

Virtual Schooling Service: Productive Pedagogies or Pedagogical Possibilities?

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This article reports on an evaluation of a virtual schooling innovation in an Australian context. The Virtual Schooling Service Pilot uses online technologies to deliver senior school subjects in both synchronous and asynchronous modes of delivery. The purpose of the study was to analyze the organizational, pedagogical, and technological efficacy of the innovation for the purpose of exploring the feasibility of mainstreaming virtual delivery for secondary schooling. Although the Virtual Schooling Service was important in maintaining curricular provision, application of the Productive Pedagogies framework showed that the innovation held pedagogical potential that remained unrealized.

Distance education has a long and creditable record in countries like Australia where the tyrannies of space and isolation continue to challenge state education providers. Yet new telecommunications services and online technologies are transforming traditional forms of print-based, external studies approaches. Improved bandwidth and reduced connectivity costs are making online learning more readily available for students who would not have access to school subjects they want to study.

This article describes an evaluation of a virtual schooling service provided by the state government's education department in the jurisdiction of Queensland, Australia. Secondary school subjects taught via the Virtual Schooling Service Pilot—mathematics, economics, physics, and languages other than English—would not otherwise be available to students, who live not only in rural and remote areas but also in urban and metropolitan centers. We begin with a theoretical overview of virtual schooling and discussion of curricular and pedagogical issues in relation to online delivery methods. Following a description of the initiative's institutional context, we outline the Productive Pedagogies framework that was used to evaluate its organizational, pedagogical, and technological efficacy. Factors that were considered central to the success of the service are discussed, and an anal-

ysis of stakeholder perceptions and student learning outcomes is reported. The article closes with a review of key findings from the evaluation.

DISTANCE EDUCATION AND VIRTUAL SCHOOLING

Virtual schooling is a derivative of paper-based distance education. For over a century in Australia, in remote areas in particular, schooling via distance education has been delivered through what is affectionately known as the “School of the Air.” In this mode of learning, students are provided with a print-based curriculum, resource materials, a high-frequency radio for daily contact with their teacher and classmates, and a program of field activities. The many synonyms for distance education—open learning, flexible delivery, external studies—illustrate the contested nature of its meaning, and despite ambiguity and fluidity in their usage, the terms are not strictly interchangeable. Distance education, nevertheless, is generally understood as a form of learning where instructor and students are in separate locations or times, communications between teacher and student are mediated by print or other technologies, and where greater volitional control of learning is held by the learner (Picciano, 2001).

In the last two decades, however, Web-based technologies have transformed distance education into virtual schooling. Compression technologies combined with improved computer processing speeds and reduced costs are making access to interactive, multimediated learning more readily available for learning and teaching in schools (Chute, Thompson, & Hancock, 1999). Although most distance education students still live in rural/remote areas, new kinds of delivery systems have been adapted for students in regional and metropolitan centers. Because “distance” is no longer a primary factor in the uptake of e-learning through new technologies and is considered restrictive in its connotations, the term “distributed learning” has gained preeminence (Oblinger, Barone, & Hawkins, 2001).

Most technology-based systems use one or more of the following delivery systems: one-way and two-way video conferencing, audio and teleconferencing, audiographics conferencing, electronic mail, computer conferencing, and Web-based delivery systems. Virtual schooling was originally based on asynchronous models in which students engaged in online activities at a time of their choosing. Although this may have been sufficient for courses emphasizing memorization of factual knowledge, techniques such as synchronous discussion are central to more collaborative and socially meaningful learning (Tait & Mills, 1999). The Internet and the World Wide Web, in particular, have provided facilities for interactive learning through virtual social engagement. Because the Web combines photos, graphics, text, audio and video in an interactive environment, it has enabled the design and implementation of virtual schooling. Table 1 compares the key

Table 1. Comparison of distance education with virtual schooling

Distance education	Virtual schooling
Geographical distance	Geographical proximity or distance
Asynchronous teaching and learning	Synchronous and asynchronous teaching and learning
Print materials	Electronic and print materials
Time lag	Immediate feedback and instruction
Centralized delivery	Decentralized delivery

Note. Summarized from Lundin, Elliott, & Richardson (1999).

features of virtual learning services with those of conventional distance education.

Curricular and pedagogical issues that need to be considered in virtual learning environments differ from face-to-face contexts. A decade ago, Jonassen, Davidson, Collins, Campbell, and Haag (1995) asserted that distance education should utilize emerging technologies to provide an opportunity for students to build and participate in communities of scholars and practitioners. Yet the educational potential of much online learning today remains unrealized as interactive technologies continue to be used for didactic, one-way lectures to students in remote locations (Oblinger et al., 2001). Furthermore, many courses utilize pedagogies that are the same for all students. So if teachers are to meet the diverse needs of all students in online contexts, then both course design and pedagogical approach need to be reconceptualized (Husmann & Miller, 2001; Rockwell, Furgason & Marx, 2000). Strategies used for enhancing learning outcomes through interaction include cognitive mentoring, case-based instruction, problem-based learning, inquiry-based learning, experiential simulation, and situated learning (Lundin, Elliott, & Richardson, 2000).

Not only is pedagogy frequently problematic, but the bulk of research focuses on the teacher, teaching, or the technology (cf. Cole, 2000; Nguyen & Kira, 2000). Program evaluations typically use constructivist approaches (Jonassen, Peck & Wilson, 1999; Morphew, 2000) and occur in higher education contexts (Belanger & Jordan, 2000; Lockwood & Gooley, 2000; Palloff & Pratt, 2001; Van Dusen, 2000). The few extant case studies on virtual school education describe North American contexts (cf. Barker, 2000, and this issue of *Teachers College Record*). Because of a dearth of international research dealing with school education initiatives, teacher uncertainty about effective pedagogical practices remains a challenge for proponents of e-learning (Brown & Currier, 2001). The following case study addresses this gap by describing a virtual schooling initiative for the delivery of secondary school subjects within a public education context in Australia.

