS OF DIGITAL CITIZENSHIP WITH SUGGESTIONS FOR IMPLEMENTATION WITH PERSONALLY OWNED DEVICES FOR STUDENTS AND TEACHERS/SCHOOLS.

		In BYOD situations, students:	In BYOD situations, teachers/schools*:
1	Digital Access and Inclusion - *full electronic participation in society for all*	• Work with their parents to ensure that their personally owned device adheres to school requirements. • Bring their device to school and class each day, ensure it is fully charged each night and can connect to the Internet. • Are aware of and take advantage of options to connect outside of the school day with their personally owned device (e.g., after school labs, community libraries, etc.).	• Ensure that all students have a device that connects to the Internet during the school day. • Ensure that accommodations are available for those students who need them. • Consider what options for connectivity for students outside the school day are available (e.g., after school access, community library access, support for home access, etc.). Support where possible.

		In BYOD situations, students:	In BYOD situations, teachers/schools*:
2	Digital Communication - *electronic interactions and exchanges of information*	• Develop an understanding of the appropriateness of various venues for communication, depending on context and associated etiquettes. • Recognize that once sent, digital messages can never be retrieved or erased – consider long-term consequences of each and every message (especially sexting, gossip, bullying, etc.). • Adhere to school rules related to cell phones, instant messaging and other communications. • Recognize that the abbreviations they use to text friends may not be appropriate in other venues. • Know when, where and how often digital communications are appropriate and act accordingly.	• Establish communication systems that are secure for school-related interactions (e.g., blogs, wikis, forums, chats, e-mail, instant messaging, videoconferencing, etc.). • Are clear about what types of digital communications are appropriate in the school. Build awareness with students of the nature of digital communications (e.g., range of types, permanency of digital records, knowledge of storage and backups and management of folders and files). • Make resources available that are written at levels appropriate for all students, including those with cognitive delay. • Develop awareness of the digital footprint created online and the possible long-term consequences.
3	Digital Fluency - *capability to use digital technology using high standards of conduct online*	• Develop digital basics in the use of: browsers, search engines, download process and e-mail. • Develop skills in using search terms to locate resources. • Evaluate online resources (e.g., accuracy, reliability, currency, comprehensiveness, trustworthiness, security, phishing attacks, etc.). • Evaluate opportunities for online learning; make good choices as to supplemental and course options for learning (see copyright in #6, also). • Recognize that different etiquettes apply in different contexts. • Develop sensitivity to how their actions online are affecting others and adjust behaviour accordingly (e.g., avoiding flaming, cyberbullying, inflammatory language, etc.). • Develop the capacity to join a virtual community and figure out the etiquette.	• Use digital resources to increase the interest, engagement, active learning, collaboration and motivation of students to learn. • Curate resources for lessons/units and offer access to students for home use. • Develop resources specific to content for student access 24/7 (e.g., podcasts, flickr photos, blog, wiki, etc.). • Model appropriate uses for students. • Recommend virtual learning resources to students when appropriate. • Model good practices for students. • Establish and discuss digital etiquette for the classroom/school. • Build the capacity of students to recognize the implications of following – and not following – appropriate etiquette. • Present scenarios and facilitate discussions among students (e.g., do you answer a phone call in the middle

		In BYOD situations, students:	In BYOD situations, teachers/schools*:
		• Use digital devices at appropriate times.	of a face-to-face conversation?).
4	Digital Rights, Responsibilities and Security - freedoms extended to all digital technology users and the expectations that come with them Digital Law - legal rights and restrictions governing technology use Digital Security - precautions to guarantee online personal safety and the security of their network	• Ethically create new digital works by becoming familiar with and adhering to copyright law as it applies to the use of source material in students' digital compositions and productions (e.g., remixing, photos, use of videos, citations of sources, etc.). • Protect their online identity and their individual right to privacy when using e-mail, chat, gaming or instant messaging, recognizing the right of the school to monitor all student activity associated with the school. • Manage their own workspaces and interactions by managing passwords appropriately (e.g., do not share passwords, even with friends; change passwords periodically; do not write down passwords in obvious places, etc.). • Recognize that just because students can do something (e.g., copy software, copy movies, share audio files, etc.), it does not mean that it is legal. Ethically use online materials, citing sources as appropriate -- following the practice of "do no harm." • Recognize the tradeoff between individual adherence to rules and order and mutual respect within a digital community; and recognize the consequences of inappropriate actions. • Follow responsible/acceptable use policies inside and outside of school. • Understand how to take appropriate precautions to protect electronic data and act accordingly (e.g., virus protection, firewalls, backups, etc.). • Install patches and software	• Institute digital citizenship policy school wide. • Work collaboratively with students to develop digital rights and responsibility doctrine and associated list of consequences for violations. • Become familiar with Creative Commons (a site that addresses copyright in the digital age, where educators can offer limited use of their materials yet retain copyright) and fair use for education. • Have students use the Creative Commons to register some original work, making appropriate choices regarding whether or not they share their product. • Establish policies, guidelines and practices that adhere to digital law; establish the same with students, model appropriate use and monitor students use. • Discuss the range of digital law with students (e.g., file-sharing, copyright, pirating software, hacking into systems, stealing identifies, etc.). • Model and teach legal copyright practices. • Establish appropriate security measures and procedures in the school environments. • Protect hardware and network security. • Protect personal security (e.g., avoid identity theft, phishing, online stalking, etc.). • Protect school networks from hackers and viruses. • Install patches and software updates as they are released. • Teach and model secure behaviour. • Discuss the reasons for the acceptable use/responsible use

		In BYOD situations, students:	In BYOD situations, teachers/schools*:
		updates as they are released. • Do not interact online with strangers.	policies (e.g., precautions to take to protect themselves online, etc.). • Practice privacy by design – understand that the strength of privacy measures is commensurate with the sensitivity of the information.
5	Digital Health and Wellness - *physical and psychological well-being in a digital world*	• Recognize possible health concerns associated with digital devices and adjust usage accordingly (e.g., eyestrain, poor posture, impact of repetitive motion of texting on hands, etc.). • Focus on balanced lifestyle, healthy/informed choices.	• Know that deployment of technologies should be accompanied by plans for sound ergonomic use by students, teachers and others. • Model safe and appropriate use. • Build capacity of students to use technologies safely, in ways that promote good health.
6	Informed Digital Consumerism – expert analysis and healthy skepticism as a backdrop to students' buying and selling online	• Monitor their online spending habits. • Understand how to purchase online while also protecting their identity. • Avoid insecure sites (avoid identity theft).	• Build awareness of the benefits of digital commerce (e.g., comparison shopping, immediacy of purchase for digital products, ease of shopping from home, etc.). • Build awareness of the potential hazards of digital commerce (e.g., identity theft, credit card theft, debt accumulation, etc.).

* Resources, discussions and explanations should be made available at levels appropriate for students with cognitive delay.
Source: Table developed by authors based on the International Society for Technology in Education definition of digital citizenship (Ribble, et al. 2004) and Jason Ohler's work on digital citizenship (Ohler 2008).

Getting students ready to be successful digitally is extremely important when opening school doors to personally owned devices. The BYOD approach will not be successful unless students intrinsically value their participation in digital environments and recognize how high standards in digital citizenship enable and enhance their successful participation. Today's students will define who they are partially through their social, personal, educational and political interactions online. A healthy balance between their online rights and online responsibilities will keep them safe, respectful of others, ethical and within the law.

An Example – Student Guidelines in the Admirable Use of Electronic Information Resources

Source: Calgary Board of Education (CBE)

Follow these three principles of respect to ensure that you are using information and technology resources in a responsible way:

1. Respect Yourself
    - Keep your CBE account passwords and other personal information confidential.
    - Practice responsible conduct and digital etiquette when using electronic information resources.
    - Inform your teacher if something on an electronic device makes you feel uncomfortable or is inappropriate.
    - Use electronic information resources in a responsible manner that supports learning and demonstrates exemplary character.
    - Care for personally owned devices is the individual student's responsibility.

2. Respect Others
    - Use appropriate language and communicate respectfully while using electronic devices.
    - Respect the property and the creative work of others.
    - Protect and respect personal information of others.

3. Respect this Place
    - Use all electronic resources in a responsible manner that does not damage computer systems, data or networks.
    - Leave the school equipment so that it is ready to be used by others.
    - Use electronic equipment in the classroom environment to support learning in consultation with your teacher.

Students at West Dalhousie are expected to be responsible digital citizens who demonstrate exemplary character through an understanding of personal and civic responsibility. Any violation of the above expectations may result in disciplinary measures as outlined in CBE administrative regulations 1062 and 6001.

The Wolf Creek Public Schools provides a definition of digital citizenship along with criteria for a student passport to digital citizenship. The site includes examples, tips and techniques for teachers in establishing a positive culture of digital citizenship.

The website is available at http://www.wolfcreek.ab.ca/S02A6EE9B-02FCD428.

Section References

Ohler, J. (2008). *Digital storytelling in the classroom: New media pathways to literacy, learning and creativity*. Thousand Oaks, CA: Corwin Press.

Ohler, J.B. (2010). *Digital community, digital citizen.* Thousand Oaks, CA: Corwin Press.

Ribble, M.S., Bailey, G.D., & Ross, T.W. (2004). Digital citizenship. *Learning & Leading with Technology, 32*(1), 6. International Society for Technology in Education. Eugene, OR http://privacybydesign.ca

Section 5: Teaching, Learning and Assessment Using a Bring Your Own Device Model

Teaching and Learning with Personally Owned Devices

Students' access to personally owned devices changes teaching and learning. As noted earlier in this document, the use of personally owned devices bridges the formal and informal learning and gains immediate traction for increased use of technology in schools. These factors shift the role of the student in the learning process, the relationship of teacher to student and the student's access to digital content. As educators seek to develop students as engaged thinkers, ethical citizens with an entrepreneurial spirit (Alberta's vision for the 21st Century learner) they will need to redesign learning.

The personally owned devices serve as a link to the world beyond the classroom, one that can provide the context that triggers student interest, motivation and engagement in deep learning. That calls for more balanced pedagogical approaches that include inquiry-based, authentic and real-world learning, as well as a mix of coaching and didactic teaching (Edelsen, 2001). When designed well, such approaches can provide opportunities never before possible for all students, including those with diverse learning needs.

Personally owned devices serve as tools that enable personalization, participation and productivity in learning – three innovations to advance deep learning required if students are to achieve Alberta's vision for the 21st Century learner. (NESTA FutureLab, et al. 2004; Norris & Soloway 2009; Sharples 2000; McLoughlin & Lee 2008; Traxler 2010). (See Figure 2).

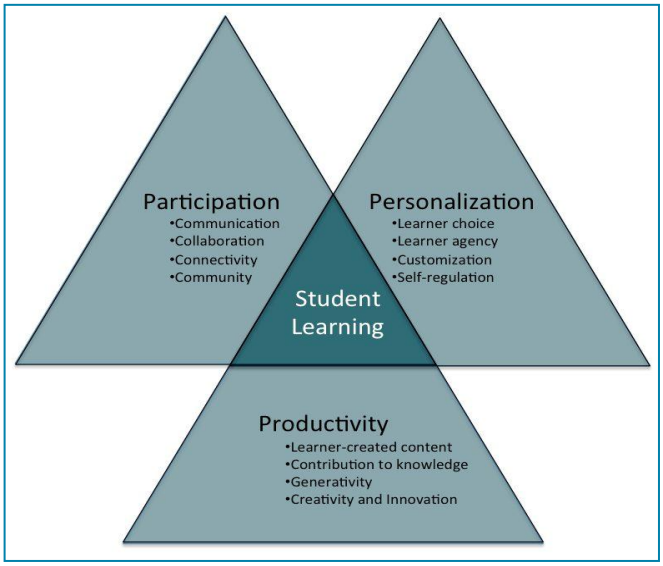


FIGURE 2: AVENUES FOR LEARNING WITH PERSONALLY OWNED DEVICES

Enabled by educational transformations that bring to life these three innovative strategies, students will need to step up and take increased responsibility for their own learning.

