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The Promise and the Reality: Exploring the Research on Virtual Schooling

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The first web-based distance education programs at the K-12 began in the early 1990s. Unlike distance education and online learning in general, much less is known about virtual schooling – even less of which is based on systematic research. What is known is often based solely on practitioner experiences. Regardless, the growth and practice of virtual schooling has far outpaced the production of reliable and valid research. This paper will focus upon describing the evolution of K-12 online learning in Canada and the United States, how that evolution has impacted rural schools, and what lessons can be learned from the experiences with K-12 online learning.

While the use of distance education and online learning at the K-12 level occurs in many jurisdictions around the world, according to Powell and Patrick (2006) the organization of these programs into single entities or schools is largely a North American phenomenon. Unfortunately, this is also true of the K-12 distance education literature. A quick examination of the last five years of the main distance education journals for Australia, Canada, New Zealand and the United States revealed a total of 24 articles out of a total of 262 related to K-12 distance education (see Table 1).

Table 1. Analysis of main distance education journals for K-12 focused articles

	Australia	Canada	New Zealand	United States
<i>American Journal of Distance Education</i> (United States)				8
<i>Distance Education</i> (Australia)	2			4
<i>Journal of Distance Education</i> (Canada)	1	4		
<i>Journal of Distance Learning</i> (New Zealand)		1.5*	1	.5*
<i>Total</i>	3	5.5	1	12.5

* One article had a focus on both Canada and the United States

As indicated in Table 1, only 22 articles related to K-12 distance education in Australia, Canada, New Zealand or the United States (the remaining 2 articles focused on K-12 distance education in South Africa). However, 18 of those 22 articles were focused on K-12 distance education in Canada or the United States. It is for these reasons that I limit my discussion of K-12 distance education primarily to Canada and the United States.

In this paper I briefly describe the growth of K-12 online learning in North America. I then discuss the literature related to K-12 online learning, with special attention to the published research where I will argue that the majority of the research conducted to date has been methodologically limited. Further I explain the dangers of relying upon this research, particularly for the use of K-12 online learning in rural jurisdictions. Finally, I will argue the need for more systematic research conducted into the effective design, delivery, and support of K-12 online learning opportunities.

Growth of K-12 Online in North America

The first use of online learning at the K-12 level can be traced to a private school in California – Laurel Springs School around 1991 (Barbour, 2010). This was followed by supplemental, statewide virtual schools in Utah in 1994 (Clark, 2003) and Florida in 1996 (Barbour & Reeves, 2009). The Virtual High School Global Consortium (VHS), a supplemental program designed on a cooperative model (see Zucker & Kozma, 2003), was also created in 1996. The first full-time program in the United States began around 2000-01. At present, there is significant K-12 online learning activity in 45 of the 50 states and in the District of Columbia (Watson et al., 2009). In addition to the growth of K-12 online learning programs, its popularity among students has increased exponentially. In 2000-01 it was estimated that there were approximately 40,000 to 50,000 K-12 students enrolled in online courses (Clark, 2001). By 2008-09 there were over 1,000,000 K-12 students enrolled in one or more online courses (Picciano & Seaman, 2009), with 175,000 of those being enrolled in full-time cyber schools (Watson et al., 2009)

The first K-12 online learning programs in Canada were the New Directions in Distance Learning and the EBUS Academy, both of which began operating in 1993 in British Columbia (Dallas, 1999). Other district-based programs soon followed in Manitoba, Ontario, Alberta, and Newfoundland and Labrador (Barker & Wendel, 2001; Barker, Wendel & Richmond, 1999; Haughey & Fenwich, 1996; Stevens, 1997). Barbour (2009) reported that all thirteen provinces and territories appeared to have some level of K-12 distance education activity. In terms of student participation, in 1999-2000 it was estimated that there were approximately 25,000 K-12 students enrolled in distance education courses (Canadian Teachers Federation, 2000), with the majority of this enrollment occurring in the Province of Alberta (O’Haire, Froese-Germain & Lane-De Baie, 2003). At present, it is estimated that there are between 100,000 and 150,000 K-12 students enrolled in K-12 distance education courses. British Columbia has the most students engaged in distance education courses – with approximately 49,000 students or 7.5% of the total student population enrolled in at least one distance education course (Winkelmans, Anderson & Barbour, 2010).

While K-12 distance education and online learning has been growing in Canada and the United States, the rate of published literature – particularly systematic research – has not kept pace. In fact, the practice of K-12 online learning has far outpaced the availability of both general literature describing practitioner experiences and reliable, valid research.