THE CURRENT STUDY

THE VIRTUAL SCHOOLING SERVICE

Education Queensland is the state government education department for schooling in the jurisdiction of Queensland, Australia. Located on the northeast coast of the Australian continent, Queensland is best known overseas for its natural beauty and tourist attractions such as the Great Barrier Reef and the wet-tropic rainforests. Yet recent policy directions represent and promote the state as the “Smart State,” one that is well positioned in the globalized information economy. Education Queensland’s policy mandate is to provide quality education for all students—irrespective of their location—across this large and, by international standards, relatively empty land mass (Education Queensland, 1999, 2000). To support this goal, Education Queensland operates a large decentralized organization whose facilities and services span the entire state. The organization operates some 1,320 primary, secondary, distance, and special education schools, which are supported by 35 district offices, 4 facilities service centres, and a central office located in the capital city, Brisbane.

The needs of remote or external students in Queensland have traditionally been met by distance education, delivered through a combination of print and high-frequency radio. The Virtual Schooling Service (VSS) Pilot was commissioned by the Director-General of Education in 1999 as part of the *Queensland State Education—2010* plan (Education Queensland, 2000). This plan provides a vision for state education in Queensland and outlines strategies whereby education can contribute to the government’s objective of reinventing Queensland as the nation’s “Smart State.” Located in a management unit called AccessEd, the VSS was established as a pilot project to determine the viability of synchronous and asynchronous online delivery of senior school subjects to small numbers of students at schools where teaching expertise in certain subject areas was unavailable. Two other purposes it served were to expand the range of communications channels by which remote students could receive flexible educational services and to explore the feasibility of mainstreaming online teaching and learning for schools.

Current Model of Virtual Schooling Service Delivery

There are two main models of delivery for virtual schooling possibilities: distributive and interactive. Distributive delivery refers to one-way, asynchronous communication and includes broadcast radio and television and posted printed materials. Interactive modes enable both synchronous (real-time) and asynchronous communication through audio; telephone;

facsimile; high-frequency (HF), ultra-high-frequency (UHF), and very high-frequency (VHF) radio; audiographics conferencing; computer conferencing; CD-ROM; computer-based online communications including the Internet and the World Wide Web; and interactive satellite television.

The VSS uses an audiographic conferencing system with an Internet-based software program for offline access to lessons and learning materials. Audiographics conferencing enables synchronous communication during lesson time through phones and computer graphics. Five senior secondary school subjects—mathematics, economics, physics, Japanese, and information processing and technology—are taught in the VSS Pilot. Sixty-two schools and approximately 400 students located widely throughout the state utilize the service. Web-based resources enable students to access subject content and the materials of individual lessons flexibly, either from home or school, in their own time. The decision to use audiographic conferencing was made following the realization that the technological requirements of videoconferencing were beyond the technical and financial means of both Education Queensland and schools. Audiographic delivery modes will continue to be used until broadband via asymmetric digital subscriber line, cable, or satellite enables audio and video streaming. This is not expected to happen in the near future. It is apparent then that the VSS is not a bona fide “virtual” environment because most teacher/student interaction occurs at school.

Education Queensland’s communications and networking infrastructure—the Schoolsnet Internet Network Administrator—enables “multicasting,” which is the delivery of online lessons to several schools from a single site. The VSS is unique with respect to its use of Microsoft’s Exchange Server for the conference component of the synchronous lessons. Microsoft’s NetMeeting networking application was chosen because of its ready availability to schools as part of Education Queensland’s Microsoft license agreement. NetMeeting provides a data link and telephone to establish and support voice communication, chat, electronic whiteboard, file transfer, and application sharing.

Education Queensland’s statewide telecommunications network, EdNet, is central to the operation of the VSS. The major telecommunications infrastructure provider, Telstra, is used for the Schools Information Management System, which enables information dissemination through Education Queensland’s Website. There are several levels of this telecommunications infrastructure, which include wide area network links to district offices and local area network intranets within schools. All of this technological infrastructure is managed by the Information Technology Board of Education Queensland. Telecommunications infrastructure such as this can be used for a range of educational services, and the delivery of curricular materials and content via VSS is part of that.

In 2002, researchers from the School of Education at the University of Queensland were commissioned to review the educational and technical performance of the VSS during its first 2 years of operation (2000–2001). This article draws from that investigation (see Pendergast, Kapitzke, Land, Bahr & Luke, 2002).

PURPOSE

The purpose of the study was to evaluate the educational and technical performance of the VSS during its first 2 years of operation. Its aims were (a) to assess the effectiveness of secondary school studies delivered through the VSS Pilot and (b) to identify key pedagogical and curricular issues relating to the effective delivery of education to students enrolled with the service.

This article explores issues regarding the use of online services as a delivery system for teaching and learning and identifies educational benefits associated with the use of this technology in the secondary school environment.

METHODOLOGY

Data Collection

Data were collected from four delivery schools and seven receiving schools. In consultation with the project officer and staff from AccessEd, receiving site schools were selected to cover a range of variables including geographic location, subjects delivered, numbers of students utilizing the service, and the state's Index of Relative Socio-Economic Disadvantage.

Several methods were used to collect both qualitative and quantitative data, which enabled triangulation of data and added depth and reliability to the analysis. Methods included observations of delivery and receiving lessons, the scoring of pedagogical efficacy in observed classes using the *School Reform Longitudinal Study Classroom Observation Scoring Manual*, an online survey questionnaire of participating students, and interviews using structured schedules with students, delivery teachers, administrators, and study coaches. Eighteen lessons were observed, 67 students participated in the online survey, and 30 interviews were conducted (29 with students, 18 with delivery teachers, and 15 with principals, VSS coordinators, and study coaches).

The survey questionnaire consisted of two parts: the learning experience in VSS classrooms against a Productive Pedagogies framework, with a view to identifying the pedagogic characteristics of the VSS, and a series of open-ended items allowing students to identify specific issues they thought were

relevant to their experience of the VSS. Telephone interviews were also conducted with two schools that had withdrawn from the service. Data were reported at a focus group session with VSS management and staff as part of a review of the report's findings.