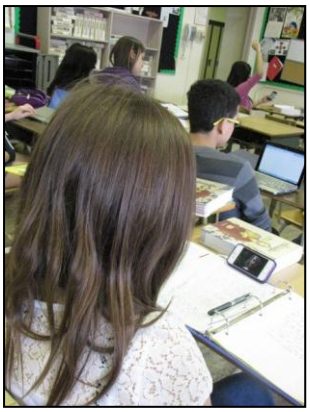
Within each of the three innovative learning strategies there are critical roles for the learner, the teacher and the school/school authority. Each of the three innovative strategies is defined and described on the following pages.

Personalization

To personalize learning is to engage students through personal interests, personal needs and personal regulation of learning.[2]

The research on how people learn has shown how the engagement and intrinsic motivation of students in deep learning can be enhanced and learning can be improved. This can be accomplished through more authentic learning, by connecting academic studies to topics of interest to students and by increasing student responsibility and a degree of control in their own learning. This is the basis for inquiry learning, authentic learning and project/problem-based learning (Bransford, et al. 2001; Dweck 2006; Edelson, et al. 1999). The intent is to provide learners with choice as to how they bring meaning to and make sense of their studies in school. Educators internationally are discussing ways in which such personalization can be accommodated through the choice of topic, resources, assignments and media through which students learn (Pollard & James 2004; McLoughlin & Lee (2008). Personalization can be supported in each of the following areas.

- **Content:** Although the curriculum standards determine the courses of study for students at each grade level, there are opportunities for student choice with respect to what subtopics they focus on, as well as opportunities for students to investigate content rather than have it presented to them in a particular sequence. As students create, discuss, exchange and revise their perspectives based on their research, their intrinsic motivation increases because *they* are asking the questions that are being investigated and answered. That said, teachers should ensure that student learning is scaffolded and, in some situations, sequenced to ensure efficiency of learning.
- **Assessment:** Multiple assessments should be triangulated for formative and summative purposes. The student should be involved in self-assessment of his own learning, cognizant of expectations, able to track his own progress over time and willing to reflect on his own learning and adjust behaviours accordingly.
- **Communication:** The student should be provided options for formal and informal communication with peers, communities of interest and the teacher. Options could relate to the modality (i.e., visual, verbal, auditory, text, etc.) or the media (e.g., blogs, wikis, chats, websites, PowerPoint, Prezi, etc.).
- **Learning processes:** The cognitive sciences suggest that learning approaches should tap into the student's prior knowledge, balance building toward automaticity with higher order thinking and situate learning in inquiry-based, real-world authentic experiences when possible. The learning strategies used with students should be differentiated to accommodate individual styles and differences.



[2] The origin of the term personalization of learning came from a definition by James Keefe (1989) "a systematic effort on the part of a school to take into account individual student characteristics and effective instructional practices in organizing the learning environment." The definition in this document encompasses that definition and adds the student role in part due to the opportunities afforded through personal devices and other technologies, enabling students to own the learning in ways never before possible.

- **Learning Tasks:** The learning tasks assigned to students should include a balance between building for automaticity and open-ended inquiry learning. The latter should be learner driven, authentic and experiential.
- **Resources:** The depth and breadth of online resources should enable teachers to accommodate student choice in media rich, interdisciplinary resources that inform their studies. Students should be independently able to search for and find appropriate alternative resources in addition to those provided by the teacher.
- **Scaffolds:** Students should have multiple formal networks to rely on and seek help from in pursuit of their studies.

This personalization often launches lines of inquiry within the formal education of school that lead to independent inquiry by students in the more informal learning time outside of school.

A Vignette: A BYOD model augmenting the personalization of learning

Source: St. Joseph High School, Edmonton Catholic School District

Personalizing the school experience. In the 2010/2011 school year, the teaching staff at St. Joseph High School embarked on a new initiative involving iPads. St. Joseph High School employs a non-traditional delivery method, the Personalized Self Directed Learning (PSDL) program. The PSDL program depends on constant communication between teaching staff, students and parents. The school has employed the services of additional programmers to develop an app designed to function as a virtual student agenda. The deployment of this app – available at Apple's App Store – is being released in three phases. The first two phases were conducted in the spring of 2011. In Phase 1, the app was used as a marketing tool for prospective Grade 10 students. In Phase 2, the app enabled students to plan their high school educational plan online and for orientation to the high school for incoming students. In Phase 3 users will focus on the app as a learning tool. Students will be able to access podcasts, video and exam preparation resources through the app. All courses offered at St. Joseph will employ a virtual classroom experience; the podcasts being created are designed to be accessed on any device.

June of 2011 marked the end of the first year at St. Joseph High School where all 73 teachers were assigned iPads to help them communicate more efficiently with students and colleagues and to aid them in the delivery of their lessons. As part of their annual registration package, students have been invited to purchase an iPod Touch as part of their registration fees. The school will be working with these students in 2011/2012 to assess the impact these new tools can have on their learning.

Benefits of Personalization

- Personalization means moving toward student-centered learning. There are important advantages gained when students' interests are taken into account, students' needs and preferred learning styles accommodated, students are provided opportunities for inquiry learning and students are provided with options in the ways they present what they have learned. Intrinsic motivation and engagement increase, attention increases and thus deep learning increases.

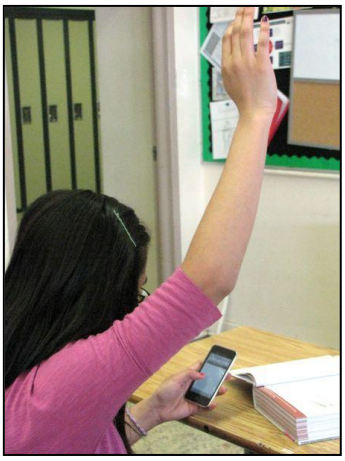
Top Actions Educators Can Take to Leverage Mobile Devices for Personalization

At the end of the day, personalization of learning is something that students do. The teacher's role is to create the environment that encourages and supports such personalization.

1. Inherent in the use of personally owned devices is the potential for 24/7 uses of the devices. The students are likely to extend their formal learning into the informal setting outside of school with the device. The teacher can scaffold this by providing choice and accommodating interests of students in assignments and projects. When students are interested they are much more likely to continue working on the topic outside of class and outside of school (Willms & Friesen 2009).
2. Increasing the self-directed learning of students will increase the students' capacity for reflection and integration of their interests into schoolwork. Teachers can accomplish this by encouraging a growth model of intelligence – assuring students that people are not born smart, but rather develop intelligence through perseverance and hard work. In addition, teachers can praise effort rather than intelligence and help students plan and regulate their own learning (Dweck 2006).
3. Establish a process for learner-focused feedback and assessment that instigates self-reflection and provides students with deep insight into ways in which they could improve (Dweck 2006).

Participation

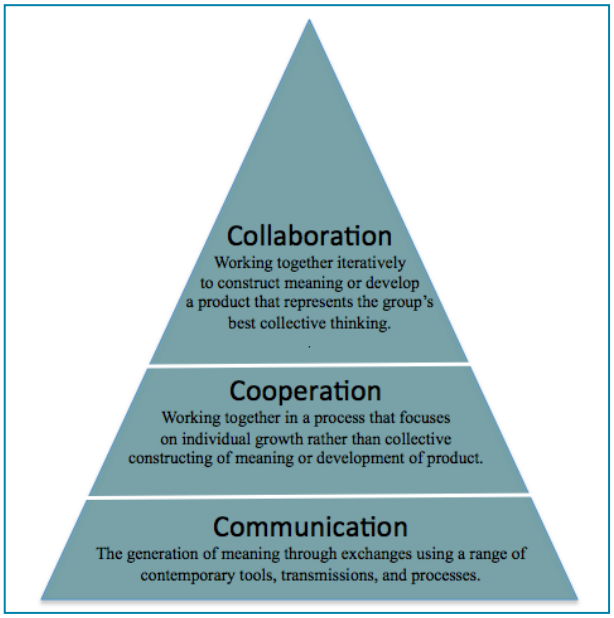
Participation represents the social and cognitive interactions students have when learning.



The evolution of Web 2.0 tools has been all about interactivity – ways to connect friends, family, peers, teachers, experts and communities with persons of similar interest – 24/7. The resultant participatory culture builds on interactions and communities of interest on three levels: communication, cooperation and collaboration (see Figure 3). Basic to all participation is communication, which is by definition interactive. As students learn together they will typically work both cooperatively and collaboratively. In the case of cooperation, students will be working together with the intent of increasing their own, individual levels of learning. For example, when a teacher asks the students to "pair and share," an exercise in which students team with another student and share their perspectives, they listen and learn and each benefits from the interaction.

Collaboration is different from cooperation, in that collaboration is participation that iteratively builds toward a joint project. Team members work together, building off each other's ideas and perspectives. Collaboration leverages communication into iterative dialogue that is critical to the end product. Collaboration is most powerful when the individuals share a common goal but bring different expertise, experiences and perspectives to the task. As Scardamelia and Bereiter have reported, students learn more when they co-construct meaning with their peers (1991). This co-construction of knowledge by students can be augmented through student interactions and participation facilitated through Internet tools, social networking and 24/7 access to personal devices and other technologies.

FIGURE 3: LEVELS OF PARTICIPATION



The interactive communication options that enable students to work cooperatively and collaboratively online include:

- E-mail
- Blogs/Wikis
- Social media (e.g., Twitter and Facebook)
- Threaded conversations
- Online chats
- Videoconferencing (e.g., Skype)
- Texting
- Exchange of documents/visual media

These interactive communications enable the teacher to gain insights into the interests, questions and prior knowledge of students to serve more effectively as a guide, fellow discussant, prompter and assessor. The online opportunities presented through such interactions connect students to communities beyond those in their locale. Mobile devices enable all three aspects of participatory learning – communication, cooperation and collaboration. An example of how collaboration and cooperation through personally owned devices advance learning is included below.

A Vignette – Participatory Learning

Source: Based on an example from Black Gold Regional Schools

Back channel use. While students are listening to lectures (teachers or other experts), observing an event, analyzing a data set, dissecting a frog or watching a movie in class, they can also be using a back channel – communicating as a group online while they work. As they do so, their reactions, questions, perspectives, insights, key findings and monitoring of the flow of information is captured in the back channel. This provides students the opportunity to communicate with peers, checking perceptions and noting what their peers are thinking about the lesson as it happens. Meanwhile, the teacher gains insights into perceptions, questions and perhaps misconceptions of students in real time.

The teacher can facilitate this in a number of ways:

- Preparing students by using the back channel for student questions prior to the exercise – with the intent of having the students use the back channel to find evidence that helps answer the questions.
- Periodically stopping the all-class activity to focus on the back channel discussion/comments.
- Monitoring the back channel and adding probing questions periodically.

- Post event, asking students to identify key questions or issue they are interested in pursuing and then creating new back channels to continue the discussion online, with the online group summarizing their thinking at the end of the postings. If all students have 24/7 Internet access, such discussions could be continued beyond that class and into the evening away from school.

