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The reality of virtual schools: A review of the literature

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ABSTRACT

Virtual schooling was first employed in the mid-1990s and has become a common method of distance education used in K-12 jurisdictions. The most accepted definition of a virtual school is an entity approved by a state or governing body that offers courses through distance delivery – most commonly using the Internet. While virtual schools can be classified in different ways, the three common methods of delivery are by independent, asynchronous or synchronous means. Presently, the vast majority of virtual school students tended to be a select group of academically capable, motivated, independent learners. The benefits associated with virtual schooling are expanding educational access, providing high-quality learning opportunities, improving student outcomes and skills, allowing for educational choice, and achieving administrative efficiency. However, the research to support these conjectures is limited at best. The challenges associated with virtual schooling include the conclusion that the only students typically successful in online learning environments are those who have independent orientations towards learning, highly motivated by intrinsic sources, and have strong time management, literacy, and technology skills. These characteristics are typically associated with adult learners. This stems from the fact that research into and practice of distance education has typically been targeted to adult learners. The problem with this focus is that adults learn differently than younger learners. Researchers are calling for more research into the factors that account for K-12 student success in distance education and virtual school environments and more design research approaches than traditional comparisons of student achievement in traditional and virtual schools.

1. Introduction

In 2007, Dean Bennett of the Canadian Press asked his readers "Why, in the Information Age, are students heading back to classrooms?" He then proceeded to describe a future when students in one country could take courses from a high school in another country. Bennett further predicted that each future student would study in virtual environments where the artificial intelligence of the computer would detect the learning style of the student and deliver course materials specifically tailored to that student. In a recent report published by the think tank Education Sector, Tucker (2007) stated:

> There has been no shortage of solutions for improving the nation's public schools. School leadership, teacher quality, standards, testing, funding, and a host of other issues have crowded reform agendas. But an important trend in public education has gone largely unnoticed in the cacophony of policy proposals: the rise of a completely new class of public schools – "virtual" schools using the Internet to create online classrooms – that is bringing about reforms that have long eluded traditional public schools. (p. 1)

There have been others who have trumpeted virtual schools as a means to enact innovative educational reform going back many years (Jones, 1997; Perelman, 1992), but there has been a deficit of rigorous reviews of the literature related to virtual schools. This review of the literature is intended to provide a critical analysis of virtual schooling at a time when this educational phenomenon is beginning to attract wider public attention. We primarily examine the benefits and challenges of virtual schools for the students who have enrolled in them. In addition, we discuss future directions for research into virtual schooling. In this review, we focus on the development and growth of virtual schooling in Canada and the United States, fully aware that the findings of our review may not extend to other regions of the world.

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For the purposes of this review, we reviewed several definitions of virtual schools. For example, Clark (2000) defined a virtual school as "a state approved and/or regionally accredited school that offers secondary credit courses through distance learning methods that include Internet-based delivery" (p. i). Russell (2004a) defined virtual schools as "a form of schooling that uses online computers to provide some or all of a student's education" (p. 2). We do not limit the definition of virtual schools to secondary education alone as Clark (2000) did in his definition, but we do limit our definition to virtual schools that have been approved or accredited by an official body. Russell's (2004a) definition and others we reviewed are limited by this failure to include approval or accreditation, but these definitions do delimit virtual schools, as we also do, to those that are primarily delivered online via the Internet.

Our specific goal in this literature review is to address the following five questions:

1. How have virtual schools developed and grown?
2. How are virtual schools and virtual school students described in the literature?
3. What are the primary benefits of virtual schooling?
4. What are the primary challenges of virtual schooling?
5. What research is needed to extend the benefits and meet the challenges of virtual schooling?

Our literature review began in 2004 and has continued into 2008 as we have progressed further into this line of inquiry – both through further exploration of the literature and through the design and implementation of various research studies (for a more comprehensive discussion of the development of this literature review, see Barbour (2007b)). We consulted several online databases available through a research university library system, including databases such as ERIC, JSTOR, PsychINFO and WilsonWeb to name a few. However, to extend our review we consulted like-minded colleagues in person at the annual Virtual School Symposium (http://www.nacol.org/events/), at the annual meeting of the American Educational Research Association (http://www.aera.net/), and at the annual Society for Information Technology in Teacher Education conference (http://www.aace.org/conf/site/). Colleagues who have written about virtual schooling and/or were interested in similar research provided significant guidance about where to locate research related to what amounts to a new and unique area of scholarship. As much of the literature for virtual schooling has primarily been disseminated through private research centers, evaluations or doctoral dissertations, we also consulted the World-Wide Web using the Google® search engine, including Google® Scholar, on a regular basis as a supplementary source. Using these resources, we conducted searches using a variety of search terms including, but not limited to: virtual school, cyberschool, K-12, online learning, distance education, e-learning, andragogy and pedagogy.

When possible, we have attempted to focus this review on refereed journal publications and papers from refereed conferences. However, the amount of refereed research evidence in this body of literature was limited. Much of the published literature is based upon the personal experiences of those involved in the actual practice of virtual schooling, while much of the research is only available in unpublished Masters' theses and Doctoral dissertations. Non-refereed documents were included when there were not refereed sources available or when the methodology of these studies was judged to be sufficiently rigorous.

2. Growth of virtual schooling

The first references to virtual schooling in the literature were based on district initiatives in Canada, more specifically in two provinces: Alberta and Newfoundland/Labrador. The first virtual schools in Alberta appeared around 1995 and were primarily based in rural portions of the province. Haughey and Fenwick (1996) first discussed administrative and policy issues surrounding the formation of school district consortia to provide web-based distance education in Alberta. From 1995 to 1999 these programs grew to include 23 virtual school programs operating in that province (Muirhead, 1999).

Beginning in 1996, Stevens (1997a, 1997b) and Stevens and Mulcahy (1997) outlined a research project that used a school district intranet to provide telelearning opportunities to rural secondary school students in the province of Newfoundland and Labrador. Unlike the Alberta example, the district initiatives in Newfoundland and Labrador expanded into the current provincial virtual school, the Centre for Distance Learning and Innovation (CDLI) (see Barbour (2005a)). During its first four years of operation, the CDLI increased from 200 student enrollments in ten courses representing 76 different schools in 2001–2002, to 1500 student enrollments in 35 courses in 95 different schools in 2004–2005 (Government of Newfoundland, 2004).

In a national survey of virtual schooling in Canada, O'Haire, Froese-Germain and Lane-De Baie (2003) reported that Alberta still had the most students engaged in virtual schooling, with approximately 4500 full-time and 2500 part-time K-12 students in more than 20 schools. Another provincial initiative, Contact North, reported 11,222 registrations from Northern Ontario in their 548 courses for the year 2000–2001 – an increase of 12% over the previous year (Betty, Hebert, & Sefton, 2002). In 2001–2002, a partnership of eighteen school districts in British Columbia offered a pilot electronic distance education program for 2200 students (Kuehn, 2002). With over 17,000 student enrollments in distance education, five years later the province of British Columbia launched a new province-wide virtual school, *Learnnow BC*, to provide rural and remote students "with more course choices and flexibility" (Government of British Columbia, 2006). This growth has even been experienced in urban areas where over the past four years the Vancouver School Board (the largest in British Columbia) and the Toronto District School Board (the largest in Canada) have established their own virtual schools. However, even with the spread of virtual schools into urban areas in Canada and the United States, Clark (2003) concluded that the majority of schools that participate in K-12 distance education and virtual schooling are rural and small schools.