To show how they were used as analytic instruments, the following subsection provides an overview of both the Productive Pedagogies framework and the *School Reform Longitudinal Study Classroom Observation Scoring Manual*.

Education Queensland's Productive Pedagogies

In the late 1990s researchers from the University of Queensland, in conjunction with Education Queensland, conducted an investigation into school restructuring in the state. This study drew heavily on work conducted in the United States by the Center on Organization and Restructuring Schools, because of its success in demonstrating substantive links between classroom practice and student outcomes (see Newmann & Associates, 1996; Newmann & Wehlage, 1995). The Queensland study extended the model through its identification of issues relevant to the Australian context that were missing from Newmann's model. For example, focus groups indicated that the goals and outcomes of many schools and curricula were not limited to cognitive development and disciplinary knowledge. As a result, the research team redeveloped Newmann's categories into a broader grid encompassing factors that made a difference to student achievement.

To differentiate it from Newmann's "authentic pedagogies," the resultant model was named Productive Pedagogies (see Lingard et al., 2001). It delineates aspects of instruction that are claimed to significantly influence the performance of specific groups of students and accounts for the commitment in Australian education to inclusive classroom environments, social participation, and active citizenship. By providing a common language for talking about classroom strategies that enable teachers to focus instruction and improve student outcomes, the Productive Pedagogies framework offered insights that were useful to the present study. As Table 2 shows, it has four dimensions of classroom practice: namely, a high degree of intellectual quality, relevance to the learner, a supportive classroom environment, and the recognition of difference. Twenty elements of classroom observation indicators are grouped under these four dimensions. A brief description of each element is presented in Table 3.

A classroom observation sheet allocating scores on a Likert scale for each of the 20 elements was designed for analyzing pedagogical activities in classrooms. The framework had been used to evaluate over 1,000 classes in Queensland schools, but prior to this no exploration of distance education

Table 2. Dimensions of Productive Pedagogies

Intellectual quality	Connectedness	Supportive classroom environment	Recognition of difference
Higher order thinking	Knowledge integration	Student control	Cultural knowledge
Deep knowledge	Background knowledge	Social support	Inclusivity
Deep understanding	Connectedness to the world	Engagement	Narrative
Substantive conversation		Explicit criteria	Group identity
Knowledge as problematic	Problem-based curriculum	Self-regulation	Citizenship
Metalanguage			

pedagogies had been undertaken utilizing the framework. It therefore offered considerable potential for better understanding the pedagogies and outcomes of these lessons.

FINDINGS

The VSS evaluation reported on a range of issues that would need to be considered if the service were to expand beyond its current parameters. Central to the investigation was an understanding of the model of delivery for virtual schooling and the online teaching processes enabled by the mode. This section identifies the pedagogical approaches enabled by the delivery system, which were outlined earlier in this article.

Online Pedagogical Processes

Pedagogical approaches for online environments are both similar to and different from face-to-face learning environments. In interviews, delivery teachers articulated a range of similarities to face-to-face teaching practices. They affirmed that, irrespective of the learning environment, teachers needed to be aware of student learning styles and to design and develop teaching materials that met the needs of all students in the class. Interviewees acknowledged that teachers needed a good rapport with students and a variety of teaching styles. They needed to know their subject content and to present it in ways that engaged students. In one school in a rural center, the VSS coordinator remarked that outstanding teachers like VSS teachers were atypical in rural areas and so she occasionally invited new graduate teachers to observe VSS lessons.

Table 3. Descriptions of the 20 elements of Productive Pedagogies**Intellectual quality**

Higher order thinking requires students to manipulate information and ideas in ways that transform meaning and allows students to solve problems and discover understandings that are new to them. This transformation occurs when students combine facts and ideas to synthesize, generalize, explain, hypothesize, or arrive at some conclusion or interpretation.

Deep knowledge concerns the central ideas of a topic or discipline. Knowledge is deep or thick because such knowledge is judged to be crucial to a topic or discipline.

Deep understanding is shown when students develop relatively complex understandings and demonstrate them by discovering relationships, constructing explanations, and drawing conclusions.

Substantive conversation is evident when there is considerable teacher-student and student-student interaction about the ideas of a substantive topic; the interaction is reciprocal and promotes coherent shared understanding.

Knowledge as problematic involves presenting an understanding of knowledge as being constructed and hence subject to political, social, and cultural influences and implications.

Metalanguage instruction is evident when there are high levels of talk about talk and writing, how written and spoken texts work, specific technical vocabulary and words, how sentences work or don't work, meaning structures and text structures, and issues around how discourses and ideologies work in speech and writing.

Connectedness

Connectedness to the world measures the extent to which the lesson has value and meaning beyond the instructional context, exhibiting connection to the larger social context within which students live.

Problem-based curriculum is identified by lessons in which students are presented with a specific real, practical, or hypothetical problem (or set of problems) to solve.

Knowledge integration refers to connecting knowledge across subject boundaries.

Background knowledge is valued when lessons provide explicit links with students' prior experience. This may include community knowledge, personal experience, media, and popular cultural sources.

Supportive classroom environment

Student control examines the degree of student influence on the nature of activities and the way they are implemented.

Social support is present in classes when the teacher supports students by conveying high expectations for all students. These expectations include that it is necessary to take risks and to master challenging academic work, that all members of the class can learn important knowledge and skills, and that a climate of mutual respect among all members of the class contributes to achievement by all.

Engagement is identified by on-task behaviors that signal a serious investment in class work. These include level of attentiveness, engagement with the assigned work, and showing enthusiasm by taking initiative to raise questions and to contribute to group tasks.

Self-regulation is high when teachers are not needing to make statements that aim to discipline student behavior or to regulate student movements and dispositions.