Note: The back channel could use a number of platforms for community posts including: a Google doc, chat room, live Twitter feed, blog, wiki or threaded discussion.

Benefits of Participatory Learning

- Research finds that students who learn in cooperative or collaborative groups outperform students who work individually or competitively, (e.g., think, pair, share; peer editing; constructive controversy, etc.) (Johnson & Johnson 2006; Smith, et al. 2006).
- A student's social-emotional engagement will be increased when he/she is actively participating in a team or group. Increases in social-emotional engagement contribute to cognitive engagement and increase the likelihood that students will stay in school (Fredricks, et al. 2004; Zins, et al. 2004).

Top Actions Educators Can Take to Leverage Mobile Devices for Participatory Learning

1. Collaboratively establish rules of etiquette for online communication in the classroom and beyond.
2. Establish long-term groups in the classroom and provide time weekly for students to work in these groups. Establish common digital tools that enable collaboration and communication within the group. For example, establish blogs or wikis in which the group or pair documents their progress on class work each Friday.
3. Establish a system of communication among all class members. Establish Facebook-like profiles highlighting their interests and areas of expertise in your subject area of study. Provide formal learning opportunities for students to tap each other's expertise and areas of interest (e.g., online discussions, team projects, research projects, etc.).

Productivity

Productivity means that students produce something with what they learn, with the intent of demonstrating their level of learning.

The technology tools of today provide youngsters with productivity tools equivalent to those of professionals working in the field. Students are used to participating fully online, sharing their compositions, video and audio files and other products through Facebook, YouTube, online communities of interest or other sites that enable them to display their work publicly (Cochrane & Bateman 2010). In this context, it is not surprising that students place little value in rote learning of factual information. They want to learn in their own time, doing something that matters – and that often implies productivity

with digital tools. Personally owned devices provide a range of opportunities through which to increase student productivity digitally. Four different types of productivity toolsets are listed below:

- Organizational tools that enable students to plan, organize, provide visual cues for sequencing work, electronically schedule milestones and due dates, file work systematically and keep track of progress over time (e.g., electronic calendars, filing systems, notebook programs, concept mapping programs, grade books, etc.).

- Production tools that enable students to write, compose, design, produce and present their work (e.g., word processors, databases, website development tools, video production, slide shows, podcasting, vodcasting, blogging, etc.).

- Thinking tools that augment student analysis, synthesis and evaluate ideas (e.g., concept mapping, spreadsheets, data bases, data visualization, etc.) (Lemke et. al. 2002).

- Online assessment tools enable the students to demonstrate what they have learned through school-based testing and provincial standardized tests.

Many of these tools can be used on a daily basis, once they are introduced. They can take on forms from the very simple to the very complex. Teachers and students should keep in mind that the intent of productivity tools is twofold: 1) to streamline learning and 2) to demonstrate what the student has learned (see Table below).

EXAMPLES OF USES OF PRODUCTIVITY TOOLS

	Organizational tool	**Production tool**	**Thinking Tool**
Streamline learning	Electronic calendars can provide automatic reminders for students.	Blogs can be used as running records kept by students on their progress in their studies over time. This is especially helpful when a team is coordinating work on a collaborative project. In addition, such data should be considered as teachers score student work.	A spreadsheet can be used to capture, store, analyze and visually display data results from experiments in Science, Mathematics or Social Studies.
Demonstrate learning	Concept maps can be used to demonstrate students' understanding of topics/subtopics, cause and effect, similarities and differences, etc.	Blogs, wikis, videos and podcasts can all serve as tools to produce a culminating artifact to demonstrate what the students learned. In some cases it will be a product the team produced that is intended to be shared publicly. In other cases it will be a documentary of the learning that took place during the unit.	An iPod, a microphone and an audio editing tool can be used to capture a group discussion in response to a prompt and then review, analyze and synthesize the discussion into a 30-second summary of key points.

Personally owned devices provide the avenue for inquiry that can lead to deep learning, the opportunity for connections to experts and community beyond the classroom that bring relevancy to the student work and the digital tools that enable students to produce high-quality products that demonstrate the knowledge they have constructed. Generating rubrics or other standards of excellence for such products have been found to be instrumental in high quality productivity and knowledge construction.

Productivity should be viewed at two levels, the individual level and the distributed/group level. While it is important that students be held accountable for some work that is accomplished strictly by them, it is equally important to hold them accountable for productivity of their groups in co-producing knowledge.

A Vignette: Productivity

Source: Rocky View School District

Cold War – Historical Thinking. In a Social Studies 30-1 class, the topic of historical thinking in the context of the study of the Cold War is approached, in part, through students' production of a historical scene investigation. Using the website *Historical Scene Investigation* from the College of William and Mary (www.web.wm.edu/his), students create a website (using www.weebly.com) to investigate some of the following questions:

- How did the use of propaganda in pop culture perpetuate hostility during the Cold War?
- What conditions led to the existence of the *Hotline* between Washington and Moscow?
- Was there a clear victor in the global domination for nuclear arms?

Students provide background evidence, physical evidence and witness statements to back up their investigations. They provide primary and secondary sources and come to a conclusion that supports or refutes their investigative questions. The use of personally owned devices is essential in building the websites. The students not only find their primary and secondary evidence on-line through various archival sites but also build the site on-line as well. The ability to access the material at school or at home and have a seamless transition in the transfer of their information is key.

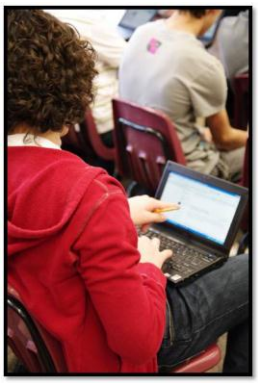
A Vignette: Assessment

Source: Edmonton Catholic Schools

One of the greatest challenges that teachers have expressed regarding being a BYOD school is that of student assessment in relation to Provincial Testing such as Diploma Exams. At Archbishop Oscar Romero High School, our English and Social Studies departments have a concise plan to allow students to utilize our lab space to write in class essays in preparation for diploma exams. With the introduction of a BYOD model, however, students prefer to use their own devices to write these exams. Due to security expectations this was not initially allowed and a solution was sought.

Alberta Education has developed Quest A+, a secure website for writing provincial standardized tests. Select students at Archbishop Oscar Romero participated in writing their Social Studies and English written response diploma exams using Quest A+ in January of 2012. This group of 50 students was able to write their diploma exams using their own laptops without technical incidences. The students used Quest A+ throughout the term to develop their skills in using the website and at diploma exam time they were prepared to write their Diploma Exams using Quest A+.

Benefits of Productivity through a BYOD Model



- Research by Newmann, et al. (2001) finds that students who engage in intellectually stimulating assignments that result in product development earn higher grades than those students who are not involved in authentic learning.
- Research on students' knowledge construction suggests there are reciprocal benefits from the involvement in group knowledge construction, to the individual and the group (Scardamalia & Bereiter 1991).

Top Actions Educators Can Take to Leverage Personally Owned Devices for Productivity

1. Develop in students the capacity to make informed choices on selecting digital tools appropriate to the specific knowledge construction task.
2. Enable students to conduct authentic learning tasks.

Section References

Bransford, J.D., Brown, A.L., & Cocking, R. (2001). *How people learn: Brain, mind, experience and school*. Washington, DC: National Academy Press.

Cochrane, T., & Bateman, R. (2010) Smartphones give you wings: Pedagogical affordances of mobile Web 2.0. *Australasian Journal of Educational Technology* 26(1), 1-14.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world: What teacher should learn and be able to do.* NY, NY: Wiley. Available at http://www.wiley.com/WileyCDA/WileyTitle/productCd-0787996343.html

Dweck, C.S. (2006). Mindsets: How praise is harming youth and what can be done about it. *The Essays of Leonard Michaels*, 302. ABC-CLIO, LLC. Santa Barbara, CA

Edelson, D.C. (2001). Learning-for-use: A framework for the design of technology-supported inquiry activities. *Journal of Research in Science Teaching, 38*(3), 355-385.

Fredricks, J., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), *59–109.*

Johnson, D. & Johnson, R. (2004). *The three Cs of promoting social and emotional Learning*. J.E. Zins, R.P. Weissbergh, M.C. Wang, & H.J. Walberg (Eds.). Building Academic Success on Social and Emotional Learning (pp. 40-58). NY, NY: Teachers College Press.

Lemke, C., Coughlin, E., Thadani, V, & Martin, C. (2002). *21st Century Skills: Digital literacies for a digital age.* Naperville, IL: North Central Regional Education Laboratory. Available online at: www.ncrel.org/engauge/skills/skills.htm

Keefe, J.W. (1989). Personalized Education. In Walberg, H.J. & Lane, J.J. (1989). Organizing for Learning: Toward the 21st Century. Reston, VA: National Association of Secondary School Principals. Pp. 74-78.

McLoughlin, C. & Lee, M. (2008). The three p's of pedagogy for the networked society: Personalization, participation and productivity. *International Journal of Teaching and Learning in Higher Education*, *20*(1), 10-27. Accessed 11/24/10 from http://www.isetl.org/ijtlhe/articleView.cfm?id=395.

NESTA Futurelab, Naismith, L., Lonsdale, P., Giasemi, V., & Sharples, M. (2004) *Literature Review in Mobile Technologies and Learning*. Author. Available at www.futurelab.org.uk

Newmann, F.M., Bryk, A.S., & Nagaoka, J.K. (2001). *Authentic intellectual work and standardized tests: Conflict or coexistence?* Chicago, Illinois: Consortium on Chicago School Research.

Norris, C., & Soloway, E. (2009, May). Pedagogy is king. *District Administration*, *45*(5), 48-48.

Pollard, A., & James, M. (2004). *Personalised learning: A commentary by the teaching and learning research programme*. Accessed on 12/08/11 from http://www.tlrp.org/documents/personalised_learning.pdf.

Scardamalia, M., & Bereiter, C. (1991). Higher levels of agency for children in knowledge building: A challenge for the design of new knowledge media. *Journal of the Learning Sciences, 1*(1), 37-68.

Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education, 34*(3-4), 177-193.

Shih, Y.E. (2005). Seize teachable and learnable moments: SMSE instructional design model for mobile learning. *International Mobile Learning*. Accessed 08/08/10 from http://www.iadis.net/dl/final_uploads/200506L012.pdf.

Smith, K.A., Sheppard, S.D., Johnson, D.W., & Johnson, R.T. (2006). Pedagogies of engagement. Annual Conference on Case Study Teaching in Science, October 6-7, 2006.

Traxler, J. (2010) Information, systems and mobility: Looking to the future. In *UK Academy for Information Systems Conference Proceedings 2010. Paper 49.* *http://aisel.aisnet.org/ukais2010/49*

Vygotsky, L.S. (1978) *Mind in society*. Cambridge, MA: Harvard University Press.

Willms, J.D., Friesen, S., & Milton, P. (2009). *What did you do in school today? Transforming classrooms through social, academic and intellectual engagement: First national report*. Toronto: Canadian Education Association. Accessed March 7, 2012 at www.ccl-cca.ca/pdfs/.../WDYDIST_National_Report_EN.pdf

Section 6: Digital Content

Digital content opens the classroom to the world – with all its potentials and pitfalls. Leveraging and managing such resources is the next big challenge for educators.

What is digital content?

Digital content is the provision of learning resources in digital format, including both off-line and online resources.

