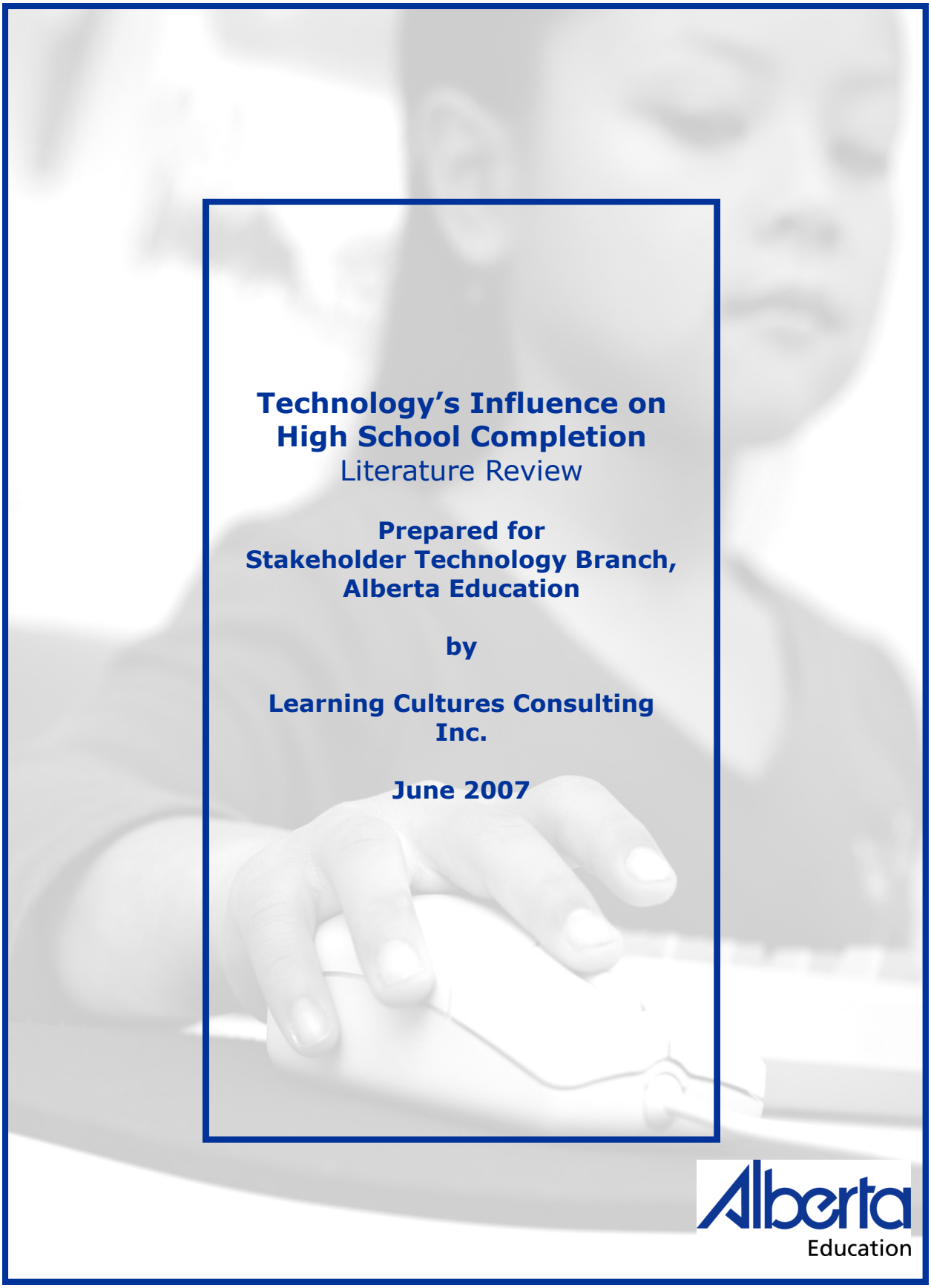

Technology's Influence on High School Completion

Literature Review

Prepared for
Stakeholder Technology Branch, Alberta Education

by

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Alberta Education

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http://www.education.gov.ab.ca/highschool/pdf/techlitreview.pdf
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A Shared Vision [1]

To create a technology-infused learning environment where at-risk students become motivated, self-directed learners who can work collaboratively through various technologies as evidenced by attendance and completion of meaningful academic performance and multimedia tasks that reflect higher-level thinking processes.

[1] Excerpted from National Foundation for the Improvement of Education (NFIE); "At-Risk Students: Technology's Particular Promise", *Connecting the Bits*; 2000; <http://www.neafoundation.org/publications/ctb8.pdf>, Retrieved June 2007

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1. Purpose

This literature review is intended to provide both background and practical research-based information to guide educators' decision making as they strive to improve high school completion rates in Alberta through the use of technology. The information is presented in the form of answers to the following questions:

- What has happened to address high school completion in Alberta?
- What does the research say about how technology has improved high school completion rates?
- What strategies might be appropriate in Alberta and how might these strategies best be implemented?

Although important to the decision-making and planning processes, this literature review does not delineate the myriad of risk factors associated with leaving school early, nor does it detail the many types of strategies that are not technology-based but have been found to be effective in preventing students from leaving school early.[2]

2. Executive Summary

Background

Alberta's K-12 education community is actively pursuing a variety of strategies to improve high school completion rates. Among these, are strategies designed to meet the needs of special populations (e.g., at-risk students, students with diverse needs,[3] and First Nations, Métis and Inuit students) as well as strategies that have the potential to benefit *all* students (e.g., Safe and Caring Schools initiatives, and learning and technology initiatives). This work has been informed, in part, by the activities of the High School Completion Task Force and the *Learning and Technology Policy Framework.*

Literature Review

This literature review was commissioned in an effort to determine *technology's* influence on high school completion. The research findings from approximately two dozen articles and publications dating from 2000 to 2007 are reported in this literature review. These articles and publications were obtained via electronic database and Internet searches and were chosen for reasons of: currency; the relevancy of their findings to the guiding question; the strength of their reported research methodology; and the reputability of the author/organization/journal within the educational community (e.g., North Central Regional Educational Laboratory, National Foundation for the Improvement of Education, Association for Supervision and Curriculum Development, University of Calgary).

The evidence provided by this review suggests that technology-based strategies have the potential to positively influence high school completion rates for *all* students, including those at-risk and those with diverse needs. According to the research, technology-based strategies have been shown to:

[2] For a discussion of risk factors and effective prevention strategies, see the document by the National Dropout Prevention Center and Communities in Schools, Inc. entitled *Dropout Risk Factors and Exemplary Programs: A Technical Report*, May 2007 (the executive summary, retrieved June 2007, can be found at http://www.dropoutprevention.org/resource/major_reports/communities_in_schools/Dropout%20Risk%20Factors%20and%20Exemplary%20Programs%20Executive%20Summary%205-16-07.pdf). Consult Sections 6 and 7 for additional information about risks and effective strategies associated with early school leaving.

[3] Also referred to as special needs.

- improve the relevancy and richness of students' learning experiences, nurture collaborative learning communities, and motivate and engage students:
  - by enabling authentic technology-mediated project-based learning; strengthening school, family and community ties; and enhancing and expanding assessment practices and processes (National Foundation for the Improvement of Education, 2000);
  - by using Information and Communication Technology (ICT) to support engagement, research, writing, editing, and presentation of work (Passey, 2004);
  - by using a constructivist approach involving project-based, student-centered activities that result in students taking an active role in their own learning (Brown Yoder, 2006);
  - by using computers to work through complex problems and tap into higher order thinking skills, as well as deepen their thinking and enhance their work products across subject areas (Wenglinsky, 2006); and
  - by enhancing teachers' abilities to support a broad range of student identities and learning styles; providing students with opportunities to acquire 21st century skills (i.e., enhance their systems, analytical and critical thinking; collaboration skills; teamwork; cross-cultural exchanges; problem solving; and media literacy); expanding teacher and student access to learning resources; and minimizing the digital divide (The Hospital for Sick Children, and the Ontario Ministry of Education and Training, 2005, and NCREL, 2005);
- offer choice and flexibility to students:
  - by participating in flexible virtual learning environments, where communication is mediated through various types of technology (Batt, 2003);
  - by overcoming barriers and contributing to increased success rates through participation in online and blended learning programs (Edmonds and Li, 2004);
  - through participation in mentor-supported online learning programs with web conferencing and well-defined communication cycles (Ascione, 2005); and
  - by using online sharing and collaboration tools to forge home-school communication links and enhance classroom activities (Lindsay, 2006);
- improve students' chances of academic success:
  - by improving achievement in mathematics and reading through the instructional use of integrated learning systems, reading and writing programs, and word processing (Slavin, 2005);
  - by using graphing software to improve mathematical concept development (Ward, 2006);
  - by using e-mail to motivate students to write and to improve their literacy skills (DiScipio, 2006);

According to the research, technology-based strategies have been shown to:

- **improve the relevancy and richness of students' learning experiences, nurture collaborative learning environments, and motivate and engage students;**
- **offer choice and flexibility to students;**
- **improve students' chances of academic success;**
- **strengthen teacher-student and home school relationships; and**
- **improve the level of independent learning among students.**

  - by participating in hands-on learning programs that integrate mathematics, science, and technology education and providing students with opportunities to experience success and achievement (Cardon, 2000);
  - by improving employment, retention, and achievement outcomes through career and technical education (Brown, 2003); and
  - by teaching ICT literacy skills, specifically those related to multimedia literacy in Web, publishing, and video production (NCREL, 1999/2005);
- strengthen teacher-student and home-school relationships:
  - by enabling social skills training; providing appropriate expressive outlets; encouraging parental and community involvement; communicating high expectations; celebrating uniqueness; encouraging critical thinking and offering choice; expanding delivery options; and emphasizing collaborative problem solving (Teague, 2004);
- improve the level of independent learning among students:
  - by using technology as a performance support (e.g., digital text and text-to-speech software, dictation tools, and web-based calculators) (Edyburn, 2006);
  - by using handheld PCs to promote independence and productivity in transition-related tasks (i.e., those tasks related to students' transition from school to work and/or independent living) (Riffle, 2005);
  - by using computer-based cognitive-mapping strategies to improve independent learning as well as reading comprehension and retention (Blakenship, 2005); and
  - by using instructor-created video to improve the attainment of skills and the level of independence (Mechling, 2005).

Using technologies in various ways to support teacher professional development programs and data-driven decision making have also been shown to improve high school completion rates (AISI Clearinghouse: Promising Practices; retrieved June 2007), although their impact is less direct.

These findings support the contention that "integrating technology into the curriculum properly can produce dramatic change and improved prospects for at-risk students."[4] The key word in this statement is "properly". Technology, in and of itself, does not produce these improvements. Best practice in meaningful technology integration and implementation makes the difference.

Best Practice Advice

The literature reviewed in this document describes technology's proven potential to improve high school completion rates. However, to realize this potential it will be important to not only refer to previous findings (e.g., those summarized in Section 4 as well as those of the High School Completion Task Force and any local needs analyses that might be available) but also to:

- consider and share the lessons learned by various educators and researchers in their implementation of technology-based strategies (i.e., it has been shown that implementing multiple evidence-based strategies that address various risk factors contributes to overall success when the strategies are fully implemented as they were designed);
- explore what synergies might be realized among the various strategies shown to improve high school completion rates (e.g., relevancy and learning strategies; instructional focus

[4] National Foundation for the Improvement of Education (NFIE); "At-Risk Students: Technology's Particular Promise", *Connecting the Bits*; 2000; <http://www.neafoundation.org/publications/ctb8.pdf>, Retrieved June 2007

strategies; accountability strategies; community involvement strategies; school structures strategies);

- determine what success will look like and how it will be measured (e.g. engaged students and facilitative teachers, authentic tasks, performance-based assessments, collaborative learning environments, equitable and flexible groupings, ubiquitous access to interoperable technologies);
- stay abreast of current technology trends (i.e., developments and uses of the Internet, and computer and emerging technologies in education and society); and
- track progress toward meeting the essential conditions for meaningful technology integration.