Table 3. (Continued)

Explicit criteria are frequent, detailed, and specific statements about what it is students are to do in order to achieve. This may involve overall statements regarding tasks or assignments or about performance at different stages in a lesson.

Recognition of difference

Cultural knowledges are valued when more than one cultural group is present and given status within the curriculum. Cultural groups can be distinguished by gender, ethnicity, race, religion, economic status, or youth.

Inclusivity is identified by the degree to which nondominant groups are represented in classroom practices through participation.

Narrative refers to an emphasis on such things as the use of personal stories, biographies, historical accounts, and literary and cultural texts in teaching and learning.

Group identity is manifest when differences and group identities are positively recognized and developed at the same time as a sense of community is created. This requires going beyond a simple politics of tolerance.

Citizenship is developed when the teacher elaborates the rights and responsibilities of individuals and groups in a democratic society and facilitates its practice inside and outside the classroom.

Forty-one percent of student responses to the online student survey revealed that the teaching staff were considered among the best aspects of the VSS. This was consistent with field observations, where students generally found VSS teachers “nicer” than classroom teachers because they “did not get angry” and were not “pushy.” Social relations with teachers were usually more informal than mainstream classrooms: For example, students called teachers by their first names.

Nevertheless, there were both benefits and drawbacks to the disembodied relationship that students had with teachers. On the one hand, it provided learners with autonomy and independence, and students reported that the physical absence of a teacher gave them space to be mature about their work, to do it when and how they wanted to. Nevertheless, there were also disadvantages to this pedagogical autonomy. Study coaches—support persons available at the receiving school site with both administrative and academic advice roles—reported that some students were not suited to virtual learning environments because they did not achieve, in spite of being intellectually capable of doing so. Reasons for this varied and included extrinsic factors such as parental interference and pressure for students to study subjects in which they had little interest. Student responses to the online survey also noted difficulties associated with independent study. Particular concerns were ease of disengagement (e.g., by hanging up on the teacher), the lack of dedicated

space to work in, and the consequent risk of distraction from non-VSS students.

There were times, though, when the teacher's absence was a definite disadvantage. This occurred particularly when students were experiencing difficulties: The teacher was unable to "see what we're doing" and seemed distant and unable to help. Some students also felt that, because the teacher was not present, it was hard to know what the key points of lessons were. The online surveys confirmed this. Some 36% of student responses indicated that issues associated with the remoteness of teaching staff contributed to the worst aspects of the VSS. Issues included such things as the amount of material covered, the speed at which it was covered, and the difficulty of exploring some concepts in detail with teachers. Several students noted that the technology interfered with their ability to share diagrams with teachers or classmates; others noted that sometimes "voice contact was not enough." Field observations revealed that students at some sites relied heavily on each other for assistance. Some found that e-mail alleviated this problem because feedback was immediate: "in five minutes." A minority felt confident enough to call their teacher "any time" from school or home.

Data from interviews indicated that the size of the virtual class and the number of receiving schools participating in the lesson were considered crucial to the success of lessons. The trend was that the optimal number of students in the class should not exceed 10 and the number of receiving schools should not exceed four. Anything larger than this led to a lack of cohesion in the class and disengagement on the part of individuals. The degree of sociality that teachers were able to construct and maintain was the "glue" that held the lesson together.

In most of the lessons observed, talk was dominated by the teacher, who typically presented content. The occasional input from students occurred as the result of teacher questions, which predictably followed the initiation-response-evaluation sequence. This pedagogy was teacher-centered and highly didactic. Class observations also showed that the quality of study coach supervision was poor. In some receiving schools it was nonexistent, which constituted a significant industrial relations and workplace health and safety issue, as students were typically left unattended in classrooms. Issues relating to the role and quality of study coach supervision were also a common theme in student responses to the online survey. A number of students indicated difficulties with the study coach, associated with feeling intimidated by him or her "watching your every move." A more indirect indicator of difficulties associated with study coaches was the relatively high reporting of distraction from other students during VSS lessons. Thirteen percent of respondents indicated that distraction by classmates was one of the worst features of VSS.

Classroom Observation Data

Classroom observations were made using the Productive Pedagogies classroom observation scoring system. Each lesson was scored on the 20 elements of the classroom observation schedule (see Table 3), and the resultant item scores were collapsed to produce indices of the four domains of the Productive Pedagogies model (see Table 2). A scale score of 1 indicates minimal evidence of the domain characteristic in the observed lesson, and a score of 5 indicates evidence of a high degree.

Two observers were used to rate each lesson. A 2 (Rater) \times 2 (Type of School) multivariate analysis of variance (MANOVA) indicated that there was no significant difference between raters in scores over the four domains of Productive Pedagogies, $F(4, 11) = 1.135$, *ns*. Nor was there a significant rater by type interaction, $F(4, 11) = 0.827$, *ns*. These results indicate that differences between sites are unlikely to reflect rater differences in reliability of coding of classroom observations.

A series of planned comparisons of the four Productive Pedagogies domains was conducted between VSS classroom performance data and Queensland School Reform Longitudinal Study (QSRLS) performance data for face-to-face classrooms using two-tailed *t* tests of a single mean. These results indicated that Productive Pedagogies domain scores for delivery schools did not significantly differ from face-to-face classrooms observed in the QSRLS study (see Table 4). Furthermore, Productive Pedagogies domain scores for receiving schools were significantly lower than QSRLS face-to-face classes on both the Connectedness domain, $t(10) = 3.835$, $p < .01$, and the Recognition of Difference domain, $t(10) = 7.347$, $p < .001$.

Although there is a general pattern of lower domain scores in VSS schools than QSRLS face-to-face classes, the difference is within the range of normal variation. However, the small number of observations impedes the sensitivity of the statistical test employed. It is possible that with more data points, a somewhat different picture might have emerged. For example, a one-tailed test—that is, had we made an a priori hypothesis about the direction of the outcome—would, as a consequence of its greater sensitivity, conclude that Intellectual Quality scores were lower for VSS classes in receiving schools than standard face-to-face classes.