The first two virtual schools in the United States were both created in 1997. The Virtual High School (VHS) was created through a five year, $7.4 million federal grant, while the Florida Virtual School (FLVS) was established through an allocation of $200,000 from the state legislature (Friend & Johnston, 2005; Pape, Adams, & Ribeiro, 2005). Within a couple of years of virtual schools being introduced to the United States, Clark (2000) presented his report, *Virtual High Schools: State of the States*, where he listed three existing statewide virtual schools (i.e., Florida, New Mexico, and Utah), with three more in the planning stages (i.e., Illinois, Kentucky, and Michigan), and also two non-statewide initiatives (i.e., the VHS and CLASS.com). In his follow-up report a year later, Clark (2001) reported that the list had grown to at least fourteen states with existing or planned virtual schools with between 40,000 and 50,000 students enrolled in courses

through these virtual schools. That same year in the monthly magazine published by the National School Boards Association, Vail (2001) reported that there were more than 50 charter and public schools running online programs in at least 30 states. This represents significant growth during the first five years that this form of distance education has been available in the United States.

The last four years have continued to see similar growth in the United States. In a summary of the five years of evaluation of the VHS, Zucker and Kozma (2003) reported that the consortium then contained almost 200 high schools within 24 states, as well as an expansion to 10 foreign countries. Two years later, Pape et al. (2005) indicated that this consortium had increased to 232 schools in 26 states and 11 countries. In their review of state-level policy for the North Central Regional Educational Laboratory (NCREL), Watson, Winograd, and Kalmon (2004) found that eleven of the 22 states that they surveyed had a substantial level of activity, or the presence of legislation and/or regulations concerning virtual schooling. In a more comprehensive follow-up to that study, Watson and Kalmon (2005) surveyed all fifty US states and found that approximately half of them had significant policies for virtual schooling. They also found that there were 21 states that had virtual schools operating on a statewide basis (although in some instances these were district-based or university-based programs that had students enrolled from across the state). In their second follow-up report, the authors found that there were now 24 statewide virtual schools (Watson & Ryan, 2006).

Huerta and González (2004) estimated that over the five years preceding their study there had been approximately 60 cyber charter schools in 15 states serving over 16,000 students. Setzer and Lewis (2005) speculated that there were approximately 328,000 public school enrollments in online or two-way television distance education programs in the United States. However, it should be noted that this figure would include all online distance education programs, not just virtual school students.

The combination of state-sanctioned virtual high schools, virtual charter schools, students served by online homeschool association endeavors (such as the online course offerings of the Pennsylvania Homeschoolers Association), university laboratory schools, and other online course offerings (such as commercial ventures like APEX Inc. and Class.com Inc.) has provided a growing opportunity for secondary school students to complete individual courses, and in many instances entire high school diplomas, through virtual school offerings. In 2006 there were "139,000 students enrolled in at least one course through a state virtual school" (Gray & Tucker, 2006, p. 1). Using a 50% growth rate over the past five years in the two oldest state programs, the FLVS and the Electronic High School in Utah, Gray and Tucker predicted that there will be over a half a million students taking virtual school courses by the end of the decade. A year later Picciano and Seaman (2007) gave an estimate which surpassed this mark when they stated that approximately 700,000 K-12 students were engaged in online courses in 2005–2006. Although this variance in enrollment estimates suggests the need for better accounting of student participation in virtual schools, the growth trend is clearly evident.

Rapidly growing programs such as these provided the basis for the National Education Association's prediction that by 2006 a majority of American high school students will have completed at least one online course before graduation (Fulton, 2002a). The conclusion that a majority of high school students have completed an online course may seem implausible; however, there have been recent developments which will make this prediction possible. For example, in the *Michigan Merit Curriculum Guidelines: Online Experience*, the government of Michigan outlined the decision to be the first state in America to require that all students will be required to take at least one online course as a requirement for graduation (Department of Education, 2006). During the 2003–2004 school year there were less than 8000 student enrollments in the Michigan virtual high school (Borja, 2005), but there were over 525,000 high school students in Michigan during this same time period (National Center for Educational Statistics., 2005). So the potential for an even more dramatic increase in the number of students enrolled in virtual school courses, in both Michigan and the country as a whole, is high.

3. Nature of virtual schooling and virtual school students

There is a general perception that a virtual school is an online, Internet-based or web-based distance education program available to K-12 schools and students. In fact, in their initial *Keeping Pace with K-12 Online Learning: A Snapshot of State-level Policy and Practice*, Watson et al. (2004) chose to survey how the states were legislating and implementing K-12 online learning – which they defined as education in which instruction and content are delivered primarily via the Internet. However, the definitions for virtual school found in the literature are more exclusive in their classification.

In Canada, Barker, Wendel, and Richmond (1999) defined a virtual school as "one that offers the mandated provincial instructional program to students through web-based means (i.e., computer-mediated and online via the Internet" (p. 2). Further, they described a virtual school as being "characterized by a structured learning environment under the direct supervision of a teacher, web-based delivery to home or in a setting other than that of the teacher, and contains instruction that may be synchronous or asynchronous" (p. 2). In the complete description of their definition, Barker et al. described how a virtual school was one where students took all of their courses in the virtual environment. According to this definition, popular American virtual schools (such as the VHS and the FLVS) provide virtual schooling opportunities, but are not virtual schools because their students are not all full-time virtual learners. Within the literature, Clark's (2000) definition of virtual schools as "a state approved and/or regionally accredited school that offers secondary credit courses through distance learning methods that include Internet-based delivery" (p. i) is the more accepted of the two.

Virtual schooling is primarily a North American phenomenon (Cavanaugh et al., 2006). This is supported by a recent study conducted by the North American Council for Online Learning (NACOL). In a survey of Ministries of Education from 30 countries, Powell and Patrick (2006) found that while many other countries operated some form of web-based or online curricular support program for students and teachers (e.g., a SchoolNet such as the one found at http://www.schoolnet.org.uk/), and some even offered web-based or online distance education programs, only Canada and the United States operated entities that would be classified as virtual schools. Glenn Russell at Monash University in Australia is one of the few scholars outside of North America who has written about virtual schooling. His work has added to our conceptual understanding of virtual schooling from an international perspective, although he relies upon the North American experience in outlining his perceptions (e.g., Russell, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006a, 2006b).

Clark (2001) indicated that there were different types of virtual schools and described them based on the seven categories found in Table 1.