3. Background: What has happened to address high school completion in Alberta?

Introduction

The Kindergarten to Grade 12 (K-12) community in Alberta works continuously to ensure success for *all* students. Over the past six years, this work has included collaborative efforts to identify and address the needs of students at risk of leaving high school early. A high school completion study was commissioned, a task force was assembled, and a symposium was held. Some of the work that was undertaken focused primarily on the needs of First Nations, Métis and Inuit students as well as students with diverse needs and students whose first language is not English. Other work involved the implementation of learning and technology initiatives designed to benefit *all* students. The research and foundational work that has been done to date provides an important context for this literature review and is therefore briefly described below. For a more thorough discussion of the results and recommendations of these previous efforts, see each referenced report.

High School Completion Study, Task Force, Symposium and ACOL Recommendation

A study of the barriers to high school completion was completed and summarized in an Alberta Education report entitled *Removing Barriers to High School Completion – Final Report* (2001). This report[5] put forward several suggested outcomes for further consideration with stakeholders. These outcomes included:

- enhancing early childhood development supports;
- listening to and supporting students;
- managing student alienation;
- increasing opportunities for success among Aboriginal students;
- increasing students' knowledge of self and the effects of labeling;
- increasing program flexibility;
- enhancing cooperative education opportunities;
- improving student tracking; and
- supporting, enhancing, and strengthening promising practices related to high school completion strategies and initiatives.

Alberta Education set high school completion targets of 78%, 79% and 80% for the 2007-08, 2008-09 and 2009-10 school years respectively.

– Alberta Education Business Plan 2007-10

This report also led the Department to set increasingly higher targets for high school completion within its annually-updated business plans[6]. In 2002-03, the target was to increase high school completion rates from 70% to 75% within five years. Having attained a 77.4% high school completion rate in 2006-07, the latest targets set for the 2007-08, 2008-09 and 2009-10 school years were 78%, 79% and 80% respectively.

[5] Alberta Education; System Improvement and Reporting; *Removing Barriers to High School Completion – Final Report*; September 2001; <http://www.edc.gov.ab.ca/k_12/special/BarrierReport.pdf>; Retrieved June 2007

[6] See the *Alberta Education's Business Plans* at http://www.education.gov.ab.ca/department/businessplan/.

Subsequent to this study, the Alberta Commission on Learning (ACOL) released its report[7] which encouraged further improvements to high school completion rates. One of the actions taken by Alberta Education in response to this report was to strike a task force.[8] The task force reaffirmed ACOL's strategies for increasing high school completion and highlighted existing efforts that either directly or indirectly support high school completion including:

- **Safe and Caring Schools** initiatives (see http://www.edc.gov.ab.ca/safeschools/ for more information);
- **Effective Behaviour Support** (see http://www.education.gov.ab.ca/safeschools/ebs.asp for more information);
- **Alberta Initiative for School Improvement** (AISI) projects that focus on high school completion (search the AISI Clearinghouse at http://www.education.gov.ab.ca/k_12/special/aisi/ to view project summaries). Relevant literature reviews were also produced including: The Issue of Early School Leaving, 2005; School Climate, 2005; Student Transitions, 2006; Career Planning, 2005; and Career and Life Management, 2005;
- expansion of alternative program delivery models (see the policy at http://www.edc.gov.ab.ca/educationguide/pol-plan/polregs/115.asp and the *Alternative Programs Handbook* (2003) at http://www.education.gov.ab.ca/educationsystem/AltProgHandbook.pdf for more information); and
- meeting students' diverse learning needs (see http://www.education.gov.ab.ca/k_12/specialneeds/ for more information).

The task force also put forward twenty-five recommendations across the following five areas:

- Success for All Students;
- Classroom and School Climate;
- Career Exploration and Planning;
- Student Supports; and
- Research and Ongoing Improvement Initiatives.

The task force used "at risk of not completing high school" as their operational definition of "at-risk" and shared the common belief that "not completing high school" is "a process – not a decision made at a single point in time." Based on this definition and belief, the task force stated that "ministries, community agencies, school jurisdictions and the teaching profession need to work together to provide appropriate services to students and their families so that all students can successfully complete high school."

To that end, Alberta Education hosted the *Your Future Starts Here Symposium*[9] in September 2006. The Symposium's purpose was "to sift through the complex array of factors that influence youth and their decision to leave high school, to identify where … the greatest impact [can be achieved], and to set out practical actions that can and should be taken to improve high school completion rates."

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[7] Alberta's Commission on Learning, *Every Child Learns, Every Child Succeeds: Report and Recommendations Alberta's Commission on Learning, October 2003*, <http://www.education.gov.ab.ca/commission/PDF/CommissionReport.pdf>, Retrieved June 2007

[8] The task force released the following report in November 2005: Alberta Education; *High School Completion Rate Task Force Report: Responding to Alberta's Commission on Learning (ACOL) Recommendation 11*; November 2005; <http://www.education.gov.ab.ca/highschool/pdf/HighSchoolCompletionRateTaskForceReport.pdf >; Retrieved June 2007

[9] Alberta Education; *High School Completion Symposium Summary Report*; September 2006; <http://www.edc.gov.ab.ca/highschool/pdf/AE_HSSYMPOSIUM_FINAL.pdf>; Retrieved June 2007

Participants at this symposium identified key factors that influence high school completion (e.g., positive school climate, interesting and relevant curriculum, match between teaching styles and students' learning styles; and high expectations) and identified several actions that could be taken to address these causal factors (e.g., enhancing teacher/student relationships, improving flexibility and options for students; increasing cooperation among schools, community, and business; and working with universities to improve teachers' abilities to adapt their teaching approaches).

Efforts to Support High School Completion for First Nations, Métis and Inuit Students

In addition to the initiatives listed on page 9, Alberta Education's *First Nations, Métis and Inuit (FNMI) Education Policy Framework* put forward a strategy that focuses on increasing high school completion rates. The corresponding progress report released in May 2003[10] described several actions that have been taken to meet this strategy including: the hiring of specialists to implement the framework; the partnership with Edmonton Public Schools to create the Amiskwaciy Academy (http://amiskwaciy.epsb.net/); the joint venture with Edmonton Catholic Schools known as the Rainbow Spirit Project (http://www.ecsd.net/programs/rainbowspirit_project.html); and eight AISI projects aimed at providing direct assistance for Aboriginal students to increase school attendance, provide cultural awareness and professional development for staff, provide student support, and promote parental involvement.

Learning and Technology Initiatives to Support Success for All Students

Finally, several learning and technology initiatives have been undertaken that have been shown to have the potential to benefit *all* students. These initiatives, guided by Alberta Education's *Learning and Technology Policy Framework*[11] and informed by research, include:

- The **ICT Programs of Study** which provide students with a broad perspective on the nature of technology, how to use and apply a variety of technologies, and the impact of information and communication technologies on themselves and on society. The ICT curriculum is not intended to stand alone, but rather to be infused within core courses and programs (see http://www.education.gov.ab.ca/k_12/curriculum/bySubject/ict/ for more information);
- The **Educational Standing Offers** (ESOs) initiative was undertaken to address issues related to technology integration (e.g., affordability, interoperability, sustainability). ESOs enable jurisdictions to acquire selected technology products from a centralized product catalogue at educational pricing levels that would not be available using independent purchasing arrangements (see http://ednet.edc.gov.ab.ca/technology/Solutions.asp and http://www.edc.gov.ab.ca/k_12/specialneeds/atl/resource.asp for more information);
- Alberta Education's **LearnAlberta.ca** web site, which is a password-protected searchable database of curriculum-aligned digital learning resources designed for in-school and at-home use by students and teachers in Alberta's K-12 community (see http://www.learnalberta.ca to search or browse for resources);
- Several **videoconferencing projects** that are being implemented to help realize a shared vision for sustainable, standards-based videoconferencing in Alberta that expands access to learning, connects and engages learners, provides access to specialized services,

[10] Alberta Education; *First Nations, Métis and Inuit Education Policy Framework: A Progress Report*; May 2003; <http://www.education.gov.ab.ca/nativeed/nativepolicy/pdfs/FNMIProgRep.pdf>; Retrieved June 2007; Goal 2: Excellence in Learner Achievement, Strategy 2.1 reads: Increase the attendance, retention and graduation rates of the First Nations, Métis and Inuit students attending provincial schools.

[11] Alberta Education; *Learning and Technology Policy Framework* (2004); <http://education.gov.ab.ca/reading/policy/techframework/ LTfwrk.pdf)>; Retrieved June 2007

enables collaborative professional development, realizes administrative efficiencies, and results in a universal culture of acceptance (see http://education.gov.ab.ca/technology/videoconf.asp, http://www.vcalberta.ca/ and http://www.vcalberta.ca/community/litreview.pdf for more information);

- The **SuperNet**, a high-capacity network that connects schools in Alberta's 429 rural, urban and remote communities. This network provides high-speed access to online resources and improved user experiences in online learning and collaboration settings to teachers and students throughout Alberta (see http://www.albertasupernet.ca/ for more information); and
- ***e*merge**, Alberta Education's one-to-one wireless learning initiative. *e*merge was undertaken to further investigate the potential educational benefits of one-to-one mobile computing in grades 3 to 12 classrooms in Alberta. The themes being addressed by the twenty participating school divisions are enhancing teaching and learning for specific student populations, and improving student learning in targeted areas (see http://ednet.edc.gov.ab.ca/technology/emerge/ for more information).

Research[12] has shown that successful implementations[13] of these types of learning and technology initiatives have the potential to:

- enhance learning opportunities through equitable access to affordable, interoperable and sustainable technologies;[14]
- increase collaboration between schools; enhance language learning; increase accessibility to learning opportunities; include subject experts and specialized experts into classroom study; enhance multicultural exchanges; establish links between schools, industry, and the community; and increase access to professional development opportunities for teachers;[15]

Research indicated that successful implementations of learning and technology initiatives have the potential to increase student motivation, engagement, interest, and attendance as well as improve teacher-student interaction — key factors that positively influence high school completion.

– One-to-One Mobile Computing: Literature Review (August 2006)

- facilitate the attainment of 21st century skills; improve student attitudes; increase student motivation, engagement, interest, and attendance; improve teacher-student interaction; reduce student attrition; increase parental and community involvement; and result in positive changes in the teaching and learning environment;[16] and
- connect and engage learners. "Engagement for today's student is tied to choice, clear expectations, relevant and meaningful curriculum, opportunities for team work, communication, cooperation and collaboration with peers and their teachers, being part of the decision-making process, multi-sensory interactive environments, personalization

[12] Alberta Education commissioned literature reviews, environmental scans and profiles to inform the learning and technology initiatives undertaken by the Department and its stakeholders. These informational documents can be found by following the links in the bulleted list above. See the References for more information.
[13] Successful technology implementations are those that address essential conditions such as those put forward by the International Society for Technology in Education. See http://cnets.iste.org/administrators/a_esscond.html for more information.
[14] Excerpted from the positive outcomes outlined on the *Technology Standards and Solutions* web page. See http://ednet.edc.gov.ab.ca/technology/Solutions.asp for more information.
[15] Canadian Association for Distance Education, et al; *Videoconferencing in Kindergarten to Grade 12 Settings: A Review of the Literature*; 2005; <http://www.vcalberta.ca/community/litreview.pdf>; Retrieved June 2007
[16] Alberta Education; *One-to-One Mobile Computing: Literature Review*; August 2006; <http://ednet.edc.gov.ab.ca/technology/emerge/resources/litreview.pdf>; Retrieved June 2007

> options, and use of a variety of appropriate technologies (Lemke, 2003, Prensky, 2005/06, St. Lifer, 2005, Gardner, 2005, Chester 2002)."[17]

These potential benefits align with and therefore may help to address some of the reasons that students leave high school early.