Digital content is defined as content that is either in digital format or is accessed digitally. Imagine a five-year-old with an e-book that reads to him as he follows highlighted text and pronounces words when he clicks on them and is able to switch to Spanish, his native language. Think of the science students who dissect frogs digitally through online simulations, the history student who explores period collections of digital artifacts through museums and the art students who Skype with an art gallery curator and artist after a virtual tour of the art exhibit. Many predict that collections of digital assets will be as viable as the printed textbook. Digital content is or will be available from a host of sources. In order that learners have access to this content they will need a personally owned device to use both in and out of school. Today, companies that provide digital content to the general public (e.g., Amazon, Apple, Google) use algorithms based on user preferences to predict and present content patrons are seeking, in their preferred formats. As these innovations are inculcated into the K-12 environment, students without 24/7 access to personally owned devices will be at a disadvantage. They will need a personally owned device to host their personalized learning content.

Appropriate combinations of digital content can lead to increased engagement, motivation and excitement on the part of students and teachers. These in turn can lead to deep learning and the extension of the pursuit of knowledge from the formal school environment into the students' informal learning environment beyond the walls of the classroom.

Digital content can take on many forms (The New Media Consortium (2010)). It may include commercial and non-commercial works, including those generated by students and educators. Some examples of the various forms of digital content include:

- Digital textbooks
- Apps for iPad, android, iPhone, etc.
- Learning objects (e.g., interactive diagrams, concept maps, virtual dissections, calculators)
- Websites
- Multimodal media/multimedia resources (e.g., video, photos, audio files, presentations, etc.)
- Simulations, models and augmented reality
- Data sets
- Visualization of data (e.g., charts, graphs, interactive images, etc.)
- Interactive communications with experts (e.g., Skype, videoconferencing, etc.)
- Online news media (audio, text, visual, multimedia, etc.)

Digital content for a BYOD model

Increasingly school authorities are also looking to provide access to digital content through streaming media services located both inside and outside the school authority. The decisions a school authority makes about devices directly impacts the capacity of the student to access digital content and the range of digital content options open to the classroom teachers in that school authority. Alberta Education currently provides a wide range of digital content through LearnAlberta (http://www.learnalberta.ca/). This content is developed to align to Alberta curricula.

The major issues about digital content and personal devices relate to accessibility, license, privacy of students and faculty, Internet access, standards/media literacy, context, curation and copyright.

Accessibility is the capacity of any device (including personally owned devices) to access, process and display the digital content. Some issues include:

- Size of display. In some cases, students and teachers are not able to read or decipher digital content due to the size of the display. This is especially problematic when there is a large amount of text, when complex graphics/text are included and when the device does not allow for magnification. In many cases, conversion programs are being developed that enable a device to at least view – if not run – the applications.

- Technical capacity of the device to run the application in which the digital content was developed. For example, the iPad cannot run digital content developed in Flash and smartphones do not allow users to run full versions of Microsoft Office, although they can read documents from the application.

Licensing refers to the agreements inherent in any purchase of digital content by the schools for use by students and teachers. Licensing agreements apply to content, regardless of whether the device it is downloaded to is student-owned or school-owned. However, as personally owned devices become more universal, the schools do need to strive for digital content licenses, purchased by the school, which include access by students from their personally owned devices in school and beyond. In all cases, students need to be informed as to any and all restrictions on the use of such materials.

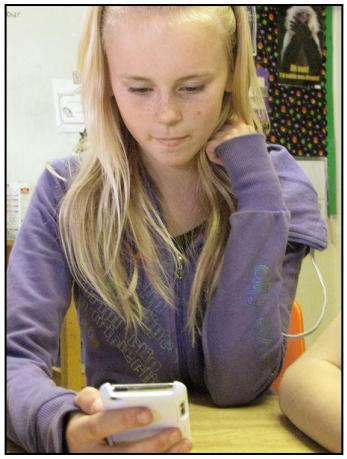
Privacy of students and faculty is an issue of paramount importance as schools begin using cloud computing. This will provide access to digital content for student and faculty and greater productivity, communication, document sharing and storage. Cloud computing is the expansion of local networks into a system of networks that include high capacity computing resources, storage in data farms, a range of computer applications and opportunities for collaboration and connections across this system of networks (e.g., Google Docs). Ultimately, it is the responsibility of schools to protect the privacy of students in the use of school-sanctioned Internet sites. The question facing schools is whether or not companies that maintain sites that students log into for schoolwork are maintaining the privacy and security of those works. Schools also need to ensure the security of data such as student data and student work and understand that the strength of privacy measures is commensurate with the sensitivity of the information (see also Section 7 on Access and Infrastructure Considerations for a BYOD Model).

Internet access both in school and beyond the school day is critical if students are to access digital content through their personally owned devices. This raises the issue of the school's responsibility for Internet access throughout the school campus for both personally owned devices and for school-provisioned devices checked out to students who cannot afford a personally owned device (see also section on infrastructure).

Standards/media literacy refers to standards associated with the accuracy, currency and reliability of digital content and sites and experts as sources of digital content. One of the keys to high quality digital content in today's world is the capacity of teachers and students to ascertain the quality of sites they choose to use as sources for digital content. Again, the implications for personally owned devices are not substantially different from use with any kind of devices. In all cases, schools have the responsibility of developing digital/media literacy and high quality research skills in students and teachers that result in informed analysis and appropriate use, of digital content.

Context refers to the learning environment within which the student engages the digital content (e.g., the aggregation of digital assets, the curriculum, instruction, assessment, pedagogy and the learning culture). As such, the context should provide a comprehensive view of the topic. It should be multi-representational, personally engaging to the student, aligned to standards and appropriate to the students' level of expertise.

Curation is the editorial grouping organization and selection or aggregation of digital content resources by a person around a topic. These curated playlists (Valenza, 2011) for digital content typically are intended to include the most relevant valuable content on a topic from multiple, often diverse sets of sources. The difference between a curated playlist and a Google search is in the human creation of the playlist versus the automated search by Google. While some librarians and teachers are creating such playlists now, the need for such works will grow as the volume of content increases exponentially.



Copyright refers to the exclusive legal right to reproduce, publish, sell or distribute the matter and form of something. Copyright issues are not unique to personal devices. In fact, the issues around updating copyright laws to reflect the Internet-based knowledge economy are currently debated internationally and the need for international reciprocity is noted.

In the meantime, sites such as Creative Commons have sprung up. Creative Commons is a U.S.-based, non-profit organization established to minimize barriers represented by dated copyright laws applied to digital content. Whereas the traditional copyright laws provide authors with "all rights reserved," Creative Commons copyright licenses provide legal language that individual creators can use to ensure ownership, while at the same time providing users with additional rights. For example, Creative Commons licenses allow the author to give users the right to copy, distribute, edit remix and build upon the original work, all within the bounds of copyright law.

Creative Commons seeks to minimize legal, technical and social barriers to sharing and reusing educational materials (Valenza n.d.) through six different attribution licenses – which allow the creators

to decide the extent to which their copyrighted products can be used. Such licenses often allow the sharing and remixing of educational materials, provided the correct attribution is made – while protecting the authors' rights.

Legally, it is the responsibility of the user to be knowledgeable about the copyright law that applies to digital content and digital materials. In schools, the expectation that students will adhere to copyright laws is addressed through an acceptable or responsible use policy signed by students and their parents/guardians. Such policies typically address the following issues with respect to student use of copyright materials and student productions – including text, audio, images, video and multimedia:

- Avoidance of plagiarism
- Appropriate citations
- Appropriate use of materials' attribution in a remix
- Internet safety related to student identification as author of work

One of the ways in which schools can support appropriate student use is by providing students with access to databases of audio, images, video and multimedia resources that are public domain.

Examples of digital content in Alberta classrooms

The following are examples of ways in which Alberta teachers are using digital content in their classrooms.

A Vignette – Digital Content

Source: Calgary Board of Education

Using iPODs to Support an Understanding of Japan in Grade 8 Social Studies. Students are asked to analyze the effects of cultural isolation during the Edo period by exploring and reflecting upon how the shogun used the feudal system and the hierarchical social classes to maintain control of Japan. Each student has his own iPod Touch synced through a teacher controlled iTunes account. These mobile devices are used to research and represent student understanding in the following ways:

1. Students use their textbooks, learning commons and the devices to research Japanese feudal society.
2. Students draw/create their own images of the levels of Japanese feudal society through a drawing application called Doodlebuddy. Once created, these images are saved to the iPod's camera roll.
3. Students use the Sketchnation app to create their own digital games representing the levels of Japanese feudal society. They use their research on Japan and Doodlebuddy images to do so.
4. Assessment is based on a prescribed rubric. Students help develop this rubric. Students assess one another's game through game play and demonstration. A document camera is used to project device content on the electronic whiteboard so all can celebrate their learning.

A Vignette – Digital Content Produced by Students

Source: Cold Lake High School, Northern Lights School Division

A culminating activity for a literacy unit in English Language Arts 9. The assignment is to create a movie trailer that illustrates the students' understanding of the major themes of sameness, memory and choice in *The Giver* by Lois Lowry. See assignment at: http://languagearts9.pbworks.com/f/Giver+Movie+trailer.pdf. Students are assessed on the quality of each step of the production, including storyboarding, planning, editing, communicating, storytelling, illustrating of themes and working in a group. Students used Aviary-Myna, an online audio editor to create original music; video and still cameras; the iPhone; and video capable iPod Touches to capture images in the creation of their movie trailer. When completed, they embed their digital content – i.e., movie trailer – in their class blog using Blogger.

Action steps in leveraging personally owned devices to access and use digital content

As school authorities use digital content through personally owned devices, they should consider the following action steps:

A. Investigate the transition from print textbooks to a combination of print and digital resources.
   a. Formalize and publicize which digital content, productivity tools and other applications/software are formally adopted and supported by the school authority. Establish a formal process:
      i. For cataloging digital content, including elements specific to digital format (e.g., accessibility, format, copyright, costs related to terms of license agreements, home and school use).
      ii. By which collaborative teams of teachers and curriculum coordinators map digital resources to the learning standards and the curriculum.
      iii. By which teachers, administrators and other educators can seek formal school authority approval to transition to digital content.
      iv. By which teachers, librarians and curriculum directors can curate digital resources and link them to standards and curriculum, perhaps through a content management system (see d. below).
      v. For communicating with staff, students, parents and community as to which digital content has been formally approved and licensed for home and/or school use; what the terms of use are according to the licenses; and the process by which students and teachers get access.
   b. Consider how budgets might be reallocated to purchase multimodal, multimedia digital content.

c. Explore licenses for digital resources that enable student use 24/7.
d. Establish a content management system that provides teachers with an electronic system for the management of the digital content they use in courses, including course outlines with associated access to digital content, student document management and storage, student collaboration on digital content, student production and exhibition of work, etc.

B. Investigate the transition from productivity on stand-alone machines, to productivity on devices connected to the cloud. Consider usage patterns for productivity tools (frequency, time of day, school or home based, etc.) in making decisions about cloud-based versus device-based productivity tools. For example, if most students do not have Internet access from home, but use their devices at home, then they will need device-based productivity tools for high use tools.

Section References

Creative Commons. (n.d.). Attribution license. Accessed 04/22/11 from http://creativecommons.org/licenses/by/3.0/.

Valenza, J. (April 23, 2011). Guide for TLs (and on curating digital content). Blog for *School Library Journal, Spartan Guides*. Accessed 01/06/11 from http://blog.schoollibraryjournal.com/neverendingsearch/2011/04/23/guide-for-tls-and-on-curating-digital-content/.