Watson et al. (2004) offered a different classification with five different types of virtual school that which was summarized by Rice (2006) in Table 2. The main difference between the Clark (2001) classification and the Watson et al. (2004) classification was Clark's focus upon the entity that was responsible for the administration of the virtual program compared to Watson et al.'s focus upon the geographic

Table 1
Clark's seven categories of virtual schools

Type	Description
State-sanctioned, state-level	Those virtual schools that operate on a statewide level, such as the FLVS or the Illinois Virtual School (IVHS)
College and university-based	Those independent university high schools or university-sponsored delivery of courses to K-12 students, such as the University of Nebraska-Lincoln Independent Study High School or the University of California College Prep Online (UCCP)
Consortium and regionally-based	Those virtual schools operated by a group of schools or school districts that pool their resources to participate, such as the VHS
Local education agency-based	Those virtual schools operated by a single school or school district, such as the Gwinnett County Online Campus or the Cobb County eSchool
Virtual charter schools	Those virtual schools created under the charter school legislation that has been passed in many states, such as Connections Academy, also commonly known as cyberschools
Private virtual schools	Those virtual schools that are operated in the same manner as a brick-and-mortar private school, such as the Christa McAuliffe Academy in Washington state
For-profit providers of curricula, content, tool and infrastructure	Those commercial companies that act as vendors for the delivery of courses or the use of course materials, such as APEX Learning or Aventa Learning

Table 2
Watson et al.'s five categories of virtual schools (p. 427)

Type	Description
Statewide supplemental programs	Students take individual courses but are enrolled in a physical school or cyber school within the state. These programs are authorized by the state and overseen by state education governing agencies
District-level supplemental programs	Are typically operated by autonomous districts and are typically not tracked by state agencies
Single-district cyber schools	Provide an alternative to the traditional face-to-face school environment and are offered by individual districts for students within that district
Multi-district cyber schools	Are operated within individual school districts but enroll students from other school districts within the state. This represents the largest growth sector in K-12 online learning
Cyber charters	Axe chartered within a single district but can draw students from across the state. In many cases they are connected in some way to commercial curriculum providers

reach of the virtual program and the level of student enrollment (i.e., part-time vs. full-time). The Watson et al. classification is currently the more commonly utilized. Regardless of which classification is considered, it should be understood that there is a great deal of variety in the different types of virtual schools that are currently operating in North America. Although we lack evidence for this development at this time, it is reasonable to conclude that virtual schools will soon become more widely deployed in other countries, including those classified as developing (Farrell, 2001).

The variety in virtual schooling is not limited to the different classifications of virtual schools, but also extends to the actual delivery of virtual schooling. As Kaseman and Kaseman (2000) accurately pointed out in *Home Education Magazine*, some virtual school courses operate much like traditional correspondence courses with student interaction being limited to readings and written responses, while in other virtual school courses students interact with their teacher and classmates through e-mail, discussion forums, chat rooms, instant messaging, real-time audio conversations, and even video conferencing. This student interaction can be unscheduled, to allow students to work at their own pace when it is convenient for them, or it can be scheduled to allow for the real-time interactions. Within all of this variety, there are three dominant methods of delivery that have emerged for virtual schooling: independent, asynchronous, and synchronous (or a combination of asynchronous and synchronous).

The student who is taking a course from a virtual school with an independent method of delivery is similar to the student who would take a traditional correspondence course, only with the computer mediating the experience. Greenway and Vanourek (2006) described the experience of one sixth grade virtual student in this independent environment as:

> In a "typical" day, a student might take mostly core courses with some electives and log on to the computer for an hour or two, clicking through interactive lessons with text, audio or video clips, Flash animation, and links to related sites; completing an online math quiz; e-mailing the teacher; and "chatting" with classmates online. Students complete the majority of their work offline in many of these online schools, for example, reading assignments, drafting an essay, conducting an experiment with school-supplied materials, and studying for an exam. . .. A parent or other responsible adult is asked to supervise – and sometimes to assist with instruction and motivation, all under the direction of a licensed teacher.

As illustrated by this description, the independent student is essentially teaching him or herself or being taught by a parent, with only minimum involvement from a teacher. For the independent student, the virtual school simply provides the materials used by the student. This method of delivery appears to be most closely associated in the literature with schools using the services of K12, Inc., or the Visions Academy (Bracey, 2004; Ohanian, 2004; Scherer, 2006).

The asynchronous method of delivery is more common among the statewide virtual schools throughout the United States. For example, Friend and Johnston (2005) described how the students taking a course through the FLVS would interact with the online curriculum, based upon Florida's Sunshine State Standards. This curriculum engaged them in real-world applications, taking them through each of the steps of Gagne's (1985) nine events of instruction, challenging them with content primarily designed for the higher levels of Bloom's taxonomy, and providing them with choice in the resources they use and how they demonstrate a mastery of the content. After the student has finished interacting with the curriculum, a student turns in "assignments, and the teacher gives written feedback in the electronic course room or phones to discuss ways the student can improve performance" (p. 109).

This asynchronous method is consistent with the description provided by Zucker and Kozma (2003), who described a student experience in a Bioethics course offered through the VHS. A student would enter their online course where the student is presented with a photo of the teacher, possibly photos of other students, the course syllabus and a course calendar. The student would use the syllabus, calendar, other web-based material, and student–teacher communications to determine the specific reading assignments and written work to be completed each week. Using the online course content and possibly a textbook, the student would work through the material and complete the written work – which would be submitted to the teacher for written feedback delivered to the student through the course management system.

In the example of the Bioethics course, students would "bring an article to class about a current event dealing with bioethics. Students post a synopsis of each article and participate in a discussion about the articles" (p. 59). Based upon the instructions for this activity, the students are the driving force behind the participation and the teacher simply monitors the discussion, only contributing when "she sees serious misunderstandings, errors, or problems" (p. 60). Unlike the description of the independent method of delivery, the virtual school provides much more than a set of resources by using a robust course management system that allows more interaction between the teacher and the students, and among students themselves. The role of the teacher in this method of delivery is much more active, guiding the students through the curriculum and serving as the source of both formative and summative evaluation of the student's work. However, even with this increase in the level of teacher involvement, there is still a great deal of independence (and even isolation) associated with the asynchronous method of delivery.

Unlike their American counterparts who must accommodate the schedules established by local educational authorities, it is more common for district-wide, consortium or provincial virtual schools in Canada to offer synchronous classes during the school day in a delivery method that utilizes a combination of both asynchronous and synchronous instruction.[2] A good example of a synchronous learning environment is provided by Murphy and Coffin (2003), "when students first enter the virtual classroom, they have access to DM [direct messaging] and hand raising. Access to other tools, such as the microphone or the WB [whiteboard], must be assigned by the teacher" (p. 236). Using these tools, the teacher can lead a traditional lecture, using slides on the whiteboard to guide their presentation or as notes for the student. In his thesis examining social presence with web-based instructors who taught in a combination synchronous and asynchronous environment, Nippard (2005) described many of the different kinds of interaction that would be expected in a traditional classroom, with the teacher presenting the content in a lecture-style with notes or worked examples on the whiteboard and students asking their teacher's questions using both the audio and text-based communication tools based on their presentation of the content.

Using a synchronous method, teachers can also facilitate an audio or text-based discussion with the students. For example, in their interview and observation study of how synchronous instruction was used in a second language French course, Murphy and Coffin (2003) described how teachers would begin the class by asking students "Quel temps fait-il chez toi?" or "What's the weather like where you are?" and some students would respond one after another using the audio feature, while others would type their answer in the direct messaging. Depending on the virtual classroom software that is utilized, there may only be the opportunity for one person to speak at a time or multiple people, however, the direct or instant messaging always allows for multiple individuals to participate in private or public discussions. The teacher also has the ability to assign students to a particular room which allows them to work in groups without the interference of audio or additional text-based discussion from members of other groups. Finally, the teacher can also assign the moderator controls over to a student to allow them to present material within the classroom.