Summary

As can be seen from the discussion above, Alberta's K-12 education community is actively pursuing a variety of strategies to improve high school completion rates. Among these are strategies designed to meet the needs of special populations (e.g., students with diverse needs and First Nations, Métis and Inuit students) as well as strategies that have the potential to benefit *all* students (e.g., Safe and Caring Schools initiatives, and learning and technology initiatives).

[17] Alberta Education; *e-Learning Environmental Scan: Needs and Preferences / Trends and Promising Practices*; March 2006; <http://www.education.gov.ab.ca/technology/elearning/scan.pdf>, Retrieved June 2007

4. Literature Review: What does the research say about how technologies have improved high school completion rates?

> "More than a decade of research, development, and implementation make it clear that … integrating technology into the curriculum properly can produce dramatic change and improved prospects for at-risk students."
>
> "At-Risk Students: Technology's Particular Promise", *Connecting the Bits* (2000)[18]

Introduction

What does the research say about how technologies have improved high school completion rates? This is a complex question requiring, at a minimum, an explanation of what is meant by technology.

Technology, in this case Information and Communication Technology (ICT), can take many forms and be used in many ways in today's schools and classrooms.[19] ICT use can involve:

- students participating in partial to complete technology-mediated learning environments (i.e., a blended or virtual learning environment with access to learning management systems, social networks, and other emerging technologies and participating in videoconferences, web conferences, webcasts, podcasts, WebQuests);
- students and teachers using curriculum-aligned digital/multimedia learning resources or learning objects (e.g., video clips, simulations, animations, interactive applets, graphics, images, text, audio clips or any combination thereof) and computer-based tools (e.g., word processing, spreadsheet, database, and presentation software) to support teaching and learning; and
- students, teachers, administrators, parents and others using several technologies across various networks to improve the efficiency or effectiveness of a learning program or administrative process. This could involve providing: various program choices (e.g., alternative programs, including High School Equivalency Diploma, that include a variety of media-rich, technology-mediated learning opportunities within a customized individual learning program to facilitate academic/social engagement);

ICT use can involve:

- **students participating in partial to complete technology-mediated learning environments;**
- **students and teachers using a variety of digital learning resources and computer-based tools to support teaching and learning; and**
- **students, teachers, administrators, parents and others using several technologies across various networks to improve the efficiency or effectiveness of a learning program or administrative process.**

[18] National Foundation for the Improvement of Education (NFIE); "At-Risk Students: Technology's Particular Promise", *Connecting the Bits*; 2000; <http://www.neafoundation.org/publications/ctb8.pdf>, Retrieved June 2007

[19] For a discussion of the different types of technology and their educational applications, see the North Central Regional Educational Laboratory article entitled "Critical Issue: Using Technology to Improve Student Achievement", posted in 1999 and updated in 2005, <http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm#type>, retrieved June 2007.

flexible scheduling and program delivery options (e.g., continuous admission, part- and full-time, virtual and blended schooling); and various synchronous and asynchronous communications options (e.g., e-mail, text and instant messaging, chat, blogs, discussion forums, VoIP).

Answering this question also requires an explanation of the extent to which these technologies have demonstrated their value in education by describing:

- the context in which the research is occurring (e.g., alterative schools/programs; outreach schools; virtual, blended or face-to-face classrooms; early school leaving prevention or intervention programs);
- what complementary strategies might be in use (e.g., counseling, mentoring, tutoring, conflict resolution, career education);
- how the use of ICT affects the learning process and what evidence students provide of their learning through the use of ICT; and
- how improvements are measured (e.g., high school completion rates (over what timeframe and at what age upon graduation); teacher and/or student satisfaction/attitudinal surveys, observations, and focus groups; academic achievement).

This is especially true when the anticipated improvements resulting from the use of a particular technology or combination of technologies may be less direct. In these circumstances it is important to understand the relationship between ICT use and the desired goals, processes and outcomes.

Given the inherent complexity of this question, the following research[20] was reviewed and has shown the potential of technology-based strategies to improve high school completion rates either by proactively addressing the root causes of early school leaving (i.e., technology-based prevention strategies) and/or by supporting students who have been identified as at-risk of leaving school early (i.e., technology-based intervention strategies).

Technology Shown to Positively Influence Learning for All Students

Means (1997)[21] recognized early on that "technologies can provide meaningful learning experiences for all children, especially those at risk of educational failure." Means suggested that these gains require "a transformation of not only the underlying pedagogy … but also the kinds of technology applications typically used in classrooms serving at-risk students."

Technology improves the relevancy and richness of students' learning experiences, nurtures collaborative learning communities, and motivates and engages students

Today, several examples exist of successful programs where technology has contributed to improved learning among at-risk students. Among them are the *Learning Tomorrow* programs described in *Connecting the Bits.*[22] These K-12 learning and technology programs

[20] The research findings from approximately two dozen articles and publications dating from 2000 to 2007 were reported in this literature review. These articles and publications were obtained via electronic database and Internet searches and were chosen for reasons of: currency; the relevancy of their findings to the guiding question; the strength of their reported research methodology; and the reputability of the author/organization/journal within the educational community (e.g., North Central Regional Educational Laboratory, National Foundation for the Improvement of Education, Association for Supervision and Curriculum Development, University of Calgary).

[21] Means, B.; Vice President, Policy Division, SRI International, Menlo Park, California; North Central Regional Educational Laboratory; *Critical Issue: Using Technology to Enhance Engaged Learning for At-Risk Students*; 1997; <http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at400.htm>; Retrieved June 2007

[22] National Foundation for the Improvement of Education (NFIE); "At-Risk Students: Technology's Particular Promise", *Connecting the Bits*; 2000; <http://www.neafoundation.org/publications/ctb8.pdf>, Retrieved June 2007

were characterized by: a shared vision; a commitment to changing curriculum and to creating a positive, productive school culture focused on teaching and learning in new ways; dedicated teamwork and district support; high-quality professional development; flexible scheduling and instructional management; and a shift from rote learning to project-based learning. Learning in these environments emphasized "intellectual achievement through problem solving and teamwork." Technologies were used in these programs to:

- *enable authentic technology-mediated project-based learning*. Learning emphasis in *Learning Tomorrow* programs shifted from memorizing facts to inquiry and research where data was analyzed, synthesized and presented, and thereby increased opportunities for student success. Authors stated that digital information sources and presentation tools meant "enhanced engagement and productivity on increasingly complex tasks" for their at-risk students. Teachers became coaches and advisers, creating a collegial learning environment for their students. Students became invested in the quality of their work. Teachers also reported that "project-based learning and authentic, real-world applications increased student motivation, attendance, and willingness to stay with the learning;"

> ***Learning Tomorrow* programs are contributing to improved learning for at-risk students by:**
> - **enabling authentic technology-mediated project-based learning;**
> - **strengthening school, family and community ties; and**
> - **enhancing and expanding assessment practices and processes.**
>
> – results from *Connecting the Bits* (2000), a National Foundation for the Improvement of Education publication

- *strengthen school, family and community ties*. Technology was used successfully: to provide information to families about educational objectives and student progress; to provide social and health resources to meet family needs; and for home use by the family for their own educational and communications purposes. School facilities were also open to families after school. Many schools also recruited community partners, using e-mail and online opportunities to bring resources to the school and export resources back to the community; and

- *enhance and expand assessment practices and processes*. Video records of student work, electronic portfolios, and searchable databases were used and found to be advantageous in that they were "sharable, immediate, and stable." Student involvement in the assessment process was found to engage them in improving their performance and giving them new analytical and process skills. The recognition that many at-risk students received during their assessment presentations to parents, school boards and community members was reported to be a highlight.

Changes resulting from these *Learning Tomorrow* programs were measured in terms of: the transformation of classrooms "from places that many students [wished] to avoid to places where students [were] eager to work"; and the alteration of student attitudes toward school (i.e., "students … have altered their life course to become enthusiastic learners moving toward positive academic and career goals").

Similarly, findings reported by Passey, et al (2004)[23] indicated that ICT helped to motivate students who were disaffected with traditional forms of learning, especially when used appropriately to support engagement, research, writing, editing, and presentation of work. Passey also provided evidence that ICT use impacted positively upon student behaviour in and out of the classroom.

[23] Passey, D., et al; *The Motivational Effect of ICT on Pupils*; 2004; <http://www.dfes.gov.uk/research/data/uploadfiles/RR523new.pdf>; Retrieved June 2007

Brown Yoder (2006),[24] Director of Online Learning at Lesley University in Massachusetts adds her support for the results of these previous studies. In "Adventures in Electronic Constructivism" Brown Yoder states that "a constructivist approach involving project-based, student-centered activities can result in students taking an active role in their own learning and engaging in thought-provoking challenges" thereby "igniting students' curiosity and building an environment that encourages and supports their creativity." She went on to say that these results are further enhanced when "existing technologies and the emerging Web 2.0 applications are integral aspects of information gathering, data analysis and presentation possibilities."

Wenglinsky (2005/2006) [25] summarized a series of National Assessment of Educational Progress (NAEP) studies which examined the link between computer use and student test performance. These studies showed that:

- using computers to help younger students work through complex problems and tap into higher order thinking skills produced greater benefits than using computers to drill students on a set of routine tasks;
- middle school students profited when they used computers in ways that promoted higher-order thinking in specific content areas, while high school students needed to use computers to deepen their thinking and enhance their work products through technology-driven processes that were the same across subject areas (e.g., word processing; creating charts, tables and graphs; creating computer graphics; completing projects; and communicating electronically); and
- students at the extremes of the continuum in terms of their technology skill proficiency required basic computer skills training at the one extreme and technology enrichment opportunities at the other extreme.

A review of several hundred research studies on the effectiveness of technology on student achievement revealed positive gains for students (e.g., improved attitudes toward learning and increased self-esteem; improved motivation and discipline; improvements in critical thinking and analysis skills).

– North Central Regional Educational Laboratory; 1999/2005

In 2005, the North Central Regional Educational Laboratory (NCREL) updated an article entitled "Critical Issue: Using Technology to Improve Student Achievement." This article[26] summarized the results of research conducted between 1993 and 2005; research that revealed positive gains for students through the use of technology. Three examples are described below.

1. The Software and Information Industry Association reviewed 311 research studies on the effectiveness of technology on student achievement and found "positive and consistent patterns when students were engaged in technology-rich environments, including significant gains and achievement in all subject areas, increased achievement in preschool through high school, … and improved attitudes toward learning and increased self-esteem;"

[24] Brown Yoder, M.; "Adventures in Electronic Constructivism", *Learning and Leading with Technology*; September 2006

[25] Wenglinsky, Harold; "Technology and Achievement: The Bottom Line", Association for Supervision and Curriculum Development – *Educational Leadership*; December 2005 / January 2006; <http://www.hccsc.k12.in.us/technology/tip/Teachers'%20Academy/The%20Bottom%20Line.pdf>; June 2007

[26] North Central Regional Educational Laboratory; "Critical Issue: Using Technology to Improve Student Achievement"; posted in 1999 and updated in 2005; <http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm>; Retrieved June 2007

2. Michigan's Freedom to Learn (FTL) initiative, a one-to-one laptop initiative, was credited with improving grades, motivation and discipline, with one school seeing reading proficiency scores increase by 12 to 32%; and
3. Computer technology was reported to help support learning, especially in the development of higher-order skills such as critical thinking, analysis, and scientific inquiry by engaging students in authentic, complex tasks within collaborative learning contexts.

Technology offers students choice and flexibility

In a report out of Queensland, Australia,[27] Batt concluded that "virtual learning environments, where communication is mediated through various types of technology, offer immense potential for rural and remote students to engage in interaction" and that students will benefit from more "flexible ways of engaging with education through the use of ICTs." This Australian virtual schooling system, called *The Learning Space* (http://education.qld.gov.au/learningplace/), has been recently expanded. Online support services have been incorporated for primary and secondary students at risk of disengaging from mainstream education. As a result, the *i-support* program (see http://education.qld.gov.au/learningplace/isupport/) including *Ollie Up* (http://www.learningplace.com.au/deliver/content.asp?pid=17020) and *Stepping Stones* (http://www.learningplace.com.au/deliver/content.asp?pid=14424) are proving successful for at risk students in middle and high schools in the district.