Literature on K-12 Online Learning

Over the past five years there have been three major literature reviews of K-12 distance education published (i.e., Barbour & Reeves, 2009; Cavanaugh, Barbour & Clark, 2009; Rice, 2006). Building upon a list of benefits of and challenges facing K-12 online learning first published by Berge and Clark (2005), Barbour and Reeves (2009) described the literature as outlined in Tables 2 and 3.

Table 2. Summary of the benefits of K-12 online learning (p. 409)

Benefit	Reference
Higher levels of motivation	Kellogg and Politoski (2002)
Expanding educational access	Berge & Clark (2005); Cavanaugh (2001); Freedman, Darrow, Watson & Lorenzo (2002); Fulton (2002a); Hernandez (2005); Kellogg & Politoski (2002); Zucker (2005)
Providing high-quality learning opportunities	Berge & Clark (2005); Elbaum & Tinker (1997); Fulton (2002b); Kaplan-Leiserson (2003); Kellogg & Politoski (2002); Thomas (1999; 2000; 2003); Tinker & Haavind (1997)
Improving student outcomes and skills	Berge & Clark (2005); Zucker & Kozma (2003)
Allowing for educational choice	Berge & Clark (2005); Fulton (2002a); Hassell & Terrell (2004)
Administrative efficiency	Keeler (2003); Russo (2001); Vail (2001)

Table 3. Summary of the challenges of K-12 online learning (p. 411)

Challenge	Reference
High start-up costs associated with virtual schools	Berge & Clark (2005); Morris (2002)
Access issues surrounding the digital divide	Berge & Clark (2005)
Approval or accreditation of virtual schools	Berge & Clark (2005)
Student readiness issues and retention issues	Ballas & Belyk (2000); Barker & Wendel (2001); Berge and Clark (2005); Bigbie & McCarroll (2000); Cavanaugh, Gillan, Bosnick, Hess & Scott (2005); Clark et al., (2002); Espinoza, Dove, Zucker & Kozma (1999); Haughey & Muirhead (1999); Kozma, Zucker & Espinoza (1998); McLeod, Hughes, Brown, Choi & Maeda (2005); Zucker & Kozma (2003)

As illustrated by these tables, the bulk of the literature related to the benefits of K-12 online learning fell into the categories of expanding educational access, providing high-quality learning opportunities, and allowing for educational choice; while the majority of the literature related to the challenges facing K-12 online learning fell into the student readiness issues and retention issues category.

Barbour and Reeves pointed out that while K-12 online learning may allow for educational improvements such as high quality learning opportunities, it certainly did not guarantee any of these potential benefits would be realized simply by its introduction.

In their review of the open access literature, Cavanaugh et al (2009) indicated that the published literature to date had “focused on statewide and consortium/multi-district virtual schools, the roles of teachers and administrators, the promise of virtual schooling and its initial rationale for implementation, administrative challenges, the technology utilized, and interactions with students” (Conclusions and Implications, ¶ 1). Both Barbour and Reeves, along with Cavanaugh et al., also lamented the lack of empirical research among the published literature. For example, Barbour and Reeves wrote that “there [had] been a deficit of rigorous reviews of the literature related to virtual schools” (p. 402), while Cavanaugh et al. found only a small percentage of the open access literature was based upon systematic research. Rice reached the same conclusion, and stated “a paucity of research exists when examining high school students enrolled in virtual schools, and the research base is smaller still when the population of students is further narrowed to the elementary grades” (p. 430). In examining this limited amount of research, Rice categorized the research into two distinct areas: comparisons of student performance based upon delivery model and studies examining the qualities and characteristics of teaching and learning online. Similarly, Cavanaugh et al. also identified two categories: effectiveness of K-12 online learning and student readiness and retention issues.

To date, the research focused on student performance in K-12 online learning environments has been quite positive. For example, in examining the performance of virtual and classroom students in Alberta, Ballas and Belyk (2000) found that student performance was similar in English and Social Studies courses, but that classroom students still performed better overall in all other subject areas. However, one of the challenges to their findings was the fact that the participation rate in the assessment among online students ranged from 65% to 75% compared to 90% to 96% for the classroom-based students. This leads one to wonder if the results would have remained the same had more of the online students taken the assessment? In their annual evaluation of the Florida Virtual School (FLVS), Bigbie and McCarroll (2000) found that over half of the students who completed FLVS courses scored an A in their course and only 7% received a failing grade. Similarly, they also reported that between 25% and 50% of students had dropped out of their FLVS courses over the previous two-year period. Again leading one to wonder what the failure rate may have been had these students remained in their online courses?