Regardless of the method of delivery offered by the virtual school, the descriptions of the students typically found in virtual schools have been fairly consistent in the literature. Probably the most detailed description of a virtual school student was provided by Stevens (1999b), who described an actual student from an online Advanced Placement project who he felt possessed the characteristics and a particular routine that made him an effective online learner.

> He goes home from school and works from 4 p.m. until supper at 5 p.m. then from 6 to 9 p.m., Monday to Thursday and also for much of Sunday. He has his own room at home with plenty of study space and his own desk. He also has his own room at school in which to work as he is the only AP student there.
>
> His Principal and many of the teachers at his school follow his progress and report on this to the rest of the students. Accordingly, many of his fellow students take an interest in his online learning and have learnt about the requirements of AP subjects. From time to time the Principal will report to other teachers a good grade that this AP student has achieved. There is a qualified teacher in this student's AP subject in his school although he has never taught at this advanced level.
>
> He maintains that it is necessary to work steadily and keep to working regardless of any problems that come his way. He clearly relates very well to his AP teachers and e-mails him regularly. If there is a problem he contacts his AP teacher. From time to time he e-mails a student at Arnold's Cove who is taking the same online course.
>
> This student maintains that his AP course does not interfere with his social life as long as he gets works done by the time he sets himself – 9 p.m. His main concern appears to be the amount of work needed for the prom later in the year – particularly the decoration of the gymnasium.
>
> At home his mother – an ex teacher with a degree – "keep me going on this" (AP course). His mother "understands science and what I am supposed to do". She is pleased with his marks and follows his progress closely. His mother "rates me with my older brothers and sister aged 25 and 23. They got 70% and 75%, respectively, in this course in their first year at MUN [Memorial University of Newfoundland]". One brother is now doing honors in geology at MUN and a sister has completed a business degree. Another sister is doing a Masters degree in biochemistry at present and contemplating a PhD.
>
> He summed himself up as someone who has preferred to work by himself all through his school life. However, he pointed out that he has never been afraid to ask a teacher questions when he did not understand something. (p. 6)

While this quoted passage is rather lengthy, it is significant since it represents the type of student for whom virtual schools seem to be intended, at least in their present status of design and implementation. However, the description of a student who has a teacher as a parent, siblings completing post-secondary education, access to a desk and sufficient work space in the quiet and comfortable environment of their

[2] It should be noted there are many virtual schools in Canada that also operate using one of the other two methods of delivery – only that the use of the synchronous method tends to be more common in Canada than in the USA.

room probably represents a small percentage of high school students in general, and an even smaller group of rural school students. In other words, it is not the description of a typical student. In fact, if the student described by Stevens is the ideal student for the virtual schooling environment, it presents a rather selective view of the potential audience for online learning opportunities at the K-12 level. Unfortunately, the image described by Stevens has been one of the main limitations of virtual schooling, as is discussed later in Section 5.

4. Benefits of virtual schooling

One of the reasons given for the growth of virtual schooling is that there are a number of perceived benefits to both schools and individual students. Like much of the literature regarding virtual schooling, the benefits of virtual schooling have been largely reported based upon the perceptions of those involved in the delivery of virtual schooling and not based upon robust research. For example, in their national survey of virtual schooling in the United States, Kellogg and Politoski (2002) stated that there are many benefits of online education for elementary and secondary schools. These benefits included the ability to provide individual instruction to meet specific needs and learning styles of students, flexibility in both scheduling and in geography, opportunity for students who are not physically able to attend a brick-and-mortar school, and higher levels of motivation. In an edited book on virtual schooling largely based upon practitioner contributors, Berge and Clark (2005) identified four similar benefits of virtual schooling: expanding educational access, providing high-quality learning opportunities, improving student outcomes and skills, and allowing for educational choice.

Probably the most often cited benefit of virtual schooling is the first listed by Berge and Clark, expanding educational access. In her meta-analysis of 19 experimental and quasi-experimental studies, Cavanaugh (2001) described the major benefit of distance education for K-12 schools as allowing rural and small schools to offer courses that they would otherwise be unable to teach (e.g., higher level mathematics and science courses). In his quantitative study of student interaction and collaboration in the VHS, Zucker (2005) stated that the most common reasons given by school districts when asked why they utilize distance education were the ability to offer courses that would not normally be offered at their school, followed by the ability to meet the needs of certain groups of students and the ability to offer Advanced Placement (AP) and other college-level courses. As a part of their planning process for the UCCP Initiative, Freedman, Darrow, Watson, and Lorenzo (2002) conducted a national survey of those engaged in virtual schooling across the United States. Based upon this survey, they outlined a number of potential audiences who would benefit from virtual schooling in the state of California. The primary group was students who needed or desired courses for graduation or university admission that were unavailable to them in their schools (e.g., AP or other specialized courses not offered in small, rural schools). Three years later, Hernandez (2005), in describing the experiences of the UCCP Initiative, indicated that it was a way to provide equity and access to students from small and rural schools, and to students who are typically disadvantaged due to their ethnicity.

Freedman et al. (2002) also included other groups for whom the UCCP Initiative would expand access. These groups included students in alternative education programs, remedial students who had failed a course or needed additional time to complete a course, adult learners who had not completed high school, and home-schooled students. This is similar to the views expressed in a policy document for the Center on Education Policy, where Fulton (2002b) stated that online learning was beneficial to students who were not otherwise able to attend their brick-and-mortar schools, such as students who were hospitalized or homebound, students who had been removed from the schools because of suspension, assignment to alternative programs, or incarceration, and students who traveled due to their participation in athletic events or parental status (i.e., children of politicians or diplomats who split time between a number of locations).

Virtual schooling is not the first example of using distance education to provide access to advanced learning opportunities. The student described earlier by Stevens was enrolled in a small web-based distance education program designed to offer four AP mathematics and science courses to students from ten rural schools located in a single school district (Power, Stevens, Boone, & Barry, 1999; Stevens, 1997a, 1999a). Another example of programs that provide access to advanced learning opportunities are projects that allow students to earn college credits online while still in high school. Two examples of these projects are Project Advance from Syracuse University (e.g., Andrews, 2004; Brune, 1975; Mercurio, 1982 – see http://supa.syr.edu/) and the Clipper Project from Lehigh University (e.g., Bishop, Hyclak, & Yerk-Zwickl, 2007; Bishop & White, 2007 – see http://clipper.lehigh.edu/). Another notable initiative available to students in some high schools is the network certification program which includes online courses provided through the Cisco Networking Academy Curriculum (see http://www.cisco.com/warp/public/779/edu/academy_roadmap/index.htm).

The second benefit mentioned by Berge and Clark (2005) was that of providing high-quality learning opportunities. However, despite the policy documents of the Southern Regional Education Board (see Thomas (1999, 2000, 2003)) and the National Education Association (see Fulton (2002a)) which have provided standards for quality in virtual school courses, the design and delivery of all virtual school courses cannot be assumed to be of high quality. In the same way that there are good and poor classroom teachers, there are likely good and poor virtual school learning experiences. Barbour (2005b, 2007a) described the lack of research focused on the principles of web-based design for secondary school students.