Synchronous and asynchronous online programs in Australia are engaging at-risk middle school students in ICT-infused lessons that focus on literacy, numeracy and social skills.

– results from *Ollie Up*, part of *The Learning Space's i-support* program

Ollie Up is an online program that involves synchronous and asynchronous lessons that integrate ICT into the middle school curriculum where the main focus is literacy, numeracy and social skills. Lesson topics are often driven by students. The program is supported by learning coaches, mentors, and facilitators and employs various technologies including webcams, chat rooms, comic chat, forums, moos, online games, Kahootz ™, data conferencing, teleconferencing, e-mail and Blackboard™. The primary aim of the program is to develop modules that engage at-risk students in learning.[28]

Stepping Stones is an online career education course that also addresses the school-to-work transition. The aim of this initiative is to assist schools to support at-risk students and students in schools with limited access to guidance services. *Stepping Stones* courses are delivered using a variety of technologies including teleconferencing and the Internet for synchronous lessons and Blackboard™ for asynchronous lessons.

Edmonds and Li (2004)[29] studied nine high school teachers' online and blended learning approaches with at-risk students. Their results indicated that these technology-based learning environments helped some students overcome barriers and contributed to increased success rates for at-risk learners. They cautioned, however, that what may be effective for one student

[27] Batt, D.; *i-support! A smart state approach to supporting students at risk online*; 2003; <http://www.odlaa.org/publications/2003Proceedings/pdfs/batti.pdf>, Retrieved June 2007

[28] To view a webcast describing the successes of the Ollie Up program, see http://mediasite.eq.edu.au/mediasite/viewer/Viewer.aspx?layoutPrefix=LayoutTopRight&layoutOffset=Skins/Clean&width=800&height=631&peid=1d344778-f33d-4cdb-9ccf-136284941dc2&pid=8ceece18-cc1c-474c-8988-e7088cdd5789&pvid=507&mode=Default&shouldResize=false&playerType=WM7.

[29] Edmonds, K., and Li, Q.; *Teaching At-risk Students with Technology: Teachers' Beliefs, Experiences, and Strategies for Success*; 2004; <http://www.ucalgary.ca/~qinli/publication/kelly_qing_aera05%20.html>; Retrieved June 2007

may not be effective for all students, especially in completely online environments, and that care should be taken to individualize the learning to best meet the needs of each student.

Ascione (December 2005)[30] described yet another successful online education program called eGRAD (Graduation Recovery and Aptitude Development) that helped several at-risk Illinois students (several of whom were either pregnant or parenting, working full-time, being released from incarceration, or experiencing transportation issues) earn their high school diplomas. This Illinois Virtual High School (IVHS) program employed certified teachers and qualified mentors who provided instruction and support in an online education program that operated during the school day, employed web conferencing technologies, and had mandatory attendance and participation agreements as well as a well-defined communication cycle that involved the student, mentor, teacher, and parent.

Others have reported success using online sharing and collaboration tools to forge home-school communication links and enhance classroom activities (Lindsay, 2006).[31]

Illinois' online *Graduation Recovery and Aptitude Development* program helped at-risk students earn their high school diplomas. The program employed certified teachers and qualified mentors, and included mandatory attendance and participation agreements and a well-defined communication cycle.

– "Webcast: Virtual school helps at-risk students succeed", *eSchoolNews*, December 2005

Technology improves students' chances of academic success

Additional research on technology-based programs that have demonstrated strong evidence of effectiveness for improving the education of at-risk students was reviewed by Slavin (March 2005).[32] He reviewed seven program categories including: comprehensive school reform models; instructional technology; cooperative learning; innovative mathematics programs; elementary reading programs; tutoring programs in reading; and dropout prevention programs.

Slavin reported that a meta-analysis of the instructional use of various technologies (i.e., integrated learning systems (individualized courseware and management systems or ILSs), word processing, and reading/writing computer programs) revealed mostly positive results. ILSs were found to be most effective when used in mathematics, especially if students spent more time on them and if students worked in well-structured pairs. ILSs for reading were found to be effective, but less so than those used for mathematics. Positive effects of the use of word processors on writing skills were reported. Although most of the studies were small, positive effects were also reported on the student use of:

Positive results in mathematics, reading and writing are being reported for at-risk students in the U.S. who used computer programs such as *Writing to Read*, *Accelerated Reader*, *Cognitive Tutor* and *I Can Learn*.

– results from review of research by Slavin (March 2005)

[30] Ascione, L.; Assistant Editor, "Webcast: Virtual school helps at-risk students succeed"; *eSchool News*; December 19, 2005; <http://www.eschoolnews.com/news/showstory.cfm?ArticleID=6006>; Retreived June 2007

[31] Lindsay, J., International School Dhaka, Bangladesh; "Online Tools for Sharing and Collaboration", *Learning and Leading with Technology*; September 2006

[32] Slavin, R.. Johns Hopkins University; *Evidence-Based Reform: Advancing the Education of Students at Risk*; March 2005; <http://www.americanprogress.org/kf/slavin%203%2017%20final.pdf>; Retrieved June 2007

- the *Writing to Read* computer program (see one such study at http://digitalcommons.wayne.edu/dissertations/AAI9915664/);
- the *Accelerated Reader* reading management program (see product information at http://www.renlearn.com/ar/ and study results at http://www.whatworks.ed.gov/Topic.asp?tid=01&ReturnPage=default.asp);
- the *Cognitive Tutor*, an intelligent tutoring system to support mathematics learning (see product information at http://ctat.pact.cs.cmu.edu/ and a study report at http://oer.dadeschools.net/algebra.pdf); and
- *I Can Learn*, a computerized algebra curriculum (see product information and topic coverage at http://www.icanlearn.com/courseware/k12/algebra.asp?src=content and study results at http://www.whatworks.ed.gov/Topic.asp?tid=03&ReturnPage=default.asp).

Slavin repeatedly referred to the *What Works Clearinghouse* in his review. In an effort to support evidence-based decision making, the U.S. Department of Education created the *What Works Clearinghouse*, a site that provides scientific evidence of what works in education. Systematic reviews of evidence from Dropout Prevention Programs (designed to increase high school completion rates) are continually updated on the site. These reviews attempt to answer the questions:

- Which early school leaving prevention programs are effective in reducing high school dropout rates; and
- Are some early school leaving prevention programs more effective for certain types of students?

These reports[33] do not explicitly describe the technologies used, if any. However, it is apparent that technologies may be in use to enhance aspects of those programs considered successful.

Other tools have been used successfully to improve mathematics and writing achievement (e.g., graphing software has been shown to improve mathematical concept development (Ward, 2006)[34], and e-mail has been shown to motivate students to write and to improve their literacy skills (DiScipio, 2006).[35]

At-risk students have also been shown to benefit from technology education programs. For example, Cardon (2000)[36] studied why at-risk students want to take technology education courses, how they value these courses, and why technology education courses help them remain in school. His examination showed that schools that offer hands-on learning programs that integrate mathematics, science and technology education where at-risk students have opportunities to experience success and achievement demonstrate higher

Hands-on technology-based education and career and technical education programs have been shown to improve graduation rates, and employment, retention and achievement outcomes respectively.

– Cardon (2000) and Brown (2003)

[33] See reports at http://www.whatworks.ed.gov/Products/BrowseByLatestReportsResults.asp?EvidenceRptID=06&ReportType=All and strict review protocol at http://www.whatworks.ed.gov/reviewprocess%5Cprotocols%5CDropout_protocol.pdf for more information.
[34] Ward, R., Department of Teaching and Teacher Education, University of Arizona; "Engage Students with Graphing Software", *Learning and Leading with Technology*; September 2006
[35] February 8, 2006 news release entitled "E-mail Improving Student Reading and Writing Test Scores" from ePals.com Classroom Exchange which described a fourth grade e-mail exchange project between a school in Newark and a school in Italy.
[36] Cardon P.; *At-Risk Students and Technology Education: A Qualitative Study*; 2000; <http://scholar.lib.vt.edu/ejournals/JOTS/Winter-Spring-2000/pdf/cardon.pdf>; Retrieved June 2007

graduation rates than schools who focus on lecture-and-examination subjects geared to university entrance. The findings in his study corroborated existing research regarding the benefits to at-risk students of hands-on technology-based learning and the integration of various subjects in technology education. Brown (2003)[37] provided several additional sources of information about the various ways in which career and technical education has been shown to benefit at-risk and disadvantaged students by improving employment, retention, and achievement outcomes.

NCREL[38] also highlighted the potential gains for all students including at-risk students, language learners, and students with diverse needs (e.g., "teaching ICT literacy skills (specifically those related to multimedia literacy in Web, publishing and video production) can improve the economic prospects of at-risk youth by giving them marketable skills").

Technology strengthens teacher-student and home-school relationships

Teague (December/January 2004/2005)[39] described eight areas in which technology has been used with success to enhance curriculum for at-risk students, some of which describe how technology can enhance relationships within and beyond the classroom, and some of which support the findings outlined above. Teague's findings are briefly described below.

1. Social skills training can be successfully combined with consistent and proactive discipline in computer-based environments to offer students a place to belong and help them achieve, feel secure, and build self-respect.
2. Technology can be used for appropriate expressive outlets (e.g., encourage expression through e-journals (dated word processed files where students respond to review questions, quotes, ideas, or reflective writing prompts) or blogs; use the Insert/Comment feature in a word processed file to provide formative assessment or evaluative comments).

> **The thoughtful application of technology can provide at-risk students with opportunities for expression, social skills development, critical thinking and collaborative problem-solving.**
>
> – Teague (2004/2005)

3. Technology can be used to encourage parent and community involvement (e.g., reinforce the message of community using a variety of online communication strategies including e-mail updates, newsletters, homework assignment postings, and class calendars; or invite parents to school to participate in mini-tutorials on the uses of various technologies). *SchoolNotes* (http://schoolnotes.com) and *Assign-A-Day* (http://assignaday.4teachers.org) web sites were referenced for possible use in this area.
4. Technology can be used to communicate high, yet attainable expectations through the use of rubrics and performance supports (*Rubric Machine* http://landmark-project.com/rubric_builder/index.php and *Teach-nology* http://www.graphic.org/kwhl.html were cited as potential resources in the development of rubrics and graphic organizers respectively).

[37] Brown, B.; Educational Resources Information Center; "The Benefits of Career and Technical Education"; *Trends and Issues Alert No.* 49; 2003; <http://www.cete.org/acve/docs/tia00117.pdf>; Retrieved June 2007
[38] North Central Regional Educational Laboratory; "Critical Issue: Using Technology to Improve Student Achievement"; posted in 1999 and updated in 2005; <http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm>; Retrieved June 2007
[39] Teague, H.; "Can tech save students?"; *Classroom Connect*; December/January 2004/2005; <http://twi.classroom.com/workshops/kershaw/pdf/decjan05_pg4-7%5B1%5D.pdf>; Retrieved June 2007

5. Technology can be used to provide opportunities to celebrate uniqueness (e.g., give all students a meaningful "technical" job at which they can succeed and for which they become the class expert).
6. Authentic technology-mediated learning experiences can encourage critical thinking and offer students choices.
7. A variety of technologies can be used to modify curriculum delivery for students.
8. Technology can be used to encourage collaborative problem solving (http://www.jigsaw.org was cited as a potential resource site for teachers).

Technology improves the level of independent learning among students

Edyburn (2006)[40] shares Wiley's model of student performance to make a point about the importance of technology as a performance support for students experiencing difficulties in an academic environment. According to Wiley, student performance is affected by seven variables: 1. organizational systems; 2. incentives; 3. cognitive support; 4. tools; 5. physical environment; 6. skills/knowledge; and 7. inherent ability. Edyburn argues that Wiley's model illustrates why interventions that focus on organizational structures (e.g., course options) or instructional strategies may fail to produce the desired results unless cognitive supports and tools are also part of the intervention. Edyburn reported that tools such as digital text and text-to-speech software, dictation tools, and web-based calculators and math instructional supports (e.g., WebMath, http://wwwwebmath.com) are examples of some of the technology-based tools that have been shown to be critical to the enhanced academic performance of low-performing students.