Two-tailed, independent-groups *t* tests also indicated that there were no significant differences between the VSS delivery and receiving schools on the four domains (see Figure 1). Figure 1 graphs the distribution of the Productive Pedagogies domain scores for delivery and receiving schools. The black line centered in each box represents the median score. The lower bound of the box indicates the 25th percentile, and the upper bound represents the 75th percentile. In short, 50% of observations fall in the shaded area. For example, approximately 50% of delivery school scores

Table 4. Mean Productive Pedagogies scores for each domain

	Intellectual Quality	Connectedness	Supportive Environment	Recognition of Difference
Delivery				
Mean	2.00	2.05	2.94	1.61
Standard Deviation	0.78	0.76	0.53	0.57
Receiving				
Mean	1.86	1.52	3.05	1.20
Standard Deviation	0.62	0.48	0.10	0.33
QSRLS Standard				
Mean	2.27	1.90	3.06	1.40

fell between a score of 1.5 and 2.75 for the Intellectual Quality score. Typically, delivery schools scored below 2.0 on the Intellectually Quality domain, which is lower than the scale notional midpoint, but this is not significantly different from face-to-face class performances observed in QSRLS data.

Online Survey

Sixty-seven students responded to the online survey. As can be seen from Figure 2, students tended to rate all domains of Productive Pedagogies

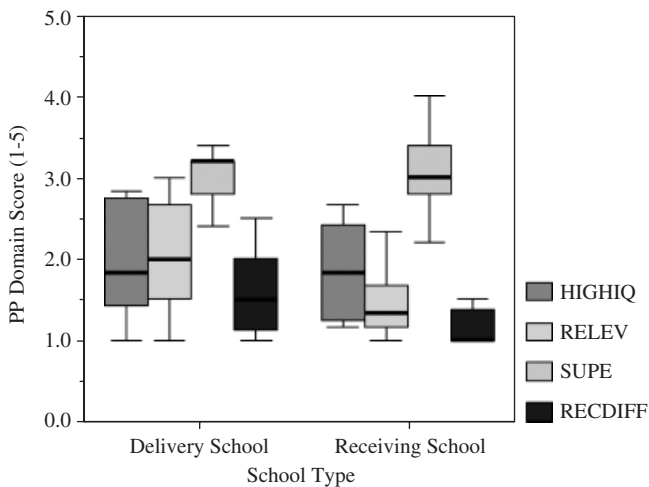


Figure 1. Box and Whisker Plots of Productive Pedagogies Dimension Scores for Delivery and Receiving Schools

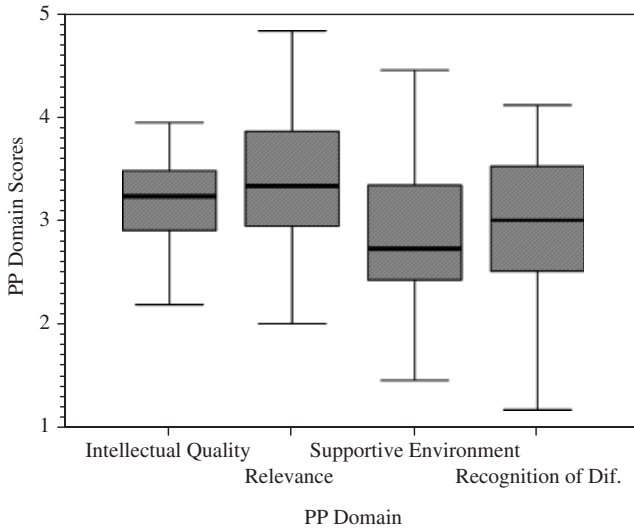


Figure 2. Mean Student Ratings of Productive Pedagogies Performance in VSS Classrooms

above the scale notional midpoint, indicating that students were reporting some exposure to positive teaching practices. Note that the median for each domain—with the exception of Supportive Environment—is above the notional scale midpoint of 3.0. It should be noted, however, that student rating of the four domains was variable, as indicated by the range of the whiskers shown in Figure 2.

Student median scores of slightly above 3.0 for Intellectual Quality, Relevance, and Recognition of Difference indicate that students generally saw no clear evidence of these characteristics in their VSS lessons. (A score of 3.0 indicates neither agreement nor disagreement with the survey items.) The long whisker on the Recognition of Difference item is consistent with state data from the QSRLS study.

Somewhat surprisingly, student scores for the Supportive Environments domain was low. QSRLS data indicates that in general schools across the state provide a supportive environment for students. Indeed, the classroom observation data suggest that the VSS environment is as supportive of students as other state schools. However, VSS students are in a unique environment, and as has been noted earlier in regard to student responses to open-ended survey questions regarding the difficulties of virtual schooling lessons, a number of students identified environment and hardware difficulties as contributing to difficulties with teacher access. Thirty-four percent of students noted difficulties with the whiteboard, audio conferencing

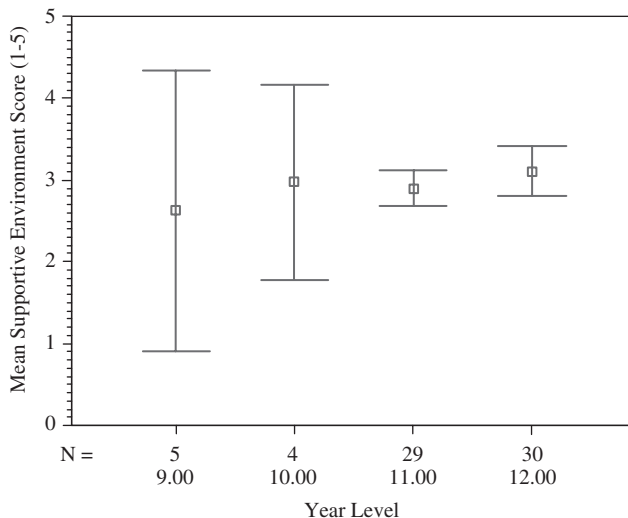


Figure 3. Mean Supportive Environment Scores by Year Level

device, phone dropouts, and the lack of face-to-face contact. All of these could have contributed to students feeling less supported than in traditional classrooms.