Interestingly, while the quality of virtual school course design and delivery most likely varies, the nature of virtual schooling provides a viable framework for high-quality learning opportunities that brick-and-mortar schools may not be able to match. The FLVS is a good example of an institution that has taken advantage of this framework. The FLVS uses a team of individuals to create each of its web-based courses. The team consists of instructors who act as subject matter experts, web development specialists, project managers, and external instructional designers (Johnston, 2004). The team approach allows each group of individuals to focus upon their area of expertise, for example, instructors can focus upon what students need to be able to learn or do, instructional designers can focus upon engaging activities to accomplish the goals of the instructors, web development specialists can focus upon creating a variety of learning objects that cater to a variety of learning styles to support the activities of the instructional designers, and so on. Each course designed in this manner is based on Gagné's nine events of instruction, and focuses on levels 4, 5 and 6 (i.e., analysis, synthesis, and evaluation) of Bloom's taxonomy (Friend & Johnston, 2005). While the FLVS model is not indicative of how most virtual school learning opportunities are designed, it is an example of how the nature of virtual schooling can be used to create a framework for providing high-quality learning opportunities. Of course, most traditional classroom-based high school courses are not designed by a team of specialists, but simply developed by individual teachers or a small group of teachers within a department. Thus, it is important to note that the FLVS is rather unique among virtual schools in this approach to rigorous course design.

Along with the creation or design of virtual school courses, there are also factors inherent in the delivery of virtual school learning opportunities that can allow for high-quality instruction. In their research focused on the VHS, Elbaum and Tinker (1997) stated that online courses can increase the range of course offerings for students and provide them an opportunity to learn with, and from, students from different geographic and cultural perspectives than the ones found at their own brick-and-mortar schools. Tinker and Haavind (1997) stated that online courses provide students increased opportunities to interact with the teacher, and with other students, and to collaborate with their peers. They also indicated that the nature of the asynchronous functions within an online course, such as e-mail and the threaded discussion forum, allow students the necessary "think time" and provide shy students the opportunity to become involved in the conversation. However, these articles were not based upon research studies, but were derived from the authors own experiences with the VHS after only two years of operation. More recently, Kaplan-Leiserson (2003) described the results of another researcher's action research project where instant messaging was used as a tool for students to interact with their instructor and other students, citing benefits such as the ability to socialize and communicate their feelings about the course with others, discuss and get feedback on coursework, get to know the instructor better, and be more engaged. Butz (2004) also concluded, based upon 195 student surveys, that online instruction can motivate students who have different learning styles. Many of these findings mirror similar perceptions, as most were not based upon research studies, found in the online learning with adults literature (see Cavalier (1992), Chickering and Ehrmann (1996), Collins (1998), Grahame and Scarborough (1999), Kearsley (2000), Moller (1998), Schoenfeld (1993) and Winn (1990)). The unfortunate aspect is that the experiences of those involved with the FLVS, and the limited research described above are in all likelihood the exception rather than the norm across the spectrum of virtual schooling. Clearly, although virtual schools may allow for better instruction, they certainly do not guarantee it.

A third benefit cited by Berge and Clark (2005) was improving student outcomes and skills. The authors described this benefit in terms of the current regime of *no child left behind* (NCLB) in the United States, and the necessity for schools to meet annual yearly progress (AYP) under that piece of legislation. As discussed earlier, the use of virtual schooling means that more students, including minority students (who are an important subset measured by NCLB), can have access to specialized courses such as AP courses. Increasing the number of students taking and passing AP courses and AP exams, particularly if these students are from minority groups measured by NCLB, can help schools in meeting their AYP. Virtual schooling can also improve student skills in various technology proficiencies that will be useful to them as they progress to the next stages of their life. For example, in their survey of American universities, Lewis and Greene (1997) reported that as more post-secondary institutions are providing online learning opportunities it is beneficial for students to begin to acquire these skills in the safer environment provided by the K-12 experience (as cited in Butz (2004)). Zucker and Kozma (2003) surmised that online education is useful for global competitiveness, as it provides students with the skills that they will need for the new knowledge economy. However, to date there have been very few, if any, research studies to verify these potential claims.

The final benefit listed by Berge and Clark (2005) was allowing for educational choice. Berge and Clark were concerned with choice in terms of public, private, charter, and homeschooling choices, along with the necessity that schools who are not meeting their AYP under NCLB provide choice to their students. The NCLB legislation states that "a virtual school can be among schools to which eligible students are offered the opportunity to transfer as long as that school is a public elementary or secondary school as defined by state law" (US Department of Education, 2004, p. 13). As Hassell and Terrell (2004) described in their contribution to the *Virtual Schools Report*, a publication of the charter school Connections Academy, for many school districts that lack the necessary resources to offer their students choice under the NCLB requirements (e.g., a rural school which is so very remote and geographically distant from another brick-and-mortar school), virtual schools many be the only option available to them.

This final benefit was also consistent with Baker, Bouras, Hartwig, and McNair (2005), who described the relationship between the commercial vendor K12, Inc., and the Colorado Virtual Academy (COVA), a virtual charter school. In describing their personal experiences with virtual schooling, Baker et al. discussed how using the curriculum provided by K12, Inc., enables COVA to offer choice to any parent of a student in the state of Colorado. Public school students who choose to attend (i.e., take courses through) COVA bring with them the funding allocated for public school students to the charter school. Virtual charter schools allow public schools that do not meet their AYP under NCLB an alternative avenue to provide educational choice to their students. Of course, there is no guarantee that the mere fact that a school is virtual means that it can provide high-quality education. In fact, two studies released by the Education Policy Research Unit of the Education Policy Studies Laboratory at Arizona State University found that the level of public scrutiny (Bracey, 2004) and the quality of the curriculum (Ohanian, 2004) of K12, Inc., were both questionable. So, this conjecture must be carefully evaluated for each virtual enterprise whether it is commercial or otherwise.

Another layer of choice in virtual schooling is for home-schooled students. As students progress to the higher grades and more specialized subject areas, many parents are unable to provide curriculum support to their children due to a lack of their own knowledge base. Butz (2004) maintained that virtual charter schools can provide access to course materials and curriculum for parents of home-schooled students. Indeed, this is the model that is utilized by K12, Inc., for homeschooling populations (Bracey, 2004; Ohanian, 2004). In addition to choice for charter and homeschool opportunities, virtual schooling can provide educational choice to other groups of students. In her policy document, Fulton (2002b) proposed that students who have not been successful in the traditional school environment, due to behavioral problems and other issues, often find success in online education. She also indicated that students who wished to supplement their schooling by taking extra classes in addition to their regular schedule could choose online learning opportunities as an avenue. Fulton (2002b) also observed that students for whom part-time enrollment is necessary, such as those enrolled in summer school or credit recovery programs, were often able to take advantage of online learning opportunities. These opportunities may even provide students with the opportunity to find employment while continuing their studies, due to the flexibility in scheduling that many online programs offered.

Along with the four benefits for students outlined by Berge and Collins, others have put forward administrative benefits for virtual schooling, particularly administrative efficiency. Russo (2001), a free-lance writer, concluded that online learning can assist schools in addressing their inability to offer certain courses and attract highly qualified teachers (a crucial issue for rural schools), the lack of physical space for students in larger schools, higher dropout rates, and a growing movement towards home and charter schooling.