"If all students are to achieve a given educational standard, then time and tools should vary to allow for differences in learning. If time is to be held constant, … then … viable options for enhancing performance [need to include providing] cognitive supports and appropriate technology tools."

– Dave Edybrun, *Learning and Leading with Technology*; September 2006

The *Journal of Special Education Technology* routinely reports on research which investigates the impact of assistive and other technologies on students with diverse needs. Some recent examples[41] illustrate the benefits of technology use among special populations, including research reports:

- by Riffel[41] where it is stated that "students with intellectual and developmental disabilities can benefit from the use of handheld PC-based technologies to promote independence and productivity in transition-related tasks. In both studies, the use of the handheld PC reduced the external prompts

Independence, productivity, reading retention and comprehension, and skill acquisition can all be improved for students with special needs through the use of a variety of technologies.

– *Journal of Special Education Technology*, Spring 2005

[40] Edyburn, D., Department of Exceptional Education, University of Wsconsin-Milwaukee; "Failure is Not an Option", *Learning and Leading with Technology*; September 2006

[41] The articles referenced from the *Journal of Special Education Technology*, Volume 20 Number 2 Spring 2005, found at http://jset.unlv.edu/20/JSETv20n2.pdf include: Riffel, L., et al; "Promoting Independent Performance of Transition-Related Tasks Using a Palmtop PC-based Self-Directed Visual and Auditory Prompting System"; Blankenship, T.; "Effects of Computer-Based Cognitive Mapping on Reading Comprehension for Students with Emotional Behavior Disorders"; and Mechling, L.; "The Effect of Instructor-created Video Programs to Teach Students with Disabilities: A Literature Review"; Retrieved June 2007

needed by the student to complete a vocational or independent living task and performed at higher levels of accuracy;"

- by Blankenship[41], whose research demonstrated that "students who previously struggled with learning class material from text-based presentation can successfully accomplish these tasks given [a] cognitive mapping reading strategy and access to a computer to create the cognitive maps;" and
- by Mechling[41], who reviewed twenty-four studies involving the use of instructor-created video programs for feedback, modeling, self-modeling, subjective point of view, interactive video, and computer-based video instruction. She concluded from this review that instructor-created video programs can be a successful means to increase the acquisition of skills (including changing undesirable behaviors and learning new social, academic, communication, and self-help skills) and the level of independence of students with diverse needs.

Technology-enabled professional development and data analysis indirectly influences high school completion rates

Less direct but worth mentioning were the gains in student achievement reported by three Alberta school divisions following their use of technology for professional development and/or data analysis.[42] Calgary Catholic High Schools reported a three-year increase in high school completion rates in 2003/2004 after using a web-based learning management system and a distributed learning model to access to interactive, multimedia-enhanced resources for teaching and learning. Elk Island Catholic Schools reported increases in student achievement in all four divisions following the implementation of their *Classroom Based PD: Technology Mentorship* project which required participating teachers to map out and implement strategies that would assist them in all facets ICT infusion. Edmonton Public Schools employed technology-enabled data tracking and analysis, among other strategies, to improve evidence-based decision making in the district. This was reported to have led to improved high school completion rates.

Summary

Recent research provides evidence that technology-based strategies have the potential to positively influence high school completion rates for *all* students, including those at-risk and those with diverse needs. Technology-based strategies have been shown to:

- improve the relevancy and richness of students' learning experiences, nurture collaborative learning communities, and motivate and engage students:
  - by enabling authentic technology-mediated project-based learning; strengthening school, family and community ties; and enhancing and expanding assessment practices and processes (National Foundation for the Improvement of Education, 2000);
  - by using ICT to support engagement, research, writing, editing, and presentation of work (Passey, 2004);
  - by using a constructivist approach involving project-based, student-centered activities that result in students taking an active role in their own learning (Brown Yoder, 2006);
  - by using computers to work through complex problems and tap into higher order thinking skills as well as deepen their thinking and enhance their work products across subject areas (Wenglinsky, 2006); and

[42] See Alberta Education; Alberta Initiative for School Improvement (AISI); <http://www.education.gov.ab.ca/k_12/special/aisi/> for more information.

  - by enhancing teachers' abilities to support a broad range of student identities and learning styles; providing students with opportunities to acquire 21st century skills (i.e., enhance their systems, analytical and critical thinking; collaboration skills; teamwork; cross-cultural exchanges; problem solving; and media literacy); expanding teacher and student access to learning resources; and minimizing the digital divide (The Hospital for Sick Children, and the Ontario Ministry of Education and Training, 2005, and NCREL, 2005);

- offer choice and flexibility to students:
  - by participating in flexible virtual learning environments, where communication is mediated through various types of technology (Batt, 2003);
  - by overcoming barriers and contributing to increased success rates through participation in online and blended learning programs (Edmonds and Li, 2004);
  - through participation in mentor-supported online learning programs with web conferencing and well-defined communication cycles (Ascione, 2005); and
  - by using online sharing and collaboration tools to forge home/school communication links and enhance classroom activities (Lindsay, 2006);
- improve students' chances of academic success:
  - by improving achievement in mathematics and reading through the instructional use of integrated learning systems, reading and writing programs and word processing (Slavin, 2005);
  - by using graphing software to improve mathematical concept development (Ward, 2006);
  - by using e-mail to motivate students to write and to improve their literacy skills (DiScipio, 2006);
  - by participating in hands-on learning programs that integrate mathematics, science and technology education and providing students with opportunities to experience success and achievement (Cardon, 2000); and
  - by improving employment, retention and achievement outcomes through career and technical education (Brown, 2003);
- strengthen teacher-student and home-school relationships:
  - by enabling social skills training; providing appropriate expressive outlets; encouraging parental and community involvement; communicating high expectations; celebrating uniqueness; encouraging critical thinking and offering choice; expanding delivery options; and emphasizing collaborative problem solving (Teague, 2004); and
- improve the level of independent learning among students:
  - by using technology as a performance support (Edyburn, 2006);
  - by using handheld PCs to promote independence and productivity in transition-related tasks (Riffle, 2005);
  - by using computer-based cognitive-mapping strategies to improve independent learning as well as reading comprehension and retention (Blakenship, 2005); and
  - by using instructor-created video to improve the attainment of skills and the level of independence (Mechling, 2005).

Using technologies in various ways to support teacher professional development programs and data-driven decision making have also been reported to improve high school completion rates

(AISI Clearninghouse: Promising Practices; retrieved June 2007), although their impact is less direct.

The findings summarized above illustrate the potential for a variety of technology-based strategies to improve high school completion rates. The following section provides complementary best practice advice to assist in the successful implementation of these types of strategies.

5. Best Practice Advice: What strategies might be appropriate in Alberta and how might these strategies best be implemented?

"What is now known about learning provides important guidelines for uses of technology that can help students and teachers develop the competencies needed for the 21st century."

– Bransford, J., et al; *How People Learn: Brain, Mind, Experience and School* (1999)[43]

Introduction

As stated in Section 3: Background, Alberta Education expressed its commitment to work with stakeholders to "provide services to students and their families so that all students can successfully complete high school."[44] The literature reviewed in Section 4 described several technology-based strategies that have been successfully implemented to do just that. But which strategies, if any, are appropriate for implementation in Alberta and how might these strategies best be implemented? To answer these questions, it will be important to not only refer to previous findings (e.g., those summarized in Section 4 as well as those of the High School Completion Task Force and any local needs analyses that might be available) but also to:

- consider and share the lessons learned:
  - when implementing technology-based strategies that were designed to address issues related to high school completion; and
  - when implementing learning and technology initiatives in general;
- explore what synergies might be realized among the various strategies designed to improve high school completion rates;
- determine what success will look like and how it will be measured; and
- stay abreast of current technology trends.

Consider and Share Lessons Learned

Several authors have shared the lessons they have learned when implementing technology-based strategies to improve high school completion rates. Consideration of these lessons, as well as those learned through the implementation of a broad range of learning and technology initiatives will be important to ensure that the desired outcomes are achieved. A compilation of lessons learned by various authors is provided below.

1. The report entitled *Early School Leavers: Understanding the Lived Reality of Student Disengagement from Secondary School: Final Report*; May 2005[45] stated that "early school leaving is the result of a long term, multi-dimensional process influenced by a wide variety of school and out-of-school experiences and the as-yet not fully understood, complex relationship between these multiple causes." Hence, the report suggests that no single best practice model for early school leaving prevention or intervention program

[43] Bransford, J., et al; *How People Learn: Brain, Mind, Experience and School;* 1999; <http://www.nap.edu/html/howpeople1/>; Retrieved June 2007

[44] Alberta Education; *High School Completion Rate Task Force Report: Responding to Alberta's Commission on Learning (ACOL) Recommendation 11*; November 2005

[45] Community Health Systems Resource Group, The Hospital for Sick Children, Toronto, CA and Special Education Branch, Ontario Ministry of Education and Training; *Early School Leavers: Understanding the Lived Reality of Student Disengagement from Secondary School: Final Report*; May 2005; <http://www.edu.gov.on.ca/eng/parents/schoolleavers.pdf>; Retrieved June 2007

exists or is necessarily appropriate. However, the report did suggest that some strategies hold promise, including those that involve the use of instructional technologies. Rather than provide examples of effective strategies using instructional technologies, the authors chose to identify the characteristics of technology-based strategies that would most likely produce significant benefits. Based on the research, successful strategies involving instructional technologies need to:

- enhance teachers' abilities to develop methods that support a broad range of student identities and learning styles;
- employ emerging technologies in an effort to remove barriers to learning and promote positive attitudes and success for students previously disengaged with school and learning;
- provide students with opportunities to enhance systems thinking, collaboration skills, teamwork experiences, cross-cultural exchanges, analytical and critical thinking, problem solving, and media-literacy;
- expand teacher and student access to educational resources (especially critical for rural and remote students); and
- minimize the digital divide.

Research has shown that to ensure success of instructional technology-based strategies for at-risk students, that strategies need to:

- **help support a broad range of student identities and learning styles;**
- **promote positive attitudes and remove learning barriers;**
- **expand access to educational resources; and**
- **minimize the digital divide.**

– excerpt from *Early School Leavers: Final Report*; May 2005

2. The National Dropout Prevention Center and Communities In Schools, Inc. released a report[46] that outlined some of the lessons learned from their research on risk factors related to early school leaving and the implementation of evidence-based programs to improve high school completion rates. These learned lessons, adapted here as recommendations, include the following:

- Address multiple risk factors across several domains wherever possible to increase the likelihood that the program will produce positive results (see pp 11-17 for a discussion of the significant risks factors for early school leaving);
- Use multiple strategies that address "personal assets and skill building, academic support, family outreach, and environmental/organizational change" to help assure positive impacts;
- Fully implement exemplary and/or new programs as they were designed. When implementing a new program, use evidence-based strategies that have been proven to impact the risk factors to be addressed and are based on best practice; and

The National Dropout Prevention Center and Communities in Schools recommend fully implementing, as designed, multiple evidence-based strategies that address multiple risk factors.

– from *Dropout Risk Factors and Exemplary Programs: A Technical Report*; May 2007

[46] National Dropout Prevention Center and Communities in Schools, Inc.; *Dropout Risk Factors and Exemplary Programs: A Technical Report*; May 2007; <http://www.dropoutprevention.org/resource/major_reports/communities_in_schools/Dropout%20Risk%20Factors%20and%20Exemplary%20Programs%20Executive%20Summary%205-16-07.pdf>; Retrieved June 2007

- Whether adopting an existing program or developing a new one, use evidence-based strategies to evaluate the program's effectiveness.