The New Media Consortium. (2010). 2010 Horizon Report: K12 Edition. Accessed 12/20/10 from http://www.nmc.org/publications/2010-horizon-k12-report.

Privacy by Design http://privacybydesign.ca

2Learn Education Society www.2Learn.ca

Media Awareness Network http://www.media-awareness.ca/english/index.cfm

Section 7: Access and Infrastructure Considerations for a Bring Your Own Device Model

Schools need a roadmap of where they want to go pedagogically before they can put in the infrastructure to get them there.

- Alberta Educator

The intent of this section is to investigate the specific implications of personally owned devices related to student access and associated infrastructure considerations. To help schools with the implementation of wireless networks, Alberta Education has published the *Wireless Local Area Network (WLAN) Best Practices Guide* (2011). It should be noted here that much of this section applies to the technology infrastructure required to support both school-owned and personally owned devices. A BYOD model typically requires a segmentation of the network and increases the time line and scale of the implementation to accommodate the increased number of devices for learning.

The provincial government contributes to school authority access to high speed networks through SuperNet. Thus, most schools across the province provide students and teachers with online access to digital resources, online content and communication services. Increasingly, such connectivity is via Wi-Fi (see box to the right). School authorities implementing BYOD models are reconfiguring their Wi-Fi system to enable connectivity similar to guest access in public spaces.

What Is Wi-Fi?

Wi-Fi stands for Wireless Fidelity. Personal computers (PCs) can be equipped with Wi-Fi adapters (which are available as internally mounted cards, most typically a USB adaptor. Most laptops are standard now with a Wi-Fi interface that will handle all current Wi-Fi standards including 802.11a/b/g/n. Wi-Fi adapters are fairly inexpensive. The adapters seek out signals broadcast by devices called access points (AP) that in turn are typically connected to the existing wired network. This gives Wi-Fi devices access to the same resources that devices connected to the wired network have. Although it is less common, Wi-Fi devices can also communicate directly (one-to-one) with each other. Wi-Fi devices, if capable will adapt to the standard in use by the access points that are within range and employ several different technical standards grouped together and referred to as the IEEE 802.11 specification in order to communicate with an access point.

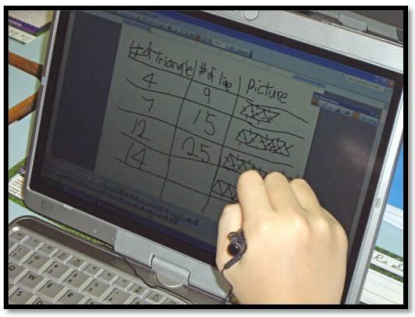
Source: WLAN Guide

According to the WLAN Guide, “The combination of wireless technology’s relatively low cost and easy deployment has led many school authorities into implementing wireless technology without adequate up front planning and without addressing ongoing support requirements.” The guide goes on to warn that, “This has often lead to degraded levels of service and significant security exposures, dramatically increasing failure rates of user adoption and seamless usage.”

These are important considerations for school authorities. It is important that a comprehensive plan be developed prior to implementation. The plan should address wireless technologies and bandwidth, security standards, network policies and procedures, human capital and projections of the total cost of BYOD models. The latter should include the possibility of unknown or hidden costs, including potential theft or damage issues that can happen to the personally owned devices while on school property or during daily transportation and who will be responsible should repairs or replacements become necessary. The school authority should manage the students, parents and communities’ expectations related to technology and a BYOD model. School leaders should not over promise (in terms of expected outcomes from the BYOD policy) and should help the public see that a sound decision process – even though it does take time, will enable the school authority to plan for and expend public dollars wisely.

First things first

The first step in designing a sound plan for wireless access and infrastructure is determining the educational need – how will the personal devices be used educationally. Access and infrastructure to support a BYOD model must be driven by the school authority’s vision for learning. There will always be an emergent technology that the Information Technology (IT) group will need to support in pilot phases until the proof of concept can be established and perhaps scaled. But such work must also be informed by its potential value-added to learning and teaching or the associated business processes that support that mission.



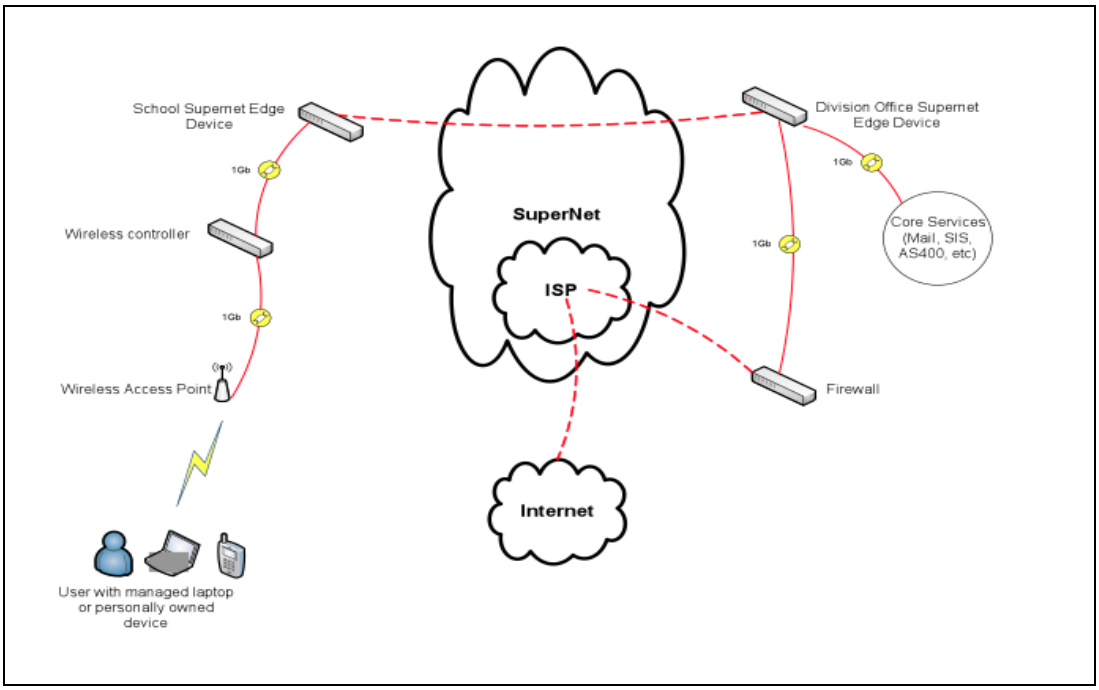
Networks and wireless technology. The design of the infrastructure (local area networks, wide area networks and operating system) should be informed by the vision for the use of personally and school-owned devices. Once this vision is established, the school authority should be able to project the intensity, frequency of use and type of online downloads, streaming and interactivity of use. In addition, they should be able to project other structures that will be necessary to achieve that vision (e.g., web services and tools, cloud computing services, productivity tools and other fundamental structures).

In most cases, the wireless solution for a BYOD model should build on the wireless network and hard-wired infrastructure already in place in the majority of school authorities. In addition, the wireless solution for a BYOD model should provide an opportunity for the school authorities to upgrade to the latest standards for wireless computing. In some cases, this will translate into the need for new construction; retrofitting existing locations; or upgrading the backbone of the infrastructure to handle the incremental increase in bandwidth demand that personally owned devices typically bring to a school. Most schools have deployed wireless access points according to need, while others are wiring high concentration computer areas to work in conjunction with wireless systems. With the introduction of personal devices, a hundred percent of each campus will need seamless wireless coverage and will require an increased density of hub placement. The key questions to ask related to wireless technologies are:

- What are the projected requirements per student/staff?
- What is the current wireless capacity and configuration? What is the number of supported users per access point? Can you manage the network centrally?
- What is the gap in bandwidth? Wired network capacity? Wireless coverage? Network configuration? How will you close the gap in the short-term?
- What will the network look like in the long-term?
- What will be your projected adoption rate, i.e., growth rate among students with personally owned devices and subsequent upgrading of your infrastructure?
- What model will your school or school authority use for recharging personally owned devices?

Figure 4 highlights network functionality within a general technical framework for personally owned devices.

FIGURE 4: DIAGRAM FOR TECHNICAL NETWORK ACCESS FOR A BYOD MODEL



Note: Diagram provided by Wolf Creek Public Schools

A Vignette – Wireless configuration

Source: St. Paul Educational Regional Division

Wireless configuration issues. Setting up a wireless network for a BYOD model was a challenge and resulted in a few wrong turns along the way. Initially, after much consideration, the school authority decided to control access to their wireless system through the Network Access Control (NAC) box. The process it used was to first download a dissolvable client to the user's computer to scan for both an antivirus program and an antispyware program. If the NAC does not find an antivirus program on the target computer, it redirects the user to a website where she could download antivirus software. The process was sound in theory, but in practice, it had some shortcomings.

School authority administrators decided not to use the NAC box to allow personally owned devices on the network. Instead, they reverted to a previous system with open guest wireless access for personally owned devices that allows users to only browse the Internet. Thus, their access is still going through the school authority's web filter to deny access to inappropriate sites. There is no limitation on how many users can be connected at a time.

Bandwidth. One of the challenges associated with personally owned devices is having adequate bandwidth in the school to meet the learning needs of students, including access to digital resources, online content and communication networks. The increased number of devices connected to the wireless network through a BYOD model can negatively impact bandwidth performance. This is especially true when students are accessing multimedia resources. Schools that provide personally owned device access to their networks will need to establish guidelines for use in order to ensure high bandwidth performance over time.

Currently BYOD schools in Alberta are reporting that some students are bringing two to three devices and simultaneously logging them into the network, which increases bandwidth demand substantially. Schools have also reported that after every holiday break (especially winter and summer breaks), there is a substantial increase in the number of personally owned devices in the school. Schools need to be aware of such trends and prepare for them. School authorities with current BYOD installations suggest the following rule of thumb: plan for double the number of devices per user. As usage increases, school authorities may want to consider strategies for intelligent routing and throughput (i.e., packet shaping, compression, etc.). See WLAN Guide for further details on this.

Some of the questions that arise about usage that impacts network performance with personally owned devices include:

- How much bandwidth should students be allowed to consume? Should students have individual limits on bandwidth?
- Should students be limited to a certain number of devices on the network?
- What is a rule of thumb (i.e., reasonable amount of service) to provide to a student with a personally owned device?
- Should students be allowed to use devices that bypass the school authority's network and use other networks (e.g., 3G, 4G, etc.) through plans privately supported on their devices?
- What steps will be taken to address the needs and access for students who do not have home access? [e.g., opening up schools in off hours, arrangements for access in other public buildings, even the provision on non-digital resources (in some cases even hard copies) or borrowing computers with resources installed (not links to the Internet)]?

A Vignette – One School Authority's Take on Bandwidth Issues Related to Personally Owned Devices

Source: Calgary Catholic School District

Bandwidth. Bandwidth will continue to be an ongoing issue with the implementation of a BYOD model. Currently a school fully accepting personally owned devices has three times the student population worth of devices logging on. Students typically will bring more than one device with them to school. Recent upgrades to SuperNet (Alberta's high-speed network) has reduced some of the strain on the network related to bandwidth for the time being. As websites continue to become more content and bandwidth intensive the temporary relief from network issues is expected to disappear.