Keeler (2003) described the benefit to schools as decreasing the amount of time spent on discipline issues, flexibility in scheduling (both of students and teachers), and time saved on administrative tasks associated with registration, attendance, and grading. This final point is consistent with Vail (2001), an associated editor with the *Electronic School*, who argued that online courses made it easier for teachers and

Table 3
Summary of the benefits of virtual schooling

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

administrators to monitor content delivery, for parents and learners to access current grade information, and for teachers to communicate with parents. A summary of these benefits is presented in Table 3.

5. Challenges of virtual schooling

In addition to listing the benefits of virtual schooling, Berge and Clark (2005) also listed five challenges that virtual schools currently face. Unlike the benefits of virtual schooling, the challenges listed by Berge and Collins were based more upon evidence from research studies than the personal experiences of practitioners. The first three of these challenges were described as administrative in nature: the high start-up costs associated with virtual schools, access issues surrounding the digital divide, and the approval or accreditation of virtual schools. As Morris (2002) noted in the description of his own experiences with the Wichita eSchool, the start-up costs for many virtual schools can be quite high. The virtual school needs to develop or purchase course content, it needs to develop or lease a means to deliver that content, and it also needs to staff a system that would handle both the administration and course delivery.

Along with the high costs associated with beginning a virtual school, students' differential capacities to access these learning opportunities also present a challenge for virtual schooling. While students are able to access the Internet at 99% of public schools in the United States (Kleiner & Lewis, 2003), the percentage of students who have access to the Internet at home is much lower. According to DeBell and Chapman (2003) approximately 70% of White and Asian children had computers in the home, however, this level decreases to approximately 33% for Black and Hispanic children. Less than a third of children from homes with an annual income of less than $20,000 had a computer. Approximately 25% of children with parents who did not complete high school had computers in the home.

Clark and Berge (2005) discussed how state approval or regional accreditation were important with respect to the ways that the public will view virtual schools. This challenge was especially important with respect to whether or not the courses offered by virtual schools would be accepted by various post-secondary institutions. This leads into a second area of challenges that Berge and Clark (2005) raised for virtual schools: public perception. While still a growing phenomenon, there has not been a wholesale acceptance of virtual schooling as an alternative to classroom instruction. In the annual Phi Delta Kappa poll on the public's attitude towards public schooling, Rose and Gallup (2008) found that only 41% of people approved of students earning high school credits online without attending a regular school and only 27% were willing to have their child take most of their high school courses online at home instead of attending a regular school. In previous polls the authors found that only 30% of people were in favor of having their children participate in virtual charter or online schooling unless it was within the context of a brick-and-mortar school (see Rose & Gallup, 2000, 2002). This change led the authors to conclude that "opposition to earning some credits online may be softening, but opposition to earning most high school credits online is growing stronger" (Rose & Gallup, 2008). Clark and Berge (2005) argued that concerns that virtual schooling will reduce the amount of funding available to public schools or replace teachers in brick-and-mortar schools were largely responsible for the current mixed attitudes toward virtual schools.

The remaining two challenges outlined by Berge and Clark (2005) were student readiness issues and retention issues. Both of these issues were illustrated in a series of studies funded by the NCREL into various quantitative aspects of virtual schooling across the United States. One of these studies examined student success in a secondary school algebra course offered through the FLVS. Cavanaugh, Gillan, Bosnick, Hess, and Scott (2005) found that students in the virtual school course performed better on a non-mandatory assessment tool than students from the traditional classroom. The authors also revealed, however, that there were a higher number of virtual school students who completed the assessment and speculated that the virtual school students who did take the assessment may have been more academically motivated and naturally higher achieving students. This potential limitation was consistent with the findings of Rosenthal and Rosnow (1975), who in their literature review of the studies that relied upon volunteers as subjects found that volunteers "are likely to show higher levels of achievement that their less achievement-motivated colleagues" (p. 40) and "although there are a good many results (15) showing no relationship between volunteering and intelligence, there are even more (20) showing volunteers to be significantly more intelligent, while only two results show volunteers to be significantly ($p < .10$) less intelligent" (p. 66). Essentially those who would complete a non-mandatory assessment would be those who had a greater desire to achieve and who were more likely to succeed in school.

In a similar NCREL study of student performance in algebra between virtual school and traditional classroom students, McLeod, Hughes, Brown, Choi, and Maeda (2005) found that virtual school students performed better on an assessment of algebraic understanding than their classroom counterparts. These authors speculated, probably accurately, that the reason was due to the high dropout rate in virtual school courses. As a result of attrition, many low-achieving virtual school students had already removed themselves from the sample prior to the assessment. They also indicated that the majority of virtual school students in the sample were doing the course for the second or third time, so familiarity with the content and the motivation to take advantage of their "last chance" were also potential factors in the differences that were found.

In these studies the low retention or high attrition rates are pointed to as factors influencing the outcome of any comparisons. This problem, while better documented at the post-secondary level (see Moore (2001)), is a common one for virtual schools. Clark, Lewis, Oyer, and Schreiber (2002) found that the Illinois Virtual High School (IVHS) had a completion rate of only 53% during its first year of operation and 80% the following year. In their evaluation of the 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. However, they also found that between 25% and 50% of students had dropped out of their FLVS courses over the previous two-year period. These findings lead us to wonder, as McLeod et al. (2005) did earlier, if all of the low-achieving students had already dropped out of their courses when comparisons were made. The nature of students who are served by virtual schools has been a consistent discussion in the literature. Clark et al. (2002), in their evaluation of the IVHS found that students who were "highly motivated, high achieving, self-directed and/or who liked to work independently" typically did well in the online environment (p. 41). This was consistent with the characteristics of the student Stevens (1999b) described earlier. Both of these descriptions are also consistent with the characteristics more often attributed to adult learners, who according to Knowles (1970) are more self-directed and independent in their orientation to learning than adolescents.

These findings were supported by the work of SRI International and their five-year evaluation of the VHS. The VHS is one of the oldest and most researched virtual schools in the United States. In their first year evaluation of the VHS, Kozma, Zucker, and Espinoza (1998) found that the vast majority of students in their courses were planning to attend a four-year college. They also reported that two thirds of the teachers indicated that the VHS students were less likely to drop out of school than students in their classroom-based courses. These findings led the evaluators to conclude that "the current VHS curriculum [was] dominated by advanced courses that cater to students who are successful, independent, and college bound" (p. 49). The following year, Espinoza, Dove, Zucker, and Kozma (1999) reached similar conclusions when they stated that "VHS courses are predominantly designated as 'honors,' and students enrolled are mostly college bound" (p. 49). These finding were not surprising to the evaluators, as they indicated that the VHS' own faculty handbook promoted this kind of selectivity when it stated: "although all students should have access to the VHS catalog, we recommend that the school site coordinator and guidance counselors select students who can work independently and handle responsibility" (p. 50).

In both the Clark et al. (2002) and the Espinoza et al. (1999) evaluations, the authors recommended that the virtual school take steps to increase the range of students served. During the third year evaluation of the VHS, Kozma et al. (2000) took a slightly different approach and focused upon four classes as a case study of the VHS model. The four courses selected were Advanced Placement Statistics, Modern Classics, Photographic Vision, and pre-engineering and design. The students from these classes were described by their teachers as very capable academically and college bound. However, even with this selectivity the evaluators still found a higher dropout rate for these four VHS courses than for the face-to-face comparison groups. To summarize their five-year evaluation of the VHS, Zucker and Kozma (2003) released the book *The Virtual High School: Teaching Generation V*. In this volume, they reported that students who were not expected to succeed in the VHS environment were discouraged from taking VHS courses and that more than four out of every five students in VHS courses were college preparatory.