These questions have largely remained unanswered, however, the researchers involved in these studies have become more open with their questions. For example, Cavanaugh et al. (2005) found that FLVS students performed better on a non-mandatory assessment tool than students from the traditional classroom. The authors questioned this finding by speculating that the virtual school students who did take the assessment may have been more academically motivated and naturally higher achieving students. Similarly, McLeod et al. (2005) found that FLVS students performed better on an assessment of algebraic understanding than their classroom counterparts, but speculated that the student performance was likely due to the high dropout rate in virtual school courses. Finally, Barbour and Mulcahy (2008; 2009) found that students enrolled in online courses through the Centre for Distance Learning and Innovation performed as well as classroom-based students on final course scores & exam marks. Even though they had access to a complete population of data for the Canadian province of Newfoundland and Labrador over a five-year period, the authors were concerned that they were not comparing apples and oranges when it came to the nature of students enrolled in each group.

The concerns over the nature of online K-12 students, which was the second general area of research identified by both Rice and Cavanaugh et al., was well founded. For example, in their first-year evaluation of the VHS, Kozma, Zucker and Espinoza (1998) indicated that the vast majority of students enrolled in VHS courses were planning to attend a four-year college. Similarly in their second evaluation, Espinoza et al. (1999) reported that “VHS courses are predominantly designated as ‘honors,’ and students enrolled are mostly college bound” (p. 49). In describing K-12 online learners in Canada, Haughey and Muirhead (1999) included characteristics such as highly motivated, self-directed, self-disciplined, independent learners who could read and write well, and who also had a strong interest in or ability with technology, while Roblyer and Elbaum (2000) added “only students

with a high need to control and structure their own learning may choose distance formats freely” in their discussion of K-12 online learners in the United States.

In fact, the research literature has provided a fairly consistent description of K-12 online students. Clark et al. (2002) described students enrolled in the Illinois Virtual High School as “highly motivated, high achieving, self-directed and/or who liked to work independently” (p. 40), while Mills (2003) described K-12 online learners in the United States as typically an A or B student. Watkins (2005) stated that 45% of the students who participated in e-learning opportunities in Michigan were “either advanced placement or academically advantaged” (p. 37).

However, one of the difficulties or limitations with the research into K-12 online learning is this description of K-12 online learners as highly capable students, and it is problematic for two reasons. The first reason is because many have begun to question whether these kinds of characteristics describe all or even the majority of K-12 online learners (Barbour, 2009). For example, most states in the United States require students to have completed at least one full year of mathematics in order to graduate from high school. The introduction to mathematics in high school is two algebra courses, usually offered in grade nine. In her opening address to the 2007 Virtual School Symposium, the President of the International Association for K-12 Online Learning (iNACOL) stated that the two courses with the highest enrollment of online students in the United States were Algebra I and Algebra II (Patrick, 2007). In the 2008 edition of the annual *Keeping Pace with K-12 Online Learning* report, Watson, Gemin and Ryan (2008) stated that the largest growth in K-12 online learning enrollment was with full-time cyber schools, and Klein (2006) indicated that many cyber schools have a higher percentage of students classified as “at-risk”. For those not familiar with the term, in the United States “at-risk” students are those individuals who are in danger of dropping out of traditional school system (Rapp, Eckes & Plurker, 2006). So it is possible that the majority of the research has been conducted with students that are not representative of the full range of K-12 online learners.

The second reason is because of the lack of understanding that the general population, including the majority of practitioners of K-12 online learning, have when it comes to systematic research methodology. For example, iNACOL (which is the professional association for individuals interested in or involved with virtual schooling) regularly makes the claim that K-12 online learning is as effective as face-to-face instruction based upon the comparisons of student performance described above. In fact, proponents of K-12 online learning – particularly in the United States – regularly fail to consider the significant limitation from the highly selective student population used in these studies. Even researchers often overlook these and other methodological issues. Hattie (2009) cautioned educational researchers in their findings to consider whether one group of students is different than another group of students beyond chance. Hattie’s research involved the synthesis of over 800 meta-analysis related to student achievement. Based upon his research, in his discussion of how to understand the effect size reported in a meta-analysis, he indicated three important considerations: any negative effect size harms student achievement; students will naturally have a 0.15 effect size improvement in a given year due to their own maturity; and any average teacher will naturally have a 0.25 effect size improvement in student achievement (see Figure 1).