Initial examination of Supportive Environment scores by year level suggested that students in earlier years (e.g., Years 9 and 10) were less likely to feel supported in the virtual schooling environment than students in Years 11 and 12. However, as can be seen in Figure 3, the small number of survey respondents from Years 9 and 10 poses a problem for analysis. Small n is associated with high standard estimates of error, as is reflected by the large confidence intervals shown for Years 9 and 10 in Figure 3.

In fact, a one-way MANOVA of Productive Pedagogies domain scores reveals no significant difference in Supportive Environment scores (with Years 9 and 10 collapsed) by year level. However, significant differences in Intellectual Quality and Recognition of Difference scores are reported by year level, $F(2, 64) = 6.89, p < .01$, and $F(2, 64) = 9.33, p < .001$, respectively. Students in Year 12 reported lower levels of Intellectual Quality and less Recognition of Difference than other years (see Figure 4).

No significant main effect of gender was observed on the Productive Pedagogies domain scores, $F(5, 57) = 1.87, ns$.

CRITICAL SUCCESS FACTORS

Delivery teachers, students, study coaches, VSS coordinators, and administrators at both delivery and receiving schools were asked to identify factors

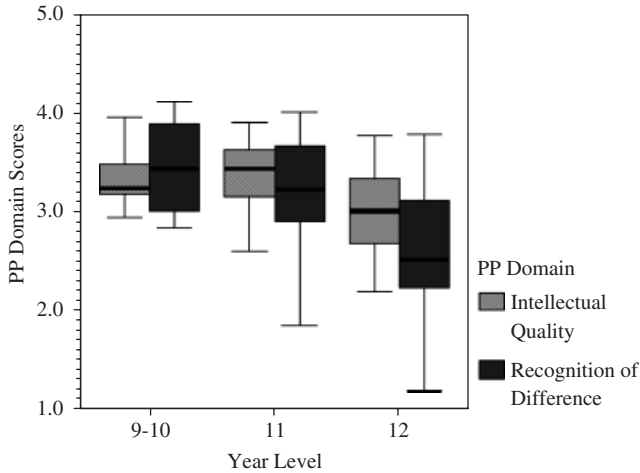


Figure 4. Intellectual Quality and Recognition of Difference by Year Level

that facilitated the success of the VSS. Data were collected from respondents using structured interviews and observations of delivery and receiving classes, using the *School Reform Longitudinal Study Classroom Observation Scoring Manual*. The factors that were most frequently reported were categorized into three dimensions—organizational, pedagogic and technological—forming the substance of the following summary.

ORGANIZATION

All respondents identified scheduling as a critical success factor. Before-school and after-school scheduling of synchronous classes was preferred by some but was unacceptable to many students because of other commitments like bus travel. Scheduling of classes across lunchtimes similarly affected the ability of students to optimize use of the service. Some students dropped out, for example, because lessons affected their involvement in extracurricular activities such as musicals, which are typically rehearsed during lunch hour. For some groups of students, both synchronous lessons were scheduled in lunch breaks, and engagement with the lesson was interrupted by students having to eat.

Facilities for delivering and receiving lessons were utilized most effectively when they were dedicated to virtual schooling and/or to independent learning programs. For delivery teachers, dedicated facilities provided an environment for development of collegiality and a learning community. Such facilities also demonstrated a commitment by the delivery school to virtual schooling, which tended to legitimize the process for non-virtual-

teaching colleagues. All categories of respondents, with the exception of students, noted that support from AccessEd facilitated the success of the service. Forms of support included online and technical support, advice regarding the establishment of facilities, and negotiation of timetables.

Controlled class sizes were conducive to organizational, technological, and pedagogic effectiveness. All respondents indicated that the more sites and/or more students in a class, the greater the number of potential problems. Recommended class sizes included four as the maximum number of sites and 6 as the maximum number of students for languages other than English and 10 for other subjects. As well, reduced contact with face-to-face students and the minimization of extra duties for delivery teachers—compared with conventional standards—was essential for effective organization and pedagogy.

Delivery teachers and students identified the role of the study coach as crucial to the organizational success of virtual schooling. Competent and enthusiastic study coaches were also strongly linked to pedagogical effectiveness. Typically, though, study coaches performed administrative roles and did not attend class or provide academic advice to students. This created a serious legal issue as students were unsupervised in online classes and also had variable supervision during offline lessons.

PEDAGOGY

All respondents—including the study coaches—identified the effectiveness of the study coach as a critical success factor for pedagogy. As previously noted, the study coaches typically performed an administrative function in receiving schools. However, this contrasted with the expectations of the delivery teachers, who placed higher expectations on the persons in this role, envisaging the study coach as someone who was a link to students and who provided guidance, motivation, and procedural support. Several delivery teachers and students suggested this was the most important facilitating factor for effective learning. Although students recognized the need to be self-reliant learners in the virtual schooling model, they depended heavily on their study coaches.

Administrators, delivery teachers, and study coaches all noted the technological literacy skills of the delivery teacher as a significant factor affecting pedagogical success. Students, on the other hand, were interested not only in the technological competence of the teacher, but also in his or her general competence as a teacher. Students recognized differences between teachers who were technically skilled and those who were less skilled with technology but who, in their view, were “better teachers” because they went beyond transmission of knowledge as the primary teaching strategy. Interview data showed that students were more likely to prefer a “better teacher” than a

technically skilled teacher. Professional development for teachers was considered crucial to pedagogical efficacy, particularly by school administrators and delivery teachers. Both groups expressed concern at the limited professional development opportunities offered to virtual teachers, particularly in the area of modifying pedagogical approaches to suit virtual environments.