Issues of student selectivity had also been found in evaluations of virtual schools in Canada. Haughey and Muirhead (1999), in their examination of online learning in the province of Alberta, described the preferred characteristics of K-12 students involved in virtual schooling to include the highly motivated, self-directed, self-disciplined, independent learner who could read and write well, and who also had a strong interest in or ability with technology. Later in their evaluation of student achievement and performance in online learning in Alberta, Ballas and Belyk (2000) found that the performance of virtual and classroom students were similar in English and social studies courses, but that classroom students performed better overall in all other subject areas (i.e., biology, chemistry, mathematics, and physics). The authors also indicated that the participation rate in the assessment among virtual students ranged from 65% to 75% compared to 90–96% for the classroom-based students. This led them to speculate, probably quite accurately, that the sample of virtual school students did not reflect the total population of these students. While not discussed by the authors, it is plausible that the 15–25% difference in participation rate reflected all of the low-achieving students, as was raised by McLeod et al. (2005). This would indicate that in the majority of courses examined, the virtual school students had lower achievement levels, even with a more selective group of students. At present, there has been little or no research into the reasons for the poor performance of these highly skilled and more motivated students. Speculation has been that the learning experience provided by virtual schools was not at the same caliber as the learning experience that classroom-based students have received – although there is also no research to support this potential cause. Barker and Wendel (2001) reported a comparison of performance between students attending six virtual schools and three conventional schools from three different provinces over a three-year period. Their findings were that students in the six virtual schools performed no worse than the students from the three conventional schools at both the grade nine and grade twelve levels. Again, even with a more selective group of students in the virtual school, the performance of the virtual school students did not exceed that of their classroom counterparts.

The findings, in both Canada and the United States, of high attrition rates in virtual school courses and no significant differences in comparative studies (or differences that may be due to the selectivity of students in the virtual school courses) may be partially explained by the fact that many of the virtual school opportunities are based upon the practice of distance education with adult learners. Until very recently, relatively little was known about these factors in K-12 contexts because historically the practice and research into distance education and online learning had been focused upon adult populations, such as those found in post-secondary institutions or the corporate training sector. This focus upon adult learners was the source of some of the challenges faced by those engaged in virtual schooling, both in the design and delivery of distance education to K-12 students. While the practice of virtual schooling has been around for little more than a decade, the practice of distance education has been around for well over a century, with universities becoming engaged in correspondence programs in the late 1800s and K-12 schools taking part in distance education using educational radio in the 1930s. While literature in the field has largely been devoted to defining distance education itself, researchers also attempted to identify theories to explain how the field worked (recent examples include Edwards (1995), Keegan (1988), Rumble (1989) and Simonson, Schlosser, and Hanson (1999)). Unfortunately, theory in the field has largely been based upon adult learners engaged in independent study courses (e.g., Moore, 1972; Peters, 1967; Wedemeyer, 1981) rather than on K-12 students.

The trend of the theory of distance education focusing upon an adult population has also spilled over into other forms of the literature. For example, in the second edition of the Association for Educational Communications and Technology's *Handbook of Research on Educational Communications and Technology*, the only reference that Gunawardena and McIsaac (2004) made to the K-12 system in their chapter on distance education is a two-paragraph discussion on the use of personal digital assistants in distance education (pp. 369–370). Earlier, as

a part of their nine-year literature review of the *American Journal of Distance Education*, Koble and Bunker (1997) found that there had only been a minor shift in the original emphasis upon adult and continuing education to reflect the growing interest in distance education in public schools. In the first edition of the *Handbook of Distance Education*, only one of the 55 chapters is devoted to distance education in the K-12 environment (Moore & Anderson, 2003). Four years later the number of chapters had doubled in the second edition to two out of the 49 chapters (i.e., Cavanaugh, 2007; Clark, 2007).

One of more accepted theories of distance education at present is the theory of transactional distance (Moore, 1972, 1973, 1983, 1993; Moore & Kearsley, 1996). Like most other theories of distance education, this theory was intended for adult learners. Based upon the work of Malcolm Knowles, one of the founders of the field of adult education, Moore conjectured that it was natural for an adult learner to exhibit autonomous behavior, which was why distance education programs should seek to have a low level of transactional distance (i.e., a high level of dialogue and a low level of structure) to maximize the opportunities for the autonomous adult learner. Knowles (1970) stated that there were four assumptions about adult learners that are different than the assumptions about child learners:

> (1) his self-concept moves from one of being a dependent personality toward one of being a self-directing human being; (2) he accumulates a growing reservoir of experience that becomes an increasing resource for learning; (3) his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles; and (4) his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness. (p. 39)

Moore (1973) himself speculated that even though the quality of autonomy, based upon Erikson's stages of development, emerges in infancy, that this ego quality may not be the same as autonomy of learning and that "it may well be that, as learners, people are struggling in an 'autonomy versus shame and doubt' crisis in grade school, high school, or university" (p. 667). Even Bright (1989), in his critique of adult learning theory, stated "it is not being suggested that there are no differences between adults and children. On the contrary, there are probably many..." (p. 55). All of these researchers and theorists agree, there are fundamental differences in the orientation that adults have to learning compared to the way in which children and adolescents learn.

Unlike the education of adult learners, Vygotsky (1962) observed that learning for a child was a social process that focused upon interaction within a zone of proximal development. The zone of proximal development "is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Cavanaugh, Gillan, Kromrey, Hess, and Blomeyer (2004) suggested, "since adults have progressed through these stages of cognitive development, delivery of web-based education at the adult level need not concentrate on methods that help the learner develop these cognitive skills" (p. 7). The methods designed to help the child learner develop cognitive skills are intended as guidance provided to these learners to ensure that they remain in the zone of proximal development.

Moore (1973) noted that typically in K-12 education teachers were expected to maintain control of the content and method of delivery within the classroom. These students "should not be compelled to assume a degree of autonomy they are not ready to handle, and so it is customary in child education for the preparatory and evaluation processes to rest entirely in the hands of the teacher" (p. 84). According to adult education experts, children are not ready to assume high degrees of autonomy, and thus child and adolescent learners require more structure in their educational settings, particularly in distance education settings (such as virtual schools) where the lack of proximity to the teacher decreases one of the main sources of guidance to the learners in their zone of proximal development. The addition of structure to support the child learner in a virtual school environment may serve to replace some of that guidance.

Due to these differences, Wedemeyer (1981) came to the conclusion that the major problem for K-12 students, who are engaged in any form of distance education (including virtual schooling), will be that:

> the person who learns through technology is not only physically distant from the teacher... he is also as a learner required to be more responsible and more autonomous. The traditional learner dependency sets believed and practiced by teacher, and required by learners in schools, come apart when the teacher and learner are physically distant from each other. (p. 111)

Unfortunately, the research into alternative design principles that cater to virtual school students has only just begun (see Barbour (2005b, 2005c, 2007a), Barbour and Cooze (2004) and Cooze and Barbour (2005)) and recommendations are still preliminary. These realities led one rural education scholar to wonder if web-based distance education may not be suitable for all secondary students (Mulcahy, 2002). A summary of these challenges is presented in Table 4.