Internet based media streaming sites put a heavy load on bandwidth, often representing 50% or more of the load. At peak hours, YouTube has at times consumed 50% to 70% of available bandwidth. Using video streaming platforms like Discovery or Learn360, in lieu of directly accessing sites such as YouTube, not only reduce the strain on bandwidth but also support the appropriate and legal use of streaming media with the provision of public performance rights as part of the delivery. Competing systems like videoconferencing, webinar solutions, learning management systems add to the demand on the network.

Technology solutions such as packet shapers and internal caching of streaming media can be a part of the solution but ultimately other solutions aside from purchasing additional bandwidth need to be examined. As students become more active in their learning it is expected that they will be accessing these media rich resources at various times throughout the day. This further amplifies the issue, as multiple streams will be needed to various devices instead of a single one projected form a single teacher station.

Suite of applications. The school authority's vision for learning through personally owned devices and other technologies should inform another layer of the infrastructure: the applications and productivity/communication tools. A device-based and/or cloud-based suite of applications should include communications, document management and spaces to work and collaborate. This basic suite of tools should be complemented within individual departments by applications and resources specific to their areas. Currently many Web 2.0 cloud applications can be used on multiple platforms (e.g., Windows and Macintosh). The use of such applications may reduce support costs for updating and purchasing software, but the question remains as to how the use of cloud computing will limit or restrict students' access to such applications should they not have24/7 high-speed access.

While the use of Google Apps can facilitate many elaborate collaboration schemes involving groups of students and teachers, the most common form of collaboration is between individual students and their teachers. The collaboration tools available vary from app to app, but the most powerful tools are found in the text documents. Documents that are shared between student and teacher can have comments added by the teacher to which the student can either act on or respond to.

A series of questions for consideration in this realm include:

- Will students be able to print from their personally owned devices or save/submit documents from their personally owned devices?
- Will students have a single sign-on for all cloud-based applications?
- Will all students have a digital locker, e-portfolio, blog, wiki, a Twitter account or an e-mail address assigned by the school authority? What formats will be required?
- Are the cloud-based productivity applications sufficient or will students need device-based applications as well?
- See also licensing issues in Section 6: Digital Content.

A Vignette – Suite of applications

Source: Calgary Catholic School District

Applications. The use of a set of applications, either locally installed or web/cloud based, is an important part of considering how teachers and students interact and collaborate in learning. Both

groups need a baseline set of defined capabilities to allow for such things as planning, the creation of exemplars, rubrics and so on.

A basic suite of applications typically includes, but is not limited to:

- Word processor
- Spreadsheet software
- Presentation software
- Audio, video and picture playback and editing
- Web browser (more than one type is recommended due to version and website differences)
- Accessibility options that include screen reading and text-to-speech abilities
- Common plug-ins like Java, Flash, Acrobat reader

Dedicated software makes common tasks integrate more effectively into a learning environment (e.g., digital storytelling, Google Earth).

Note: The above list is not all inclusive. As it focuses on teaching and learning, it does not include technology systems such as student information and learning management systems. Nor, does it address specific curricular needs that may require special programming software such as HTML editing, design software like AutoCAD or animation software.

***Cloud computing*.** Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on demand. Clouds are web applications and storage server farmers that are available as a service through the Internet via a compliant browser. A compliant browser can be private, such as a server farm for a business that houses secure company information or public (e.g., Google docs). Cloud computing is already being used extensively in business and education.

The questions associated with cloud computing include:

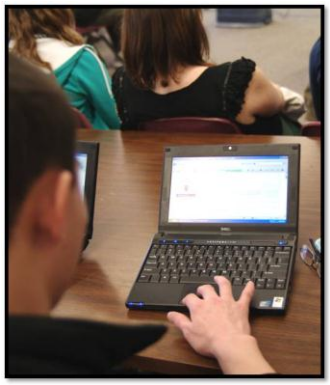
- What are school authorities' responsibilities to ensure the safety of student data on remote sites? (Consider the Alberta *Freedom of Information and Protection of Privacy Act* (FOIP) and the U.S. Patriot Act.)
- When student work and/or data are stored in the cloud:
    - Who owns the data?
    - Is the data secure, traceable and manageable if legal concerns arise?
    - What level of student data should be in the cloud?
    - What are the backup policies? What happens if the service ends or breaks?
- What are the true costs in using free cloud-based applications and services? Is it really free?

NOTE: This guide does not attempt to offer legal advice. Rather, it recommends that such advice be sought through school authority counsel and FOIP officers.

A Vignette – Cloud computing

Source: Edmonton Public Schools

Cloud computing. Edmonton Public Schools is using a cloud computing application called Google Apps. Google Apps allows access to an account for any student or staff member within the school authority. Google Apps is free. However, the total cost of ownership (TCO) is very difficult to determine, as many of the costs incurred to access Google Apps are costs that would be incurred even if the school authority did not use this cloud service. For example, Edmonton Public Schools currently incurs a cost to license Microsoft Windows for every school authority-owned PC. Since that license is required to run any local software, it should not be considered a cost associated with TCO. In fact if the school authority were using exclusively cloud-based software, it could reduce some of the cost by running open-source software on the local machines. In terms of support for staff, most of the manpower costs are associated with the transition from local- to cloud-based computing and will diminish with time. Edmonton Public Schools currently has one technical support member who could be described as providing support exclusively to cloud computing.



One of the decisions the school authority made was to have no backup policy, but rather, to rely entirely on the redundancy in the Google system to secure its data. After three years of operation, technical support staff are happy with the security of the data. It should be noted that Edmonton Public Schools does not store mission critical data in the cloud and that many staff maintain their own backups or redundancy, at least to begin with. Because there is no student personal information (outside of what individual students create that they may consider personal) stored in the cloud, the Freedom of Information and Protection of Privacy (FOIP) concerns are addressed. Edmonton Public Schools had the system vetted by both the board expert and the Office of the Information and Privacy Commissioner. Any concerns they had were easy to rectify or assuage.

Edmonton Public Schools maintains ownership of all data that is stored on Google servers, which can be easily removed at any time by any user. Google maintains a site they call The Google Data Liberation Front <http://www.dataliberation.org/>, which explains various methods of extracting your data to other locations. For a detailed explanation of the EPS Privacy Policy as it pertains to Google Apps a public site is maintained - https://sites.google.com/a/share.epsb.ca/shareepsbca-help/Home/privacy-matters.

A Vignette – Cloud computing for collaboration

Source: Calgary Catholic School District

Cloud computing for Collaboration. The Calgary Catholic School District is using Google Docs, Google Apps and Google's mail client, Gmail, through a managed domain. This use of the cloud provides students and staff the ability to collaborate on documents and presentations. Currently, students in Grades 7 to 12 and the entire school authority staff use this managed Google domain in conjunction with the learning management system. The key difference between the public side of Google and a managed domain is documents may only be shared with other users inside the managed cloud domain providing more security than simply using the public side of cloud services.

Security standards. Schools ramping up to accommodate BYOD models must address network security and ongoing management practices to protect information security while also providing reliable service. Most school authorities provide Internet access to student and staff personally owned devices by segmenting their networks. Just as hotels, universities and other entities have guest accounts, schools are establishing guest accounts for personally owned devices. The standard procedure is to require that students and staff using personally owned devices login to the network even for Internet access. Each user would be assigned appropriate credentials that would determine accessibility to various network services. The login process would authenticate their credentials as a student or staff member and in some cases, check for viruses prior to allowing access to the Internet via the school's wireless network. Logging in increases personal responsibility for the use on that device on the network. Students will be less likely to share their devices and less likely to use multiple devices simultaneously. Within the segmented network for personally owned devices, it is important to distinguish between student-owned devices and staff-owned devices, because staff will require access services and resources that students will not require.

While guest accounts allow students with personally owned devices easy access into the Internet, they often do not allow access onto the school servers. Users of personally owned devices will also need a way to access the school servers. Some schools require that personally owned device users logged into their network for Internet access open up a browser and gain access as an outside entity. Others simply ask personally owned device users already on the network to re-authenticate with more security to gain access to the school server.

Human capital/Professional development. The importance of human capital in designing, implementing, using, assessing and supporting all aspects of the BYOD model cannot be underestimated. Once a strategic plan is developed for BYOD implementation, all aspects of it should be mapped and aligned to the team functions required to support the BYOD model. Questions to ponder include:

- Does the school authority have the technical support capacity to install and maintain seamless access for a BYOD model?
- Do technical support personnel have the right capabilities?
- If the school authority lacks the capacity or the capabilities, how will they be acquired?
- Maintenance and support to ensure seamless access is not a one-time thing – there is an ongoing requirement to maintain the infrastructure and this comes with an associated cost. What is that cost?

In addition, thought should be given to the capacity building that will be required to ensure that all users – students and staff alike – understand the infrastructure, applications, the way in which the personally owned devices connect to the system and the privileges and responsibilities inherent in doing so.

Procedures for recharging personal devices. As the personally owned devices are increasingly integrated into teaching and learning, limitations due to battery life of the devices becomes evident. School authorities are finding it necessary to establish procedures that require students to bring their

personally owned devices fully charged. In addition, systems must be in place to enable students to recharge their devices during the school day.

A Vignette – Recharging Personally Owned Devices

Source: Calgary Board of Education

Within the Calgary Board of Education, the classroom is increasingly becoming a place with many devices. A typical classroom may contain laptops that are both school and student-owned. Additionally, students may bring in devices such as laptops, smart phones, iPODs and iPads. While students have the right and opportunity to bring devices to school, they also have the responsibility to bring these same devices fully charged. That being said, the creation of simple charging stations for laptops and other devices through access to power bars is recommended to aid students in emergent situations. Students need to be cognizant, however, that responsibility for the security of the device remains with each student. While teachers will do their best to prevent theft and loss, parents and students must be aware that schools will not assume responsibility for lost or stolen devices.

Section Resources

Alberta Education. (2011). Wireless Local Area Network (WLAN) Best Practices Guide. Accessed 10/10/11 from http://education.alberta.ca/media/6607528/wireless%20guide%202011%20publication%20edition.pdf.

Section 8: A Framework for School Authority Readiness

Is your school authority ready for personally owned devices?

The following set of questions was developed as a framework for determining a school authority's readiness to adopting and successfully implementing a BYOD model.

Step 1: The vision

Get clarity on the purpose of the personally owned devices. What does the school authority hope to accomplish with a BYOD model? Is the vision shared throughout the community?

- Has the school authority or school established a pedagogical need or goal(s) that will be addressed through the introduction of personally owned devices in support of all students?
- Is the community supportive? Are staff members supportive?
- What will happen if you do not introduce a BYOD model into your schools? What other options have you considered? Can the need be addressed in a different way?
- What has the school authority or school established as indicators of success for a BYOD implementation?

Step 2: Staging the school authority or school for success

- What BYOD model best fits your needs and situation? Evidence?
- Is the system ready to transition to a new ecology of learning aligned to the vision?
- Is the system ready pedagogically? Evidence?
- Is the system ready technologically? Evidence?
- What policy changes will be necessary in order to fully leverage the implementation of personally owned devices?
- Will the BYOD model be implemented incrementally or launched system wide? Has the detailed rollout plan been developed and shared? What capacity building has been done to ensure success in the classroom?
- What milestones have been established to gauge the fidelity of implementation?

- What milestones have been established to gauge the school's/ school authority's success in meeting the need or goal that was the impetus for this policy decision?
- What are the risks? How can they be mitigated?
- How will you stage the decision making, implementation and assessment? What will be your leading and lagging indicators of successful implementation?