Student learning style was also a significant factor affecting pedagogy. Interview data from delivery teachers and study coaches indicated that characteristics such as self-reliance, maturity, time management skills, combined with technological literacy (or at least the willingness to learn), were critical factors. Being sufficiently independent to complete offline and asynchronous independent learning tasks was considered to be equally important as the technical skills to participate in online classes. In some cases, students were not able to self-select into VSS classes because of their perceived inability to meet these learning requirements.

The opportunity for delivery teachers and receiving students to physically meet each other through teacher visits to schools, or by students attending school camps, was consistently reported by both groups to have enhanced teaching/learning relationships and outcomes. Students also recognized the value of peers as an important element for learning. Smaller class sizes facilitated intimacy among students, and this bond was critical to some students remaining with the service.

Offline learning tasks were critical as a pedagogical success factor. There was wide variation in the expectations delivery teachers had of offline learning time, and students and coaches generally found this to be the least guided and most poorly conceptualized aspect of the learning processes. For some students, the time was fully integrated into the overall learning of the subject, but for others offline class time was used to catch up on work from other subjects.

TECHNOLOGY

All respondent groups reported the reliability and compatibility of hardware and software in conjunction with the reliability of the delivery medium as the most critical factors for successful virtual schooling. Dropouts, downloading, and absolute downtime impacted negatively on learning, causing lost class time or the need to modify and compromise the anticipated delivery method. Typically, different problems affected different students at different sites. In some instances, classes were cancelled because of the recurrent failure of either the audio or graphic aspect of the online class. Delivery teachers reported that they had modified and often minimized their repertoire of pedagogies in an attempt to avoid such disruptions. Students and study coaches

had frequent problems with the audio speaker devices, including high initial cost and long delays when repairs were necessary.

Systemic protocols for hardware, software, bandwidth, class sizes, facilities, and clarity of role specification of study coaches were considered vague and inconsistent, compounding technological interruptions during class time. Variation in technical support at receiving sites was also problematic, with one school relying on a weekly visit by a technician to deal with issues. One effect of malfunctioning infrastructure was that students had to share computers. This also occurred in schools where computer facilities were inadequate for the number of students in a class. This created frustration and discontent among students and, unbeknown to the delivery teacher, they often had to compete for machine access.

The service offered by the telecommunications provider, Telstra, is unlikely to be challenged by other providers at this stage. Telstra showed a high level of technical support to teachers during episodes of technical problems, by way of a willingness to attend to problems in a timely fashion. Nevertheless, some problems had to be attributed to Telstra's failure to deliver a fully reliable service.

In sum, factors facilitating the overall success of virtual schooling were as follows, in the order most frequently cited by respondents and observed by researchers: student learning style, delivery teachers' pedagogical practices, reliability of technology, student-teacher rapport, subject matter, and other factors. Factors limiting its overall success, in the order most frequently cited by respondents and observed by researchers, were reliability of technology and other factors. The reliability of technology for virtual schooling is, at this time, the most significant factor detracting from the success of the project. It was also the reason some schools had withdrawn from the VSS. Within this context of focused attention on the fundamental issue of delivery, the question of effective pedagogy remains loosely challenged. That is, if the technological systems were reliable, it is likely that greater scrutiny of the pedagogical practices themselves would have been apparent.

STAKEHOLDER PERCEPTIONS AND STUDENT PERFORMANCE

Delivery Teachers

Delivery teachers were generally satisfied or very satisfied with the concept of virtual schooling. They consistently recognized that it provided an opportunity for students to study subjects that otherwise would not be available to them because of a lack of availability of teachers and/or small class sizes. It was seen by most delivery teachers as a positive development for secondary education. Teachers found the 1st year of teaching in VSS challenging but also found that the journey was revitalizing and had potential for teacher renewal

and commitment. Teachers also acknowledged differences from class to class, which were the result of variable student motivation and commitment.

Virtual Schooling Service Coordinators and Study Coaches

There was a wide range of satisfaction of VSS from the perspective of VSS coordinators and study coaches, extending from exceptionally pleased to moderately satisfied. Those who were generally satisfied argued that the initiative was conceptually sophisticated and that it enabled students access to a wider curriculum. This meant that they did not have to leave their homes or communities to attend schools with a broader curriculum base. The critical mass this provided in rural and remote schools benefited all students in the schools through higher retention rates. Those who were less satisfied commented on peak trouble times such as changeover of delivery schools or new student cohorts, which added considerable demand to the study coach, the students, and the effectiveness of the learning processes.

Several schools indicated that students in virtual classes were not self-selected, because only those who were considered to be independent, capable, and motivated learners were allowed to participate in the service. This protocol indirectly contributed to the enhanced effectiveness of the service.

Students

Students were consistently less satisfied with virtual schooling than delivery teachers, school coaches, and coordinators. In almost every instance, students agreed that regular face-to-face classes in conventional classrooms were superior for effective learning, with comments such as “not as good as a real teacher and classroom.” Nevertheless, most students reported that they would use virtual schooling if it were the only way they could study in the chosen subject area. Generally, students regarded their virtual classes as “harder than face-to-face classes” because of the need for a blend of technological literacy skills, subject-specific content and processes, and independent, self-directed learning, particularly in asynchronous classes. They also reported considerable frustration with scheduling and class routines for both synchronous and asynchronous classes. In particular, technical problems and the loss of online class time were not tolerated well by students.

STUDENT PERFORMANCE

Student performance is reported from the perspectives of delivery teachers, VSS coordinators and study coaches, and students, in the sections that follow.

Delivery Teachers

Delivery teachers claimed that student performance was dependent upon individual student commitment and that it reflected the performance range of conventional classrooms. Factors affecting student performance included student motivation, the quality of coaching at school sites, facilities provided at the school site, and student learning styles. Additional benefits to students from studying via virtual schooling included enhanced technological skills; development of independence, autonomous learning, and time management skills; and the opportunity for highly motivated students to perform.