6. Future research into virtual schooling and rural education

The number of students enrolling in virtual school courses is undoubtedly growing (Fulton, 2002a; Gray & Tucker, 2006; Huerta & González, 2004; Picciano & Seaman, 2007; Setzer & Lewis, 2005). The range of students enrolling in virtual school courses is also expanding

Table 4
Summary of the challenges of virtual schooling

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

(Barbour & Mulcahy, 2007; Cavanaugh, 2007; Rice, 2006). However, the ability of virtual schools to support these students adequately appears to be limited. Many of these students either did not know about or chose not to take advantage of many of the support structures put in place by the virtual school (Barbour, 2007a). Instead they chose to rely upon their e-teachers, their in-school teachers, and each other for content-based assistance. The question of what could have been done differently to support virtual school students remains unanswered.

There are likely many factors that influence the student-participants' online learning experiences, but clearly there are concrete measures that could be taken to prevent difficulties for many virtual school students. One example is the Educational Success Prediction Instrument (ESPRI) (Ferdig, DiPietro, & Papanastasiou, 2005; Roblyer, 2005, 2008; Roblyer & Marshall, 2002–2003), which examines the students' aptitude in four different categories and predicts how the student will perform in a virtual school course. Knowing this information at the beginning of the school year and providing remediation for the skills necessary for success in a virtual school environment could make a positive difference for some students. However, given the limitations of the current research on virtual schooling, it is impossible to determine which particular measures are most likely to succeed.

Numerous authors have called for additional research into the factors that affect student success in virtual school environments (Butz, 2004; Clark, 2003; Dickson, 2005; McLeod et al., 2005). The ESPRI developed by Roblyer and Marshall (2002–2003) is a good first step in this line of inquiry, as the authors have identified four variables or characteristics that affect success in a virtual school environment and have developed an instrument that can reliably predict student success based upon those variables. However, even the authors of this instrument acknowledge there is more work to be done.

> Our results, although promising, should be viewed as preliminary for this population. The next step to confirm the validity of the ESPRI and to test the predictive model is to use it with additional groups of VHS [Virtual High School] students to determine if the instrument discriminates as well between pass/fail groups in other populations as it did this one. (p. 253)

Roblyer (2005) went even further and stated that the next step in this line of inquiry was "to develop preparation materials to help students whose ESPRI results indicate potential for problems in online learning" (the dropout rate problem: what makes an effective online student? (p. 9)).

These statements are consistent with Rice (2006), who suggested that researchers need to "continue and expand on the development of prediction instruments that help identify successful learner attributes" (p. 442). Cavanaugh (2007) followed Roblyer's later vision, and called for "predictive instruments, diagnosis, and prescription of services and scaffolds [to] enhance every students' chance of success while increasing the efficiency of teachers" (p. 159). Smith, Clark, and Blomeyer (2005) were even more specific in their call for more research into student process skills, motivation, and learner characteristics in an effort to better understand and be able to improve upon the experiences of virtual school students.

In addition to this specific line of inquiry, there is a need to change the approach to educational research examining virtual schooling. Previous research studies have examined various aspects related to virtual schooling and based upon that examination made recommendations for both practice and future research. In some instances the researcher and/or the virtual school may have even followed through and pursued some of the recommendations. However, the impact of this research on the practice of virtual schooling has been limited or non-existent. A quarter century ago, Clark (1983) concluded that research focused on the differential learning effects of different media (e.g., virtual versus traditional schools) was doomed because of the confounding of media and methods. Clark suggested that researchers shift their attention to other factors that would demonstrate the benefits of new media such as economic issues.

An alternative to changing the focus to economic criteria is adopting new research approaches. In his chapter examining the "no significant differences" phenomenon in online learning, Reeves (2005) calls for the use of design research "to provide design guidelines for developing and implementing effective online teaching and learning environments" (p. 303). Design research is "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (Wang & Hannafin, 2005, pp. 6–7). Essentially, design research is a methodology which is conducted in cycles to allow for results from the intervention to be included in improving the intervention before the next cycle, while developing design principles and theories to explain those results and guide further refinements in the intervention. As Reeves (2005) describes, "our paramount goal of research should be solving teaching, learning, and performance problems, and deriving design principles that can inform future decisions" (p. 304). Design research approaches can be especially promising as a new approach to education research to affect improvement on virtual schools (Reeves, 2006).

7. Summary

We began this article by indicating that we would use the existing literature to answer five questions:

1. How have virtual schools developed and grown?
2. How are virtual schools and virtual school students described in the literature?
3. What are the primary benefits of virtual schooling?
4. What are the primary challenges of virtual schooling?
5. What research is needed to extend the benefits and meet the challenges of virtual schooling?

To summarize this review, virtual schooling was first employed in the mid-1990s and has become a common method of distance education used in K-12 jurisdictions today. The most accepted definition of a virtual school is an entity, which has been approved or accredited by a state or governing body within the state, that offers secondary-level courses through distance delivery – most commonly using the Internet. While virtual schools can be classified in different ways, the three most common methods of instructional delivery are by independent, asynchronous or synchronous means. To date, the vast majority of virtual school students have tended to be a very select group of academically capable, motivated, independent learners.

Proponents of virtual schooling have concluded that there are a number of benefits associated with virtual schooling. These benefits can be summarized into five main areas: expanding educational access, providing high-quality learning opportunities, improving student outcomes and skills, allowing for educational choice, and achieving administrative efficiency. However, whether these benefits are actually realized through virtual schooling remains in doubt in the minds of some critics, and the research to support these conjectures is limited at best.

Along with the benefits, there are also a number of challenges associated with virtual schooling for rural schools. Over the past decade, there have been numerous studies that have shown that the only students that are typically successful in online learning environments are those who have independent orientations towards learning, who are highly motivated by intrinsic sources, and who have strong time management, literacy, and technology skills. These characteristics are ones that are typically associated with adult learners. Some of these challenges stem from the fact that the research into and practice of distance education has typically been targeted to adult learners. The problem with this focus upon an adult population is that adults learn differently than children and adolescents. This has led many researchers to call for more research into the factors that account for K-12 student success in distance education and virtual school environments that could be explored as design research problems.

Others may suggest that a more profitable focus for research in this area would be on the cost-effectiveness of virtual schools. After all, even if virtual schooling is no more effective than traditional methods, if it is more economical for providers to set up virtual schools or users to access them, then it may be a justifiable replacement for traditional approaches. However, although one of the claimed benefits by proponents has been the cost-effectiveness of virtual schooling,[3] economic issues generally have not been the focus of the substantive research or rigorous evaluation to date. What is clear is that as the virtual school movement continues to grow and thus serves a wider range of students, the need for more and better research that can help ensure all students have the opportunity for success in virtual school environments is increasingly urgent.

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[3] In fact, one of the few research studies into this area was conducted by the Florida TaxWatch Center for Educational Performance and Accountability (2007), who concluded "Florida virtual school students outperformed their statewide counterparts on two independent assessments, both the Florida comprehensive assessment test and advanced placement examinations. They earned higher grades in parallel courses. And this was accomplished with less money than was typically spent for instruction in traditional schools" (p. 2).

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