Step 3: The communication

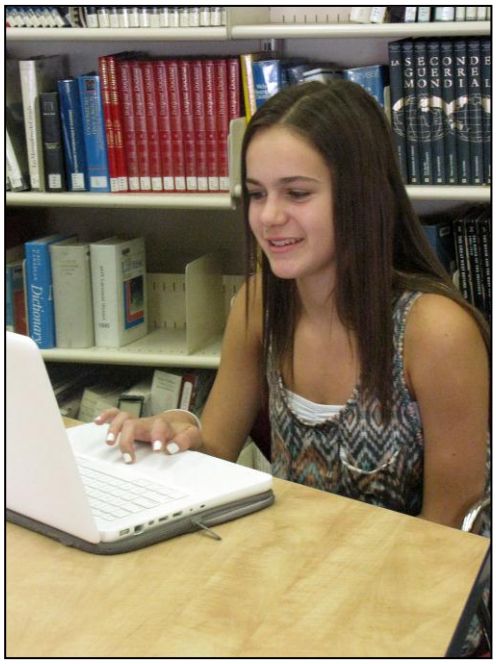
- Have public awareness sessions been conducted to involve the community in the BYOD rollout?
- Does the school authority website have information on personally owned devices with a Frequently Asked Questions section?

Section 9: Community Interaction

The communication with the school community (i.e., students, parents, community groups and other stakeholders) is tremendously important if the plan is to have strong community support and sustainability. The community needs to be involved every step of the way.

The school authority should inform school and school authority decision makers about BYOD models, plans and implementations. The decision makers will want to know what is needed to ensure success; the costs, benefits and risks associated with each option; and receive well-informed recommendations based on the school authority's needs.

Before BYOD



A great way to begin is to gather baseline data from parents and community members to inform the BYOD plan. That data collection should address the following questions:

- What are the community's priorities for using technology in learning?
- What challenges are specific student populations facing that could be addressed through a BYOD model?
- What types of technology devices do students have access to at home?
- What type of Internet access do students have at home?
- What are the parents' hopes and fears regarding personally owned devices?
- What price point is reasonable for parents to be able to afford to provide a device for each of their children?
- What support, information and training would parents need to support a BYOD model?

Once a survey of specific questions is generated, the data can be collected via paper surveys sent home with students or completed at meetings, online surveys, phone or face-to-face interviews and focus groups.

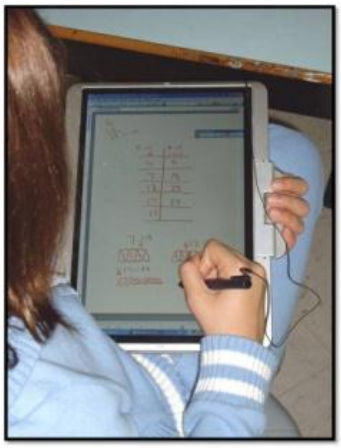
As mentioned earlier in this guide, the selection of the BYOD model should take into account equity considerations and solutions. The BYOD model selected should be affordable to most parents in the community, with a set of school-owned devices available for checkout to students whose parents cannot afford a device.

During the BYOD launch

It will be important for the school to educate parents about personally owned devices ranging from the pedagogical to the practical. Parents should hear about what personally owned devices are, what value they add to the learning process, the training in digital citizenship the students will receive and the type of work they might expect their son or daughter to conduct on the personally owned device. In addition to informational sessions, websites and packets of materials, the school may want to host round table discussions prior to the implementation of a BYOD model. This will provide opportunities for parents to voice concerns and ask specific questions about the BYOD model. Orientation meetings immediately prior to the launch of a BYOD model should include sessions on digital citizenship, where the parent and the child jointly participate, discuss and sign the acceptable use policy.

After the BYOD launch

Parents and the school community will continuously need information after the BYOD model is launched. The school should be prepared to answer the question from the community: "It's been a year, what has happened?" That means that the school must collect descriptive/anecdotal as well as quantitative data of the results. There should be an opportunity at the end of the first year for students and staff to voice their opinions about the BYOD model. Published digitally, the voices of students talking about and showing the difference the pedagogical shift associated with learning with personally owned devices can be very powerful. Parents and community should always know what you are doing and where you are going next. One of the critical messages will be connecting the BYOD implementation to improved student engagement, relevancy of learning and academic achievement. The modes for such learning can and should vary in order to meet all stakeholders needs (e.g., student presentations, student-generated podcasts, informational websites, roundtable discussions, back to school evenings, etc.). One of most impactful ways to engage parents is through websites that provide them with access to information about their child. Such sites must be secure, password protected and can provide the parent with access to the student's e-portfolio, grades, homework assignments with completions, etc.



Some of the high priorities for parents will be the following topics:

- Online safety
- Safety in students bringing devices home
- Internet filtering
- Life balance

In addition to parents, there are multiple other community groups that may be affected, may be able to contribute and participate in the BYOD model and may simply want to get involved. Schools should consider potential partnerships with industry, law enforcement, local and global experts related to digital content and post-secondary institutions. Students will be using the personally owned devices to connect with authentic audiences outside the classroom and community as they research, access digital content, join communities of interest and post their work in public spaces.

Another important community connection is with local resellers and technology service providers. It will be important to keep them posted on which of the BYOD models has been selected, what information

has been provided to parents on device selection and perhaps partnerships in providing methods of financing devices by families or ways in which to secure low cost insurance on devices.

Following are examples of ways in which school authorities and schools are engaging parents before, during and after the launching of the BYOD model:

A Vignette – Community interactions

Source: Rocky View School District

Community. At Rocky View Schools' Springbank Community High School it was a priority to garner input and support from all stakeholders prior to the launch of their one-to-one BYOD initiative. Several strategies proved successful in ensuring this mandate. One key strategy was hosting a series of community engagement meetings. The meetings provided a forum for teachers and administrators to speak with and answer questions from parents and students. The theme of these conversations centered on understanding the *why* behind the initiative. Staff reflected that parents were extremely supportive upon recognizing the enthusiasm and conviction of the staff members and as they came to understand that the initiative was centered on improving student learning. The summary of these conversations can be read here: http://springhs.rockyview.ab.ca/our-school/one-to-one/important-documents/Q-A.pdf/view.

A second important strategy was providing parents with a wealth of information via the school's website: http://springhs.rockyview.ab.ca/our-school/one-to-one. The website includes practical information such as minimum requirements, vendor information and school policy as well as videos, research reports and external links aimed to educate the parents regarding the changing face of education and student needs in the 21st Century. Finally Springbank Community High School chose to evaluate the effectiveness of its one-to-one initiative and published a research paper (See http://springhs.rockyview.ab.ca/our-school/one-to-one/important-documents/21st%20Century%20Learning%20Environments.pdf/view) to share the results of these evaluations with all stakeholders.

Parent and community interactions

Source: Wolf Creek Public Schools

Parent interactions. Wolf Creek Public Schools use the following link to communicate with parents http://www.bluffton.wolfcreek.ab.ca/031D3B3C-000F810F.15/Bluffton%20SSDZ%20FAQ.pdf.

Community interaction. Parents review an online document before sending a device to school. http://rhs.wolfcreek.ab.ca/documents_directory/FOV1 0004B8FC/rimbey_AUP.pdf?Templates=RWD&ConfPosition=1

Appendix A: Bring Your Own Device - A Vision for Education in Alberta

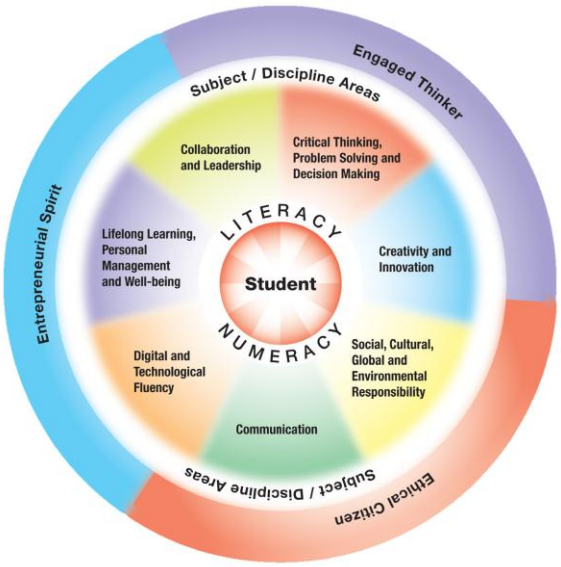
The vision for education in Alberta

Students today live in a networked world where they have real-time access to ideas, people, resources and communities 24/7. Alberta's education leaders recognize that while the province has an excellent education system, the world is constantly changing.

> *"By acknowledging and responding to these changes, we are ensuring that we continue to prepare students well."*
>
> *- Alberta Education (2010)*

In 2009 and 2010, thousands of Albertans expressed their hopes, dreams and aspirations for the education of children. These were expressed in the *Transforming Education in Alberta: Inspiring Education Steering Committee Report* (Alberta Education, 2011), which established three big ideas (the Three E's) that would position Alberta's education system for success in 2030. The Three E's provide a profile for the 21st Century learner, as described by Alberta Education: 1) engaged thinker, 2) ethical citizen and 3) entrepreneurial spirit.

FIGURE 5: ALBERTA EDUCATION'S VISION FOR A 21ST CENTURY LEARNER



Technology plays a dual role in this new vision for learning. On the one hand, technology combined with human ingenuity has influenced societal innovations, transformations and globalization, which in turn, are the impetus for redesigning learning in this 21st Century (ATS-21C 2010). On the other hand, it serves as a vehicle for the personalization, inquiry, authenticity and collaboration that will be required to achieve the Three E's in the profile of the 21st Century learner envisioned by Albertans.

In many ways, students are already creating their own learning systems quite naturally by using the Internet and mobile technologies in their daily lives. Students' technology experiences are personalized and highly participatory given the volume of daily

texting and instant messaging and – due to the ready access to audiences for Facebook, YouTube, blogs, Twitter and Flickr – information rich. That said, young students are not yet experts at learning. It is only through the guidance and leadership by educators who are open to innovations in teaching and learning, through innovative uses of these technologies, that learning in the 21st Century will be maximized equitably and responsibly for all students.

Personal interests, individual perspectives and available access drive students' formal and informal learning–enabling personalization of learning. Research indicates that personalization increases engagement and deep learning (Pollard & James 2004; & McLoughlin & Lee 2008). Due to the social nature of youth, their learning happens most often through interactive participation through online communications, collaborations and communities. Such participation is on a continuum, ranging from short bursts of communication at one end, to highly intensive collaborations in tightly knit communities on the other. Student participation in highly interactive environments often results in students expressing themselves through individual and group products and compositions. YouTube, Flickr, Facebook and other social media offer extensive opportunity for audiences to view, interact with and react to student productivity.

In situations where students have personally owned devices, learning can and should be different – given appropriate pedagogy, teacher readiness for 21st Century skills and a school/school authority 21st Century learning culture (see Section 5 for a discussion of pedagogy). Those differences made possible through access to personally owned devices can contribute greatly to attainment of the vision of the 21st Century learner described by Alberta Education in the Three E's. Each of the following vignettes provides insights into classroom practices that embody the respective trait (Engaged Thinker, Ethical Citizen and Entrepreneurial Spirit).

An **Engaged Thinker** is defined as one who thinks critically and makes discoveries; who uses technology to learn, innovate, communicate and discover; who works with multiple perspectives and disciplines to identify problems and find the best solutions; who communicates these ideas to others; and who, as a life-long learner, adapts to change with an attitude of optimism and hope for the future (Alberta Education, 2011).
Technology can makes this possible by enabling the following:

- Exploration of connections between students' studies and their interests.
- Built-in scaffolds and supports for students with diverse learning needs.
- Communications with peers, experts and others inside and outside their local community.
- Choice in the medium students use for expressing opinions, communicating ideas and demonstrating what they have learned.
- Students with a voice in their own learning.