The National Dropout Prevention Center for Students with Disabilities (NDPC-SD) offers several additional resources to support the effective implementation of programs designed specifically for students with diverse needs (see http://www.ndpc-sd.org/default.htm for more information).

A recently released report[47] outlined the following considerations and steps to build an effective program for the prevention of early school leaving, technology-based or otherwise:

- Establish a leadership team to actively coordinate the implementation of the prevention efforts;
- Establish systems for routine monitoring of risk indicators associated with early school leaving;
- Create a local action team to analyze the data and address prevention at the local level;
- Intervene early, often, and as early as preschool;
- Increase family engagement and school involvement;
- Create school environments that are inviting, safe, and supportive;
- Help students to address problems that interfere with learning;
- Use proven practices;
- Listen to students;
- Provide relevance and rigor in the academic experience;
- Help students build relationships at school;
- Focus on effective instruction;
- Take a systemic approach to address dropout prevention;
- Conduct causal analyses;
- Use data to guide program development, professional development, and other school improvement efforts;
- Consider multiple levels of implementation; and
- Examine the influence of other performance indicators on school completion.

3. Bransford et al (1999)[48] provides further research-based suggestions about how best to use technologies to develop 21st century competencies for *all* students including:

Bransford (1999) suggests using technology to build local and global communities as well as to provide a means for more student feedback, reflection and revision opportunities will help build 21st century competencies.

– Bransford, D., et al, National Research Council

- bringing real-world problems into the classroom (e.g., through the use of computer simulations and/or by bringing experts in to the classroom via electronic communications or videoconferencing);

[47] *Building Effective Dropout Prevention Programs – Some Practical Strategies from Research and Practice*, 2007 outlined the following steps to build an effective program: <http://www.ndpc-sd.org/assistance/docs/Building_Effective_Dropout_Prevention_Programs.pdf>.

[48] Bransford, J., et al; *How People Learn: Brain, Mind, Experience and School;* 1999; <http://www.nap.edu/html/howpeople1/>; Retrieved June 2007

- providing scaffolds and tools to enhance learning (e.g., graphing programs, calculators, spreadsheets, probes; 3D virtual models and other computer visualization and analysis tools; technology-based modeling tools; interactive computer micro-worlds);
- giving students and teachers more opportunities for feedback, reflection, and revision;
- building local and global communities that include teachers, administrators, students, parents, practicing scientists, and other interested people; and
- expanding opportunities for teacher learning.

4. Although dated, Means' 1997 article[49] entitled *Critical Issue: Using Technology to Enhance Engaged Learning for At-Risk Students* outlined a vision, goals, possible actions and implementation pitfalls that have stood the test of time. This information can be used to inform what more could be done to improve high school completion rates in Alberta through the effective use of technology in its various forms with at-risk students specifically.

   Means' vision for using technology to enhance engaged learning for students at risk of leaving school early includes:

   - challenging learning activities that integrate higher order thinking skills and involve authentic tasks (e.g., assignments that have a real-world application such as developing a business plan or producing a program for a school event);
   - heterogeneous groupings as part of cooperative and collaborative classrooms;
   - a curriculum that stresses composition, comprehension, and application of skills instead of practicing discrete, isolated skills;
   - constructivist teaching and learning models that employ technology to enhance student engagement and productivity;
   - using a variety of technologies in meaningful activities that integrate a variety of disciplines; and
   - equitable access to technologies and networks at school and in the home.

   Means (1997) outlined a vision for enhancing engaged learning for at-risk students that involves

   - **using various technologies to engage students in challenging, authentic and meaningful learning activities that emphasize higher order thinking and the application of skills across disciplines;**
   - **using constructivist teaching and learning models that employ technology to enhance engagement and productivity; and**
   - **providing equitable access to technologies at home and in school.**

   – Means, B., North Central Regional Educational Laboratory

   The goals and possible actions described in the article relate directly to this vision. For example, one goal was that "all students have opportunities to use a variety of modern technologies … to support their work on challenging, authentic tasks." A possible action was to "seek opportunities to collaborate with other teachers and work in teams to design and implement technology-supported projects." The implementation pitfalls described (e.g., inadequate professional development, lack of community support) are eerily

[49] Means, B.; Vice President, Policy Division, SRI International, Menlo Park, California; North Central Regional Educational Laboratory; *Critical Issue: Using Technology to Enhance Engaged Learning for At-Risk Students*; 1997; <http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at400.htm>; Retrieved June 2007

familiar and likely informed the development of ISTE's essential conditions for effective learning and technology implementations published nine years later.

5. Levin (2004)[50] categorized the majority of programs designed for students at-risk as either "in-school efforts" (e.g., supplementary or compensatory programs; programs that result in changes to mainstream instructional programs within a school; efforts to work more closely with parents and the community; and those that expanded the view of schooling to include early childhood programs, adult education and community development or integrated services) or "beyond-the-school" efforts that examined broader social policy concerns. His research indicated that the prevention or reduction of early school leaving can best be achieved through a variety of means and requires a combination of:

   - strong political support from several different spheres (alliances with parents and community groups);
   - congruence with existing structures of schooling and interests of educators so that there is substantial motivation on the part of the system to implement and sustain such measures; and
   - a strong supporting legal, policy and institutional structure that mandates or provides powerful financial or other incentives.

   Levin's (2004) research indicated that prevention or reduction of early school leaving can best be achieved through a variety of means and requires a combination of

   - **strong political support;**
   - **congruence with existing school structures and interests of educators; and**
   - **strong legal, policy and institutional structures that mandate or provide financial incentives.**

   – Levin (2004), *Students at risk: A review of the Research*

6. Bergenson (2005)[51] described effective programs and practices as those that result in:

   - school climates that are inviting, warm, and supportive;
   - students obtaining social, health, and other personal resources that help them handle obstacles to their learning and help meet their emergent basic needs;
   - personalized programs with academic challenge and learning support as needed;
   - opportunities for students to apply their learning in relevant, real world situations and help them see the connections to their own futures;
   - enhanced personal relationships with caring adults through organizational structures that provide time and opportunity; and
   - have supportive discipline and attendance policies.

7. Manitoba Education, Citizenship and Youth have developed resources to support literacy with ICT across the curriculum which include information about factors that influence how literacy with ICT can support and extend student learning as well as a description of concepts, policies, and procedures that can be followed when implementing literacy with

[50] Levin, B.; *Students at risk: A review of research: Prepared for The Learning Partnership*; 2004; <http://www.thelearningpartnership.ca/policy_research/studentsatrisk_by_Ben_Levin.pdf>; Retrieved June 2007

[51] Bergeson, T.; *Promising Programs and Practices for Dropout Prevention: Report to the* Legislature; December 2005; <http://www.k12.wa.us/research/pubdocs/PromisingProgramsandPractices.pdf>; Retrieved June 2007

ICT across the curriculum (see http://www.edu.gov.mb.ca/k12/tech/lict/s_leaders/index.html for more information).

8. The National Center on Secondary Education and Transition (see http://www.ncset.org/default.asp) produced a report entitled *ESSENTIAL TOOLS — Increasing Rates of School Completion: Moving From Policy and Research to Practice, A Manual for Policymakers, Administrators, and Educators*. In Part III of this report[52] the author described what has worked in the prevention of early school leaving including: a summary chart of prevention programs; information about the decision-making process; and abstracts from sample intervention programs (see http://www.ncset.org/publications/essentialtools/dropout/part3.3.02.asp and http://www.ncset.org/publications/essentialtools/dropout/part3.1.asp respectively).

9. Statistics Canada, Human Resources and Social Development Canada (HRSDC), and the Council of Ministers of Education, Canada produced several reports that examined the use of ICT in education and revealed information that may be useful when designing and implementing technology-based strategies for students at-risk:

   - Corbet (2002)[53] and Looker (2003)[54] discussed how gender, rural-urban location and parental education affected patterns of use and attitudes to ICT among Canadian youth.
   - Bussiere's (2004)[55] review of the literature on the effects of ICT use on reading emphasized the importance of quality of ICT use over merely access to technology.
   - Ungerleider (2003)[56] reviewed twenty-five research studies that examined the use of a variety of networked and online technologies within a range of subject areas, classrooms and interventions.

"Studies in controlled environments suggest that the use of technology under the right circumstances improves educational outcomes, and many educators believe that a new pedagogy that incorporates technology is necessary to prepare students for work in the information age."

– Corbet (2003); *Canadian Students' Access to and Use of Information and Communication Technology*

10. The lessons learned when implementing learning and technology initiatives in general helped to formulate ISTE's essential conditions, an adapted version of which can be seen in Table A below.

[52] National Center on Secondary Education and Transition; *ESSENTIAL TOOLS — Increasing Rates of School Completion: Moving From Policy and Research to Practice, A Manual for Policymakers, Administrators, and Educators*; May 2004; <http://www.ncset.org/publications/essentialtools/dropout/default.asp>; Retrieved June 2007

[53] Corbet, B., et al; *Canadian Students' Access to and Use of Information and Communication Technology*; 2002; <http://www.cmec.ca/stats/pcera/RSEvents02/BCorbett_OEN.pdf>; Retrieved June 2007

[54] Looker, E.D; *The Digital Divide in Canadian Schools: Factors Affecting Student Access to and Use of Information Technology*; June 2003; <http://www.statcan.ca/english/research/81-597-XIE/81-597-XIE2003001.pdf>; Retrieved June 2007

[55] Bussiere, P., et al; *The Impact of Computer Use on Reading Achievement of 15-years-olds*; May 2004; <http://www.hrsdc.gc.ca/en/cs/sp/hrsdc/lp/publications/2004-002625/SP-599-05-04E.pdf>; Retrieved June 2007

[56] Ungerleider, C., et al; *A Systematic Review of the Effectiveness and Efficiency of Networked ICT in Education: A State of the Field Report to the Council of Ministers of Education, Canada and Industry Canada*; October 24, 2003; <http://www.cmec.ca/stats/SystematicReview2003.en.pdf>; Retrieved June 2007

Table A: Essential Conditions for Implementing Technology in Schools[57]
Shared Vision and Leadership – The school board and school administrators provide proactive leadership in developing a shared vision for educational technology among school personnel, parents, and the community.
Equitable Access – Students, teachers/staff have equitable access to current technologies, (hardware/software), and resources.
Skilled Personnel – District leaders, teachers and support personnel are skilled in the use of technology appropriate for their job responsibilities. (Technical training)
Professional Development – District leaders and staff have consistent access to technology-related professional development for their job assignments. (Pedagogy)
Technical Assistance – Personnel have technical assistance for maintaining and using technology.
Content Standards and Curriculum Resources – Instructional personnel, school leaders and teachers are knowledgeable about content and technology standards, related ICT curriculum and resources and the use of technology to support learning.
Student-Centered Teaching – Teaching in all settings includes the use of technology to facilitate student-centered approaches to learning.
Assessment and Accountability – The school and district has a system for the continual assessment of effective technology use for improving student learning.
Community Support – The district and school maintains partnerships and communications with parents, businesses, and the community to support technology use within the district.
Support Policies – The school and district has policies, financial plans, and structures to support the use of technology in learning and in operations.
External Conditions – Policies, requirements, supports and initiatives at the national, regional, and provincial levels support the school/district in the effective implementation of technology for achieving curriculum outcomes and technology standards.

It will be important to consider and share these lessons learned among the community of educators interested in effectively implementing technology-based strategies to improve high school completion rates.

Explore Potential Synergies Among Strategies

As was suggested earlier, using multiple strategies to address various risk factors contributes to overall success, therefore, information about effective prevention strategies for early school leaving that may or may not involve the use of technology is provided below. Exploring potential synergies among multiple effective strategies may further improve high school completion rates.