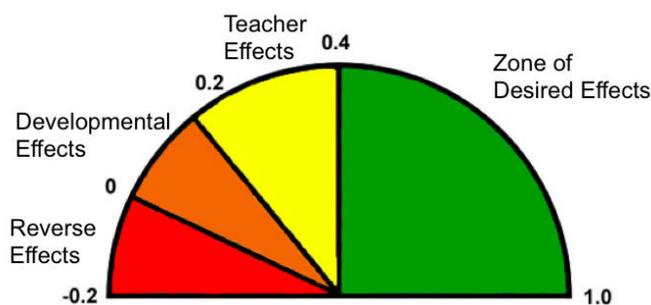


Figure 1. Hattie’s understanding of how to read effect sizes reported in meta-analysis

As illustrated by Figure 1, Hattie argued that an innovation should have an effect size of at least 0.4 before it is considered effective in improving student achievement (and he acknowledges that the 0.4 threshold is actually lower than other methodologists have argued).

To date there have been four meta-analysis that have included K-12 online learning (i.e., Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Wallet, Fiset & Huang, 2004; Cavanaugh, 2001; Cavanaugh, Gillan, Kromrey, Hess & Blomeyer, 2004; Means, Toyama, Murphy, Bakia & Jones, 2009). In her meta-analysis that included 16 studies focused solely on K-12 distance education, Cavanaugh (2001) found that there was a small positive effect of 0.147 in favor of the K-12 distance education students. Three years later, Cavanaugh et al. (2004) conducted a meta-analysis of 14 studies focused on the K-12 level and found a small negative effect of 0.028 towards the K-12 distance education students. In a meta-analysis that included 232 studies of both K-12 and adult learners, Bernard et al. (2004) found a positive effect size of 0.0128 in favour of the distance education students. More recently Means et al. (2009), using a more stringent criteria that included only 59 studies of K-12 and adult learners (only 5 of which focused on K-12 learners), found a positive effect size of 0.24 favoring online students over face-to-face and a positive effect size of 0.35 favoring students in blended environments over face-to-face.

None of these positive effect sizes rises to Hattie's "zone of desired effects", and one of the findings indicated that K-12 distance education had a negative effect on student achievement. These issues point to the fact that practitioners should be cautious in their use of K-12 distance education, particularly with students who are not among the highly selective group of students representative in the literature. Some researchers have gone so far as to question whether online learning is suitable for all K-12 students, particularly rural students (Mulcahy, 2002)?

K-12 Online Learning and Rural Education

Mulcahy's questioning of the ability of K-12 online learning to serve a full range of students came as the provincial Government in Newfoundland and Labrador was on the verge of creating a province-wide program to replace the existing audiographics system. The existing system served rural students interested in taking advanced mathematics and science courses, along with French as a second language. Even focused on this population of higher ability students "it was widely known, but rarely documented, that students often required and received a significant amount of assistance with matters of content from school based personnel" (Barbour & Mulcahy, 2004, ¶ 14). The proposed lack of content-based assistance from teachers at the local school level was particularly troubling. In their evaluation of another statewide K-12 online learning program, Roblyer, Freeman, Stabler and Schneidmiller (2007) found that school-based teachers "directly working with students day by day are key to the success of the [K-12 online learning] program" (p. 11). The creation of a distance education system without real-time instruction, and limited school-based support, appeared to be a recipe for failure for a broader range of rural students.

While the provincial Government did not proceed with an entirely asynchronous system, the model adopted asked that school-based or mediating teachers not be responsible for "providing regular instruction or tutorial assistance" (W. Shepherd, personal communication, 23 April 2001). While studies of student performance since the introduction of this program have shown online students achieving at levels consistent with their classroom counterparts (i.e., Barbour & Mulcahy, 2008; 2009), as noted earlier there remain concerns about the comparability of the two groups of students (i.e., online students with classroom-based students). As the nature of the data maintained by the provincial Government makes it impossible to compare the overall GPA of classroom-based students and web-based students, the authors will continue to be unable to determine if their sample of online students contained the same range of abilities as the sample of classroom students.

In a separate study of rural schooling in three schools on the south coast of the Labrador portion of the province, Mulcahy, Dibbon and Norberg (2008) found that two of the three schools had a higher percentage of students enrolled in basic-level courses. Within the provincial curriculum, the subject areas of English language arts and mathematics both have a basic stream and an academic stream. Students who enroll in the basic stream are not eligible for post-secondary admittance. In this instance, the authors speculated that because the only way these students could take an academic level course at their school was to do so in an online environment, that some students were specifically choosing the basic stream to avoid taking an online course. In an attempt to investigate this claim, Mulcahy and Barbour (2010) explored the percentage of students enrolled in basic courses throughout the province based on location and delivery model (see Tables 4 and 5).