Virtual Schooling Service Coordinators and Study Coaches

Coordinators and study coaches were mostly positive about the achievement levels of their students and were convinced that students would perform equally in the VSS classroom as in a conventional classroom setting. There was a strong message that certain students were better suited to virtual schooling than others. These students were typified by a high degree of self-discipline and self-regulation, with good time management skills. Several study coaches noted that students elected to study with VSS for the novelty factor—and because of greater personal freedom. However, this typically diminished learning outcomes unless students were sufficiently self-motivated and autonomous workers within the parameters of the learning mode.

One study coach believed that, generally speaking, girls were more successful with virtual schooling than boys. This was seen to be a maturity issue, with boys often having difficulty working independently and requiring greater guidance and support as they were easily distracted and moved off-task. The offline component, in particular, required greater commitment and autonomy than the online lessons.

Students

In almost every instance, students believed they would achieve at least the same, if not better performance outcomes in conventional classroom contexts. Around half of the students believed they would have better outcomes in a conventional class. Students recognized the need to be independent learners and that they could optimize learning outcomes if they chose to. Several were not working up to their potential and blamed diminished achievement levels on their own attitudes. Those students with positive and

active coach support were more likely to believe they were achieving their potential. A surprising comment from some students was that they believed virtual schooling removed the interpersonal dimension of the teacher/student relationship, which offered potential for higher achievement.

SUMMARY AND CONCLUSIONS

The key findings of the study in regard to the VSS are organized into the four categories: provision, organization, pedagogy, and technology.

VIRTUAL SCHOOLING SERVICE PROVISION

The VSS clearly provided an important means of maintaining curricula choice and provision for students. Furthermore, the provision of a wider curriculum in local schools had benefits beyond narrow educational ones. For example, social benefits included opportunity for students in rural areas to study in their hometowns with their peers, which enabled retention of a critical mass in the senior school years. This, in turn, had spin-off benefits for regional townships and remote communities suffering from economic downturn, rural decline, and attendant social costs in terms of unemployment, increased rates of suicide, substance abuse, and family violence. These benefits accrued equally in larger towns and cities where marbling of new poverties has occurred with recent shifts in employment structures and labor patterns.

ORGANIZATION OF THE VIRTUAL SCHOOLING SERVICE

Because of the difficulty of meeting the needs of schools with different organizational structures, the issue of scheduling for synchronous lessons remained a challenge for VSS. This produced some tension in terms of virtual schooling rhetoric and its implementation. For example, signifying practices purportedly characteristic of virtual schooling such as flexibility, student-centeredness, and interactivity were not reflected in organizational procedures, which typified center/periphery, industrial models of teaching and learning in most schools.

The importance of dedicated facilities at both delivery and receiving sites was another key organizational issue. There was an optimal number of receiving sites and participants in synchronous classes beyond which the limitations of technology had a negative impact on learning outcomes. Recommended limits were a maximum of four participating sites and a maximum of 10 students per class. The provision and contribution of study coaches was an issue that also needed attention. Role expectations varied

widely and the nonsupervision of students in online and offline lesson time was potentially a serious industrial relations issue.

PEDAGOGY OF THE VIRTUAL SCHOOLING SERVICE

Most students enjoyed and were relatively pleased with learning outcomes from VSS lessons. They found the high level of autonomy and self-regulation a challenge but believed that the experience was beneficial in terms of developing skills and attitudes for lifelong learning. Like most of Queensland's face-to-face classrooms, VSS lessons were highly supportive learning environments, and effective study coaches enhanced learning outcomes for students. However, these classrooms similarly rated poorly in terms of the other three dimensions of the Productive Pedagogies framework, namely, intellectual quality, connectedness, and recognition of difference. Therefore, virtual schooling in Queensland presently offers more pedagogical possibility than pedagogical productivity.

TECHNOLOGY FOR THE VIRTUAL SCHOOLING SERVICE

This condition of pedagogical potentiality could partly be attributed to technological provision, which was problematic. Considering the degree and quality of technological infrastructure, narrowband connectivity, and technical support at system and school levels, Education Queensland needs to be realistic about what is achievable in terms of educational outcomes. Technological constraints limited the range of pedagogical approaches that teachers used, and because of the direct relationship between class size and quality of learning, innovation and risk taking were not really an option.

Nevertheless, consistent with its futures approach, Education Queensland has continued to embrace online teaching and learning initiatives. For example, The Learning Place (<http://education.qld.gov.au/learningplace/>) provides a centralized electronic portal for a wide range of educational services and resources for teachers. Improved teleservices and the formation of school- and system-wide online learning communities through The Learning Place will continue to change state education provision. With this in mind, and because of its potential to provide a significantly enhanced pedagogical model of distance learning, the researchers recommended that the VSS be an ongoing part of Education Queensland's portfolio. This came with the qualifier that any further expansion of the service—by way of inclusion of new subjects and/or client groups—should be mindful of the findings of the present study.

As an educational innovation, the VSS is a transitional learning space, a hybrid of two models: industrial and "information age" education. VSS claims to have changed learning by eliminating the need for the physical

presence of teachers, but this research has shown that it retains traces of social and pedagogical practices from the system it purports to supersede. Following Bolter and Grusin's (2000) notion of "remediation," and as part of the shift from print to digital culture, VSS combines new and old technologies and new and old learning and teaching practices. This conceptualization of media evolution would view virtual schooling as competing with traditional schooling until both are eventually (re)formed.

We maintain, then, that this virtual learning program remains a "first generation" of development work, one with considerable theoretical and pedagogical limitations. An area for urgent ongoing research is therefore investigation of the pedagogical continuities and contradictions characterizing these initiatives. This research agenda would shed light on educationally productive and counterproductive tensions such as the ways that conventional approaches to scheduling, and to teacher and textbook authority, limit the autonomous, just-in-time, self-directed learning that new technologies can and should deliver. Furthermore, it would reaffirm the need for pedagogical innovation to complement technological advancements. The time is right for a "second generation" of virtual schooling design, development, practice, and research, one that extends the accomplishments documented in this edition of *Teachers College Record*.

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