Today's students will continue to study a variety of topics within subject area disciplines, but in different ways. Through technology they will be able to personalize their learning by exploring content sites of

their choice, working at their own pace and investigating resources in the order they choose. Through personally owned devices they can join communities of learners to explore topics of mutual interest; collaborate with others on projects; and produce high quality digital products that rival the quality of professionals.

An **Ethical Citizen** is defined as one who builds relationships based on humility, fairness and open-mindedness; who demonstrates respect, empathy and compassion; and who, through teamwork, collaboration and communication, contributes fully to the community and the world (Alberta Education, 2011).

Technology makes this possible by enabling students to become active participants and contributors in off-line and online communities. Such participation can result in students:

- Gaining valuable experience in cooperative and collaborative teaming on joint projects.
- Learning responsible, safe and appropriate participation in online learning communities.
- Observing strong models of interactive participation and relationship building.
- Becoming active participants in a community-based project in which they have a keen interest.
- Contributing to the work of a team on an authentic task that might have local and/or global value.

Someone with an **Entrepreneurial Spirit** is defined as one who creates opportunities and achieves goals through hard work, perseverance and discipline; who strives for excellence and earns success; who explores ideas and challenges the status quo; who is competitive, adaptable and resilient; and who has the confidence to take risks and make bold decisions in the face of adversity (Alberta Education 2011).

Technology makes this possible by enabling students to:

- Use the devices for the purposes of planning, time management, calendaring and reflecting on their work for evaluative purposes.
- Extend school-based investigations into informal learning outside of school. Often, students will go beyond the assignment to learn, investigate and contribute within a community of interest.
- Participate in investigative work through which the student sets high standards and works hard to achieve those goals, in part through online support networks of experts, peers, teachers and community.
- Gain experience in the process of joining a group, figuring out group norms, communicating with members of the group, joining evidence-based discussions and finally, having the confidence to form an evidence-based opinion and have the confidence to defend that position under adversity.
- Contribute to the work of a team on an authentic task that might have local and/or global value.

Such experiences can result in students becoming more confident, self-directed and creative in the ventures they pursue; all of which contribute to the entrepreneurial spirit.

The following vignettes represent the three E's. As noted in the previous section, these vignettes could be supported by school-owned devices or personally owned devices. However, for many school authorities BYOD models represent a viable strategy for achieving access immediately, in order to meet students learning needs.

A Vignette – the Engaged Thinker and Ethical Citizen

Based on a unit from the Greater St. Albert Catholic School District

Mr. Cole's middle school Social Studies class was studying about local government. A strategy he used was to sensitize his students to local issues by asking them to access the local paper each day and discuss the stories they considered worthy examples of community or public service. One story that quickly made it to the top of everyone's list was a story about a local town councilman, Mr. Courter, who had secured philanthropic funding for five or six community playgrounds. These playgrounds would provide both play equipment for children and a fitness circuit for both children and adults. Mr. Cole's class decided to get involved. Through e-mail, they contacted the councilman and offered to assist him in gathering information that might help him to decide where to place the playgrounds. Mr. Courter accepted the offer.

The students did some analysis of the factors that should influence the placement of the playgrounds: availability of space, lack of current opportunities, density of potential users and other factors. They formed groups and each group chose one of those factors and devised strategies for assessing that factor. In some cases students identified data sources that could be tapped such as online census data maintained by the city. In other cases they developed items for a survey that they would create online using the website Survey Monkey.

Mr. Cole's class contacted the local paper, which agreed to do a story on the project, publish the URL to the survey in the paper and provide a link to the survey on their website. Each team gathered data related to their factor and conducted an individual analysis of the data related to their team's factor. They were required to summarize those data in a student-friendly spreadsheet and then write a set of findings. In some cases the teams were able to use Geographical Information System (GIS) data to map the community, population density and other factors, to make their case. Each team created a two-minute vodcast making the case for specific park locations based on their single factor. The vodcasts were submitted to Mr. Cole for assessment purposes. The teams then met to discuss the findings, summarizing them in a group report. That report was submitted to the Council and the students presented their recommendations at a City Council meeting (Alberta Education 2009).

A Vignette – the Engaged Thinker with Entrepreneurial Spirit

Based on a report from the Public Broadcasting Services (PBS) Teachers' Community

Imagine students investigating ways to improve local transportation systems. Roads in urban settings often need expanding to meet the growing needs of increasing population bases. The design of such systems typically has serious constraints, due to limited space and existing segments of roads already in place that cannot be changed. A teacher decides this might be just the kind of project high school students with a driver's license might be interested in. She works with local transportation officials to design a request for proposal (RFP) to increase the efficiency of a local stretch of road. That RFP is then presented to the students in the local high school who are studying systems thinking – the study of the structures, patterns and inter-relationships within a system, with the intent of increasing effectiveness and efficiency.

Students use personally owned devices (iPhones and computers) to research that stretch of the road. Based on their research, they develop a mathematical model showing the roadway as a system of interconnected inputs and outputs. Such inputs and outputs are the building blocks of any system, be it the circulatory system, a waterway or in this case the ebb and flow of traffic. The students form "consulting firms" to respond to the RFP. After developing and signing contracts among members of their firm, students download usage data sheets from the official provincial transportation site, use their iPhones (both Skype and voice) to interview road officials, ask questions of officials on several occasions through a chat room, take notes and gather audio files using their personally owned devices. Then they model the flow of traffic along that stretch of road at peak hours, research the range of possible changes they could make to the system (e.g., vehicle entry and exiting, speed limits, lane structures, incentives for off-peak hours, additional exits, etc.) and design their team's proposed improvements to the road. Each consulting group of students develops a proposal, based on data they have gathered, which includes graphics, to present to officials in response to the RFP on how the public transportation system could improve the efficiency of the road.
http://www.pbs.org/teachers/innovators/gallery/2010/entries/594/

Vignette – 3 E's and the Inclusion of Learners with Diverse Needs

Source: Wolf Creek Public Schools

A Grade 5 student with a visual impairment is able to engage in classroom content and participate in a more meaningful way since he has been using a laptop. The device has been set up with a larger monitor, keyboard and mouse to essentially create a desktop workstation for him. Wolf Creek also uses the accessibility settings in Microsoft to enlarge the screen and modify the contrast. He has wireless connections to his network drives, access to printers and the ability to share his desktop or engage with the teacher's by using SMART Bridgit conferencing software. He was previously unable to participate in activities at the electronic whiteboard, but can now do so from his own desk. With the added mobility that the laptop adds he can also be more engaged in multiple areas of the school as he is often moving from class to class.

A girl in Kindergarten now has the ability to communicate in her class with the use of an iPad and an app for signing. In rural communities it can be very difficult to find a transliterator, but anyone can use an app and learn how to communicate with this child. The device seems to create immediate engagement and makes the process of learning how to sign much more exciting. Where this student would once shut down and refuse to make further attempts at communicating, she is now fully engaged and often wants to continue on when it is time to start a new task.

The use of specialty software programs has been a benefit to many students using personally owned devices. Student assessments often suggest the use of specialized software programs for multiple needs. After trials of many different software solutions, Wolf Creek has confidently been able to implement programs that it feels are best suited to meet student needs. Students who cannot express themselves verbally or may be reading below grade level have used Read & Write Gold for text-to-speech support. Those with mobility/dexterity needs who cannot access the keyboard are using Dragon Naturally Speaking for speech-to-text support, touch screen computers or switches to enable access to their devices. The use of an MP3 player is supporting students in both areas mentioned above and students are using mobile devices with apps to facilitate augmented communication in multiple ways.

Section References

Alberta Education. (2011)**.** *Transforming education in Alberta: Inspiring Education Steering Committee Report*. Accessed 08/08/11 from http://www.inspiringeducation.alberta.ca/Home/Newsroom/tabid/75/Default.aspx.

Woodbury, D. (n.d.) *PBS teachers: Innovation awards gallery.* Accessed 11/10/11 from http://www.pbs.org/teachers/innovators/gallery/2010/entries/594/.

Alberta Education. (2009). Emerge One-to-One Laptop Learning Program. Site Visitation in Greater St. Albert Catholic School District. Evaluator's reference notes.

Appendix B: Definitions

Cloud computing is the expansion of local networks into a system of networks that include high capacity computing resources, storage in data farms, a range of computer applications and opportunities for collaboration and connections. The three types of services associated with cloud computing are:

- *Single function end-user services* such as Gmail (http://gmail.com), Google documents (http://docs.google.com) or Flickr for storing and browsing collections of images (http://www.flickr.com).
- *Networking infrastructure* with no end-user services, but rather the platform upon which an entity might build such applications (e.g., Google App Engine (http://code.google.com/appengine) or Heroku (http://heroku.com).
- Computing resources without a development platform (e.g., GoGrid (http://www.gogrid.com) or Amazon's Elastic Compute Cloud (http://aws.amazon.com/ec2/)).

Deep learning is the critical analysis of new ideas, linking those ideas to already known concepts and principles and leads to understanding and long-term retention of concepts so that they can be used for problem solving in unfamiliar contexts (United Kingdom Higher Education Academy 2008).

Mobile devices have become affordable and provide users with 24/7 access to ideas, resources, people and communities. An individual may use different devices depending on the person's needs. The devices fall into six basic categories and all represent personally owned devices that may show up in classrooms:

- *Laptop computers* are portable computers that can be used with or without the Internet
- *Netbook computers* are portable computers that gain most of their functionality through the Internet
- *Smart phones/handhelds* blur the lines between the Internet and cellular networks (e.g., Blackberries, android, iPhone, personal digital assistants, etc.)
- *Tablet computers fall along a continuum from laptop-like to large size smartphones (e.g.,* iPad, android tablet, etc.)
- *E-book readers (Kindle, iPad, etc.)*
- *Audio MP3 Players (iPod, etc.)*

Personally Owned Device refers to any technology device brought into the school and owned by a student (or the student's family), staff or guests. Such devices may include cellular phones, smart phones, personal digital assistants, MP3 players and portable computers such as laptops, notebooks, tablets, iPads and netbooks.

Online, collaborative environments are virtual meeting places for community interactions. The types of environments include (New Media Consortia 2010):

- *Ad hoc environments* that bring communities of interest together temporarily. The Web 2.0 tools to do so might include backchannels through Twitter, threaded conversations, chats on webinars or other platforms, discussions through VoiceThread, etc.
- *Social networking* sites where users interact by establishing profiles, friending, messaging, joining groups, sharing documents, etc. (e.g., Facebook, Ning, Flickr, TakingItGlobal, YouTube).
- *Collaborative project*s that enable schools to interact with other schools around learning units (e.g., iEARN, Global School House, Web-based Inquiry Science [WISE]).

Section References

Creative Commons. (n.d.). Attribution license. Accessed 04/22/11 from http://creativecommons.org/licenses/by/3.0/.

United Kingdom Higher Education Academy 2008). Deep and Surface Approaches to Learning. [Definitions compiled from Biggs,1999; Entwistle, 1988; & Ramsden, 1992.] Accessed on October 1, 2008 from http://www.engsc.ac.uk/er/theory/learning.asp.

The New Media Consortium. (2010). 2010 Horizon Report: K12 Edition. Accessed 12/20/10 from http://www.nmc.org/publications/2010-horizon-k12-report.