Table 4. Basic level enrollment for English language arts in Newfoundland and Labrador by year

	2003-04	2004-05	2005-06	2006-07
Provincial total (includes both online and face-to-face)	23.4%	23.7%	23.6%	23.8%
Total online	33.1%	19.4%	18.4%	19.4%
Total rural (includes both online and face-to-face)	28.4%	27.9%	29.1%	30.2%
Total online and rural	41.2%	41.8%	29.6%	33.0%

Table 5. Basic level enrollment for mathematics in Newfoundland and Labrador by year

	2003-04	2004-05	2005-06	2006-07	2007-08
Provincial total (includes both online and face-to-face)	23.0%	23.9%	23.7%	23.2%	23.2%
Total online	28.6%	24.7%	23.3%	24.9%	25.3%
Total rural (includes both online and face-to-face)	27.8%	28.6%	28.8%	30.1%	29.9%
Total online and rural	29.3%	32.4%	28.2%	32.9%	34.8%

Table 4 illustrates that while initially there was a higher percentage of basic level students enrolled in English language arts at rural schools that relied upon distance education, the proportional has gradually decreased to be consistent to the level of basic level students at rural schools in general. (It should be noted that there is still an alarming trend of higher levels of basic students in English language arts at rural schools in general, but for the purposes of this discussion it appears the issue of students having to take English language arts online is no longer a factor.) However, Table 5 illustrates that there has been a consistent trend of higher levels of basic enrollment in rural schools that rely upon the K-12 online learning program to offer the academic level mathematics courses. This line of inquiry did not survey these basic students to determine if indeed they were enrolling in basic courses to avoid taking the course online, yet the enrollment data certainly seems to point in that direction.

The reluctance of K-12 students in Newfoundland and Labrador to enroll in this online program may lie in the delivery model utilized by the program itself. According to Barbour (2007a), the CDLI utilizes a combination of synchronous and asynchronous instruction – with approximately 30% to 80% of the students’ scheduled time being synchronous (depending on the subject area). However, in a case study of one rural school, Barbour (2007b) found that students rarely used their scheduled asynchronous time to complete course-related work. Further, online teachers rarely assigned substantive, content-based work during asynchronous time; instead attempting to teach the entire course content during the 30% to 80% allotted to synchronous instruction and assigning questions from the textbook or time to work on assignments during the scheduled asynchronous time.

The ineffective use of time – both by online teachers and online students, along with the lack of content-based assistance from school-based teachers, appear to create an environment where students struggled to achieve. In the limited sample included in Barbour’s (2007b) case study, students’ final course averages in their online courses were approximately 10% lower than in the classroom-based courses they were enrolled in during that same year. Given the experiences in this one – primarily rural – province it should not be surprising that many have called for researchers to focus their studies on issues related to the effective design, delivery and support of K-12 online learning (Barbour, 2010; Barbour & Reeves, 2009; Blomeyer, 2002; Cavanaugh et al., 2009; Rice, 2006; Smith, Clark & Blomeyer, 2005).

Conclusions

While K-12 distance education is practiced in many countries around the world, the organization of these opportunities into single program entities or schools is largely a North American phenomenon. Additionally, the majority of literature related to K-12 online learning has focused upon programs in the United States and Canada. Within these two countries, K-12 online learning is growing at a tremendous rate. In the United States this growth was initially attributed to online programs being able to provide K-12 students with opportunities not available at their local schools. However, more recently the growth of K-12 online learning has been due to the school choice movement and the increase in the number of students attending full-time cyber charter schools. The growth in Canada has been more modest and, until recently, largely focused on rural jurisdictions.

At present there is a growing body of literature related to K-12 online learning. Unfortunately, the vast majority of that literature is based upon the experiences or opinions of practitioners. The amount of systematic research that has been published has been limited. Cavanaugh et al. (2009) describe this situation as:

indicative of the foundational descriptive work that often precedes experimentation in any scientific field. In other words, it is important to know how students in virtual schools engage in their learning in this environment prior to conducting any rigorous examination of virtual schooling. (¶ 5)

Regardless, the rigorous examination that does exist has been limited to methodologically questionable claims about the effectiveness of K-12 online learning and describing the highly selective group of students that have traditionally enrolled in these environments.

It is unfortunate that the description of this group of students is not representative of the wider range of students enrolled in K-12 online learning, and possibly not even descriptive of the majority of these students. Because the available research has been skewed to the higher ability students, many have begun to question whether K-12 online learning is suitable for all students – particularly those rural students who must rely upon online learning to complete required courses. Clearly more work is needed to ensure that these rural students, many of whom have no real choice when enrolling in online courses, have an equal opportunity to be successful.

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