1. The National Dropout Prevention Centre has developed an administrator's checklist of twenty-one most effective prevention strategies for early school leaving. One of these is strategy areas is "instructional technologies" which are believed to offer some of the best opportunities for delivering instruction which engages students in authentic learning, addresses multiple intelligences, and adapts to students' learning styles. Strategies involving instructional technologies can be successfully combined with other strategies including:

[57] Adapted from the "Essential Conditions for Implementing the National Educational Technology Standards for Administrators", International Society for Technology in Education (ISTE), see http://cnets.iste.org/administrators/a_esscond.html. Retrieved June 2007

- ✓ Systemic Renewal of school policies, practices, and organizational structures
- ✓ Community Collaboration
- ✓ Professional Development
- ✓ Family Involvement
- ✓ Early Childhood Education
- ✓ Reading/Writing
- ✓ Alternative Schooling
- ✓ Individualized Instruction
- ✓ Mentoring/Tutoring
- ✓ Community Service Learning
- ✓ Learning Styles/Multiple Intelligences
- ✓ Specialized Curriculum for Personal Development
- ✓ Violence Prevention/Conflict Resolution
- ✓ Career Education/Workforce Readiness
- ✓ Out-of-School Experience
- ✓ Personalized Planning
- ✓ Student Leadership Experiences and Training
- ✓ Systematic Identification
- ✓ In-School Support Services
- ✓ Review and Evaluation

For a complete description of the twenty-one strategies, see http://www.learningalternatives.net/Checklist_of_Dropout_Prevention_Strategies.pdf.

2. The Northwest Regional Educational Laboratory identified a similar list of successful prevention strategies designed to support and build student achievement. Instructional technologies are included in this list as well. In this case instructional technologies strategies refer to those that implement technologies "throughout a program to address authentic learning, engage and motivate students, and adapt to the learners' individual needs." The complete NWREL list can be found at http://www.nwrel.org/scpd/sdpp/characteristics.asp and includes strategies in each of the following five areas:

   - Relevancy and learning strategies which have the capacity to motivate student learning within and beyond the normal school environment (e.g., Mentoring/Tutoring; Service Learning; Alternative Schooling; and After School Experiences);
   - Instructional focus strategies that expand teaching methods, accommodate a range of learning styles, include technological resources, and meet individual student needs all provide multiple benefits (e.g., Professional Development; Diverse Learning Styles; Instructional Technologies; Individualized Learning; Academic Rigor);
   - Accountability strategies in which students must demonstrate progress on standardized and authentic assessments, and progress towards established academic and affective goals (e.g., Assessment; Implementation; Data);
   - Community involvement strategies which involve linking students to the wider community, removing the school wall "barriers", providing opportunities for systemic planning and support, motivating students towards career development and participation, and providing necessary social and interpersonal skills for successful young adults (e.g., Systemic Renewal; Community Collaboration; Career Education and Workforce Readiness; Conflict Resolution and Violence Prevention); and
   - School structures strategies which provide consistent and viable elements from school improvement as well as smaller learning communities which help ensure that no students "fall through the cracks" (e.g., identity, personalization and autonomy strategies).

Determine What Success Will Look Like

Besides improved graduation rates, what other evidence would suggest successful use of technology among at-risk students? Jones[58] provides several indicators of engaged learning as follows:

- tasks are authentic, challenging, and multidisciplinary;
- assessment is performance-based, meaningful, seamless and ongoing, and equitable;
- the instructional model is interactive and generative (i.e., oriented to constructing meaning through Socratic dialogue, individual and group summarizing, brainstorming and categorizing, debriefing);
- the learning context is collaborative, knowledge-building, and empathetic;
- groupings are heterogeneous, equitable, and flexible;
- teachers are facilitators, guides, and co-learners or co-investigators; and
- students are explorers, cognitive apprentices, teachers, and producers.

Jones also provides indicators of high technology performance in each of the following six categories:

- access to technologies and the Internet is ubiquitous, inter-connective, and designed for equitable use;
- technologies are interoperable, employ an open architecture (allows users to access third party software/hardware), and are transparent (users do not need to know how the hardware and software work);
- technologies are distributed, designed to allow user input/contributions, and support collaborative projects;
- technologies engage students by providing them with access to challenging tasks and opportunities to learn by doing, as well as responding intelligently to the user with the ability to diagnose and prescribe new learning;
- technologies are fast and easy to use with effective built-in help, user-friendly controls, just-in-time and just-enough information, and offer additional training and support; and
- technologies offer a range of functionality and include generic and context-specific tools, media technologies, programming and authoring tools (wizards), and project design tools.

Jones et al provides indicators of engagement and high technology performance that could be used to provide evidence of the successful use of technology to improve high school graduation rates.

Engagement variables include:

- **Vision, tasks, assessment, instructional model, learning context, grouping and teacher and student roles.**

High technology performance variables include:

- **Access, operability, organization, engagement, ease of use, and functionality.**

– Jones et al, North Central Regional Educational Laboratory

[58] Jones, et al; North Central Regional Educational Laboratory; "New Times Demand New Ways of Learning", *Plugging In: Choosing and Using Educational Technology*; No publication date available; <http://www.netc.org/cdrom/plug_in/html/newtimes.htm>; Retrieved June 2007

These indicators can be used to guide the determination of measures of success, an important evaluative component within the plan for any learning and technology initiative.

Stay Abreast of Current Technology Trends

It is important to keep abreast of advances in technology and the uptake of various technologies in society to better understand which technologies might best be suited to educational environments. Pew Research releases annual publications that provide snapshots of the Internet and technology landscape. Some examples worth reviewing are provided below:

- The Pew Global Attitudes Project released a report[59] in February 2006 that "found substantially more people using a computer and going online now than in 2002" among the thirteen countries polled. In Canada, computer use rose from 75% to 79% and Internet use rose from 68% to 71%.
- Horrigan (February, 2007)[60] provides facts about wireless use including the fact that 34% of Internet users routinely log on to the Internet from home, their workplace or some other place using laptop computers, cell phones and PDAs (personal digital assistants) to check e-mail, get news and surf the Internet. He also indicates that wireless access shows "deeper engagement with cyberspace" than other forms of connectivity.
- Lenhart (July 19, 2006)[61] researched the use of blogs and found that: bloggers are typically young (54% under 30); they use blogs as forms of creative expression and to share personal experiences; and they use blog features that enhance community and usability.
- Lenhart (July, 2005)[62] found that: Internet use increased from 24% to 87% among 12 to 17 year olds since 2001 with more teens playing games, getting news and health information, and shopping. Teens are also using a variety of technologies to support their communication, research, personal expression, and entertainment desires.

Summary

The literature reviewed in this document describes technology's proven potential to improve high school completion rates. To realize this potential, it will be important to not only refer to previous findings (e.g., those summarized in Section 4 as well as those of the High School Completion Task Force and any local needs analyses that might be available) but also to:

- consider and share the lessons learned by various educators and researchers in their implementation of technology-based strategies (i.e., it has been shown that implementing multiple evidence-based strategies that address various risk factors contributes to overall success when the strategies are fully implemented as they were designed);
- explore what synergies might be realized among the various strategies shown to improve high school completion rates (e.g., relevancy and learning strategies; instructional focus

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[59] Pew Global Attitudes Project; *Truly a World Wide Web: Globe Going Digital*; February 21, 2006; <http://pewglobal.org/reports/display.php?ReportID=251>; Retrieved June 2007

[60] Horrigan, J.; *The World of Wireless Widens: A Third of Internet Users Now Opt for "Relentless Connectivity"*; February 26, 2007; < http://pewresearch.org/pubs/417/the-world-of-wireless-widens>; Retrieved June 2007

[61] Lenhart, A. et al; Pew Internet and American Life Project; *Bloggers: A Portrait of the Internet's New Storytellers*; July 19, 2006; <http://www.pewinternet.org/pdfs/PIP%20Bloggers%20Report%20July%2019%202006.pdf>; Retrieved June 2007

[62] Lenhart, A.et al; *Teens and Technology: Youth are Leading the transition to a fully wired and mobile nation*; July 27, 2005; < http://www.pewinternet.org/pdfs/PIP_Teens_Tech_July2005web.pdf>; Retrieved June 2007

strategies; accountability strategies; community involvement strategies; school structures strategies);

- determine what success will look like and how it will be measured (e.g. engaged students and facilitative teachers, authentic tasks, performance-based assessments, collaborative learning environments, equitable and flexible groupings, ubiquitous access to interoperable technologies);
- stay abreast of current technology trends (i.e., developments and uses of the Internet, and computer and emerging technologies in education and society); and
- track progress toward meeting the essential conditions for meaningful technology integration.

6. References

1. Alberta's Commission on Learning, *Every Child Learns, Every Child Succeeds: Report and Recommendations Alberta's Commission on Learning, October 2003*, <http://www.education.gov.ab.ca/commission/PDF/CommissionReport.pdf>, Retrieved June 2007
2. Alberta Education; *AISI Technology Projects Research Review Summary of Findings from Cycle One 2000-2001 to 2002-2003*; 2004; <http://www.education.gov.ab.ca/k_12/special/aisi/pdfs/techprojectsreview.pdf>; Retrieved June 2007
3. Alberta Education; *Education Business Plan 2007-2010*, 2007, <http://www.education.gov.ab.ca/department/budget/2007/businessplan2007.pdf>, Retrieved June 2007
4. Alberta Education; *e-Learning Environmental Scan: Needs and Preferences / Trends and Promising Practices*; March 2006; <http://www.education.gov.ab.ca/technology/elearning/scan.pdf>, Retrieved June 2007
5. Alberta Education; *First Nations, Métis and Inuit Education Policy Framework: A Progress Report*; May 2003; <http://www.education.gov.ab.ca/nativeed/nativepolicy/pdfs/FNMIProgRep.pdf>; Retrieved June 2007
6. Alberta Education; *Report on Consultations on Guidelines: Infusion of Information and Communication Technology (ICT) Outcomes into Programs of Study*, 2006; <http://www.education.gov.ab.ca/k_12/curriculum/bySubject/ict/infuse.pdf>
7. Alberta Education; *High School Completion Rate Task Force Report: Responding to Alberta's Commission on Learning (ACOL) Recommendation 11*; November 2005; <http://www.education.gov.ab.ca/highschool/pdf/HighSchoolCompletionRateTaskForceReport.pdf >; Retrieved June 2007
8. Alberta Education; *High School Completion Symposium Summary Report*; September 2006; <http://www.edc.gov.ab.ca/highschool/pdf/AE_HSSYMPOSIUM_FINAL.pdf>; Retrieved June 2007
9. Alberta Education; *Learning and Technology Policy Framework* (2004); <http://education.gov.ab.ca/reading/policy/techframework/ LTfwrk.pdf)>; Retrieved June 2007
10. Alberta Education; *One-to-One Mobile Computing: Literature Review*; August 2006; <http://ednet.edc.gov.ab.ca/technology/emerge/resources/litreview.pdf>; Retrieved June 2007
11. Alberta Education, *Science 20 Program of Studies – Information and Communication Technology (ICT)*, 2006, <http://www.education.gov.ab.ca/department/budget/2007/businessplan2007.pdf>, Retrieved June 2007
12. Alberta Education; System Improvement and Reporting; *Removing Barriers to High School Completion – Final Report*; September 2001; <http://www.edc.gov.ab.ca/k_12/special/BarrierReport.pdf>; Retrieved June 2007
13. Anderson, T. et al; *Videoconferencing in Kindergarten to Grade 12 Settings: A Review of the Literature*; 2005; <http://www.vcalberta.ca/community/litreview.pdf>; Retrieved June 2007

14. Ascione, L.; Assistant Editor, "Webcast: Virtual school helps at-risk students succeed"; *eSchool News*; December 19, 2005; <http://www.eschoolnews.com/news/showstory.cfm?ArticleID=6006>; Retreived June 2007

15. Batt, D.; *i-support! A smart state approach to supporting students at risk online*; 2003; <http://www.odlaa.org/publications/2003Proceedings/pdfs/batti.pdf>, Retrieved June 2007

16. Bergeson, T.; *Promising Programs and Practices for Dropout Prevention: Report to the* Legislature; December 2005; <http://www.k12.wa.us/research/pubdocs/PromisingProgramsandPractices.pdf>; Retrieved June 2007

17. Bransford, J., et al; *How People Learn: Brain, Mind, Experience and School;* 1999; <http://www.nap.edu/html/howpeople1/>; Retrieved June 2007

18. Brown, B.; Educational Resources Information Center; "The Benefits of Career and Technical Education"; *Trends and Issues Alert No.* 49; 2003; <http://www.cete.org/acve/docs/tia00117.pdf>; Retrieved June 2007

19. Brown Yoder, M.; "Adventures in Electronic Constructivism", *Learning and Leading with Technology*; September 2006

20. Bussiere, P., et al; *The Impact of Computer Use on Reading Achievement of 15-years-olds*; May 2004; <http://www.hrsdc.gc.ca/en/cs/sp/hrsdc/lp/publications/2004-002625/SP-599-05-04E.pdf>; Retrieved June 2007

21. Cardon P.; *At-Risk Students and Technology Education: A Qualitative Study*; 2000; <http://scholar.lib.vt.edu/ejournals/JOTS/Winter-Spring-2000/pdf/cardon.pdf>; Retrieved June 2007

22. Canadian Association for Distance Education, et al; *Videoconferencing in Kindergarten to Grade 12 Settings: A Review of the Literature*; 2005; <http://www.vcalberta.ca/community/litreview.pdf>; Retrieved June 2007

23. Corbet, B., et al; *Canadian Students' Access to and Use of Information and Communication Technology*; 2002; <http://www.cmec.ca/stats/pcera/RSEvents02/BCorbett_OEN.pdf>; Retrieved June 2007

24. Edmonds, K., and Li, Q.; *Teaching At-risk Students with Technology: Teachers' Beliefs, Experiences, and Strategies for Success*; 2004; <http://www.ucalgary.ca/~qinli/publication/kelly_qing_aera05%20.html>; Retrieved June 2007

25. Edyburn, D., Department of Exceptional Education, University of Wsconsin-Milwaukee; "Failure is Not an Option", *Learning and Leading with Technology*; September 2006

26. Gabrielle, D. M.; *The Effects of Technology-Mediated Instructional Strategies on Motivation, Performance, and Self-Directed Learning*; 2003; Proceedings of the Association for the Advancement of Computing in Education (AACE) ED-MEDIA Conference, Honolulu; <http://gabrielleconsulting.com/gabrielleaect.doc>; Retrieved June 2007

27. Horrigan, J.; *A Typology of Information and Communication Technology Users*; May 7, 2007; <http://www.pewinternet.org/pdfs/PIP_ICT_Typology.pdf>; Retrieved June 2007

28. Horrigan, J.; *The World of Wireless Widens: A Third of Internet Users Now Opt for "Relentless Connectivity"*; February 26, 2007; < http://pewresearch.org/pubs/417/the-world-of-wireless-widens>; Retrieved June 2007

29. Jones, et al; North Central Regional Educational Laboratory; "New Times Demand New Ways of Learning", *Plugging In: Choosing and Using Educational Technology*; No

publication date available; <http://www.netc.org/cdrom/plug_in/html/newtimes.htm>; Retrieved June 2007

30. Lenhart, A. et al; Pew Internet and American Life Project; *Bloggers: A Portrait of the Internet's New Storytellers*; July 19, 2006; <http://www.pewinternet.org/pdfs/PIP%20Bloggers%20Report%20July%2019%202006.pdf >; Retrieved June 2007
31. Lenhart, A.et al; *Teens and Technology: Youth are Leading the transition to a fully wired and mobile nation*; July 27, 2005; < http://www.pewinternet.org/pdfs/PIP_Teens_Tech_July2005web.pdf>; Retrieved June 2007
32. Levin, B.; *Students at risk: A review of research*, Prepared for The Learning Partnership 2004; <http://www.thelearningpartnership.ca/policy_research/studentsatrisk_by_Ben_Levin.pdf>; Retrieved June 2007
33. Lindsay, J., International School Dhaka, Bangladesh; "Online Tools for Sharing and Collaboration", *Learning and Leading with Technology*; September 2006
34. Looker, E.D; *The Digital Divide in Canadian Schools: Factors Affecting Student Access to and Use of Information Technology*; June 2003; <http://www.statcan.ca/english/research/81-597-XIE/81-597-XIE2003001.pdf>; Retrieved June 2007
35. Means, B.; Vice President, Policy Division, SRI International, Menlo Park, California; North Central Regional Educational Laboratory; *Critical Issue: Using Technology to Enhance Engaged Learning for At-Risk Students*; 1997; <http://www.ncrel.org/sdrs/areas/issues/students/atrisk/at400.htm>; Retrieved June 2007
36. National Center on Secondary Education and Transition; *ESSENTIAL TOOLS — Increasing Rates of School Completion: Moving From Policy and Research to Practice, A Manual for Policymakers, Administrators, and Educators*; May 2004; <http://www.ncset.org/publications/essentialtools/dropout/default.asp>; Retrieved June 2007
37. National Dropout Prevention Center and Communities in Schools, Inc.; *Dropout Risk Factors and Exemplary Programs: A Technical Report*; May 2007; <executive summary can be found at http://www.dropoutprevention.org/resource/major_reports/communities_in_schools/Dropout%20Risk%20Factors%20and%20Exemplary%20Programs%20Executive%20Summary%205-16-07.pdf; the full report can be found at http://www.cisnet.org/member/library/resources/downloads/Dropout_Risk_Factors_and_Exemplary_Programs_FINAL_5-16-07.pdf>; Retrieved June 2007
38. National Foundation for the Improvement of Education (NFIE); "At-Risk Students: Technology's Particular Promise", *Connecting the Bits*; 2000; <http://www.neafoundation.org/publications/ctb8.pdf>, Retrieved June 2007
39. North Central Regional Educational Laboratory; "Critical Issue: Using Technology to Improve Student Achievement"; posted in 1999 and updated in 2005; <http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te800.htm>; Retrieved June 2007
40. Passey, D., et al; *The Motivational Effect of ICT on Pupils*; 2004; <http://www.dfes.gov.uk/research/data/uploadfiles/RR523new.pdf>; Retrieved June 2007
41. Pew Global Attitudes Project; *Truly a World Wide Web: Globe Going Digital*; February 21, 2006; <http://pewglobal.org/reports/display.php?ReportID=251>; Retrieved June 2007
42. Rich, Tom (Council of Ministers of Education, Canada; *Canadian IT Policies and Practices in Education* (February 19, 2007 DRAFT)

43. Riffel, L., et al; "Promoting Independent Performance of Transition-Related Tasks Using a Palmtop PC-based Self-Directed Visual and Auditory Prompting System"; Blankenship, T.; "Effects of Computer-Based Cognitive Mapping on Reading Comprehension for Students with Emotional Behavior Disorders"; and Mechling, L.; "The Effect of Instructor-created Video Programs to Teach Students with Disabilities: A Literature Review"; *Journal of Special Education Technology*, Volume 20 Number 2 Spring 2005; <http://jset.unlv.edu/20/JSETv20n2.pdf>; Retrieved June 2007

44. Slavin, R.. Johns Hopkins University; *Evidence-Based Reform: Advancing the Education of Students at Risk*; March 2005; <http://www.americanprogress.org/kf/slavin%203%2017%20final.pdf>; Retrieved June 2007

45. Statistics Canada and Council of Ministers of Education Canada; *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program 2005*; April 2006

46. Teague, H.; "Can tech save students?"; *Classroom Connect*; December/January 2004/2005; <http://twi.classroom.com/workshops/kershaw/pdf/decjan05_pg4-7%5B1%5D.pdf>; Retrieved June 2007

47. Ungerleider, C., et al; *A Systematic Review of the Effectiveness and Efficiency of Networked ICT in Education: A State of the Field Report to the Council of Ministers of Education, Canada and Industry Canada*; October 24, 2003; <http://www.cmec.ca/stats/SystematicReview2003.en.pdf>; Retrieved June 2007

48. Wallis, C, and Steptoe, S.; "How to Build a Student for the 21st Century", *Time*, Canadian Edition, December 18, 2006

49. Ward, R., Department of Teaching and Teacher Education, University of Arizona; "Engage Students with Graphing Software", *Learning and Leading with Technology*; September 2006

50. Wenglinsky, Harold; "Technology and Achievement: The Bottom Line", *Association for Supervision and Curriculum Development – Educational Leadership*; December 2005 / January 2006; <http://www.hccsc.k12.in.us/technology/tip/Teachers'%20Academy/The%20Bottom%20Line.pdf>; June 2007

7. List of Relevant Web Sites

1. Renaissance Learning; Accelerated Reader Enterprise; <http://www.renlearn.com/ar/>
2. Alberta Education; Alberta High School Student Outcomes; <http://www.edc.gov.ab.ca/k_12/completion/>
3. Alberta Education; Alberta Initiative for School Improvement (AISI); <http://www.education.gov.ab.ca/k_12/special/aisi/>
    a. Cycle 2 Year 3, Project 10023, Focus on Supporting Teaching and Learning; <http://www.education.gov.ab.ca/k_12/special/aisi/clearinghouse/synop_cy2yr3.asp?id=10023>
4. Alberta Education; Alternative Program Policy; <http://www.edc.gov.ab.ca/educationguide/pol-plan/polregs/115.asp> and the Alternative Programs Handbook (2003); <http://www.education.gov.ab.ca/educationsystem/AltProgHandbook.pdf)>
5. Alberta Education; Assistive Technology for Learning; <http://www.education.gov.ab.ca/k_12/specialneeds/atl.asp>
6. Alberta Education; Effective Behaviour Support; <http://www.education.gov.ab.ca/safeschools/ebs.asp>

7. Alberta Education; High School Completion in Alberta; <http://www.education.gov.ab.ca/highschool/>
8. Alberta Education; Information and Communication Technology; <http://www.education.gov.ab.ca/k_12/curriculum/bySubject/ict/>
9. Alberta Education; Safe and Caring Schools; <http://www.edc.gov.ab.ca/safeschools/>
10. Alberta Education; Special Education; <http://www.education.gov.ab.ca/k_12/specialneeds/>
11. Alberta Education; Technology Standards and Solutions; <http://ednet.edc.gov.ab.ca/technology/Solutions.asp>
12. Alberta SuperNet; <http://www.albertasupernet.ca/>
13. Amiskwaciy Academy; <http://amiskwaciy.epsb.net/>
14. Cognitive Tutor Authoring Systems; <http://ctat.pact.cs.cmu.edu/>
15. Education Queensland, The Learning Place, i-support; <http://education.qld.gov.au/learningplace/isupport/>
16. "Essential Conditions for Implementing the National Educational Technology Standards for Administrators", International Society for Technology in Education (ISTE); <http://cnets.iste.org/administrators/a_esscond.html>
17. I Can Learn Education Systems; <http://www.icanlearn.com/courseware/k12/algebra.asp?src=content>
18. Manitoba Education, Citizenship and Youth; Literacy with ICT Across the Curriculum: A Developmental Continuum; <http://www.edu.gov.mb.ca/k12/tech/lict/s_leaders/index.html>
19. National Center on Secondary Education and Transition; <http://www.ncset.org/default.asp>
20. National Dropout Prevention Centre; The Keys to Success; The 21 Most Effective Dropout Prevention Strategies; <http://www.learningalternatives.net/Checklist_of_Dropout_Prevention_Strategies.pdf>
21. Northwest Regional Educational Laboratory; School Dropout Prevention Program; Key Characteristics of School Dropout Prevention Programs; <http://www.nwrel.org/scpd/sdpp/characteristics.asp>
22. Pew Global Attitudes Project (a project of the PewResearchCenter); <http://pewglobal.org/>
23. Rainbow Spirit Project; <http://www.ecsd.net/programs/rainbowspirit_project.html>
24. SoundOut, Promoting Student Voice in School; <http://www.soundout.org/tips.html>
25. What Works Clearinghouse; <http://www.whatworks.ed.gov/>