Distance Education in Schools: Implications for Teacher Education

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Abstract: The advent of sophisticated telecommunications technology In business and Industry and society's demands for technologically-literate graduates has led to the piloting of technology-based educational initiatives across Canada. Similarly, distance education, once considered a different form of education, has changed the ways learning opportunities for rural schools are organized, and has also provided opportunities for teachers to restructure classroom procedures to allow for more flexibility and greater student control of their own learning. These initiatives have Implications for teacher education including a reexamlnation of the models of teaching and learning which are prevalent In teacher-training Institutions, the Integration of media so that alternative technologies are experienced by student-teachers, and the exploration of philosophies of Instruction with an emphasis on the facilitation of learning. Student teachers must be not only competent in the use of more technologies, but also cognizant of the ethical questions which the use of technology involves,

Resume: L'avenement des telecommunications perfectlonnees dans le milieu des affaires et dans l'Industrle, et unesocietedemandant que lesdlpl6mes universltaire solent experts technologues, sont a l'origine d'un projet pllote de formation basee sur la technologie, a trovers le Canada. Ainsi, la formation a distance auparavant conslderee comme une forme d'education alternative, a change les habitudes d'apprentlssage des ecoles rurales et a perm is aux enselgnants de restructurer les methodes d'enseignement en donnant plus def lexibilite et en offrant aux etudlants un mellleur contrdle de leur propre apprentissage. Ces Initiatives ont aussi une portee sur la formation pedagogique en provoquant la re-evaluation des modeles d'enseignement et d'apprentlssage predomlnants dans nos Institutions pedagoglques. Elles proposent ('integration des medias afln que l'etudlant en pedagoglepuissesefamiliarlser avec les technologies alternatlvesetpuisse explorer les nouvelles philosophies de formation et de perfectionnement des methodes d'apprentlssage, L'etudiant en pedagogle doit non seulement avoir ('expertise necessalre a la manipulation des technologies m odernes mais Il doit egalement etre consclent de toutes les questions d'ethlque que cette utilisation peut soulever.

The advent of ready access to sophisticated telecommunications technology is changing the face of education in Canada. Not only are schools now required to prepare students who are technologically literate, educators have begun to see the potential of distance education strategies for providing better and more diverse learning opportunities for students. Both of these initiatives have implications for teacher education.

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The small rural high school in Canada is changing. Once forced by lack of qualified staff to offer only core subjects to its senior year students, today the school is able to provide a much greater range of course offerings while maintaining a high expectation of student success, and is able to do so in ways which better meet the varied learning styles of students. These changes have come about through the addition of distance education learning strategies. In Alberta, over half the high schools are small with less than 150 students and with 5 to 12 teachers, (Alberta Education, 1990a) a pattern that is not dissimilar across the Western provinces. Many teacher education students come from these schools and will return to teach in a rural area. They need to know how times are changing for rural high schools,what the possibilities are, and what they should consider in designing learning opportunities for their students. They have the potential to transform education in rural high schools.

As Knapper and Cropley (1991) note: "Despite the growth of distance education worldwide, there are still very few programs for training teachers in appropriate pedagogical strategies" (p. 102). Many of the graduates of teacher education programs are presently unprepared to use telecommunication technologies with their students. Few at the high school level have been introduced to any concept of teaching which does not involve the teacher in exposition and coaching. As student teachers, they have been evaluated for their ability to determine objectives, provide an anticipatory set, model the learning, provide practice, evaluate the learning and bring the lesson to closure. Their focus has been on teacher-centred learning. Furthermore, familiarity with media other than print such as audioconferencing, laser discs, and computer-managed learning is still relatively rare. But the situation is changing rapidly and therefore teacher education has to change also. Through examining initiatives in distance education at the school level, implications for changes in teacher education programs can be identified.

The Changing Landscape

During the last three decades, the gradual change in Canadian demography from that of a predominantly rural agricultural population on farms and communities strung out across the prairies and along the coasts of Canada, to one where the population is increasingly urban has accelerated. Economic decline in the farm industry, greater opportunities for employment and education in larger urban centres, and a declining birth rate have all been identified as contributing factors to this population flow. These shifts in population are occurring at a time when there are rising educational expectations for entry level to the work force, and a more informed population on educational matters. The most immediate impact of these changes has been on the continuing viability of rural communities.

For many communities, retention of the local school is considered a mark of community stability and a potential enticement for the relocation of industry. Hence, local school boards and provincial governments have been petitioned to help ensure that these small schools are able to provide a level of education equivalent to that available in urban centres. At the same time, the reform in

education movement with its emphasis on testing and academic achievement coupled with business and industry's demand for a greater emphasis on science subjects in the senior years have resulted in provincial curricula which require greater numbers of specialist teachers at the high school level.

Canada is not alone in facing these pressures. Barker (1986) listed similar reasons for a comparable situation in the United States. These included the crisis in the agriculture, the drop in oil prices, the reduction in numbers of people entering the teaching profession, and the greater numbers of courses required for high school completion. In the United States, the move to the cities had resulted in school closures and consolidations as fewer people were available to carry an increased tax burden including rising educational costs (Stephens, 1986; Williams, Eiserman, & Quinn, 1988). Australia with a small population in proportion to its land area is facing similar issues of rising educational expectations and population fluidity (Conboy, & D'Cruz, 1988).

Population shifts have also had an indirect impact on urban schools. The downturn in the Canadian economy which has led to cost-cutting measures such as staff lay-offs and the application of technological efficiencies, has influenced numbers of students to return to high school and upgrade their qualifications. Many high school students are living on their own and employed full or part-time: They want courses offered at times which fit in with their work demands. As well, due to the closure of some specialist vocational programs, the student clientele has become more diverse in terms of academic achievement and more demanding in terms of motivation. As high schools have begun to reexamine their programs to identify ways which will better meet these student needs they have turned to technologies as a means of developing alternative instructional strategies which would allow for greater student independence and autonomy.

The Provincial Response

Provincial governments have been involved in developing instructional alternatives which would allow students access to high school courses since 1919. All provinces except Prince Edward Island, and Newfoundland which had closed its correspondence programs in the mid-70's, have provincial correspondence schools. The most common format was for the provincial correspondence school to be responsible for the development of the instructional materials. The course materials were sent out to all students who registered. Students sent completed lessons to the school where teachers marked the materials and returned them to the students usually by mail. For students in rural high schools, the service allowed them to obtain high school credits in courses which were unavailable at their local high school and many took advantage of the opportunity afforded them. For 1989-90, Alberta and Ontario each registered over 12,000 secondary school age students in distance education while British Columbia, Saskatchewan, and Manitoba, registered between 4,000 and 6,000 students each (Haughey, 1990, p. 2). Although there had been major changes in distance education in the post-secondary sector from Radio Farm Forum in the 1920s, to television in the 1950s and computers and satellites in the '70s (Muggeridge, & Kaufmann, 1982), few

of the provincial correspondence schools were able to explore these alternatives due to lack of funding.

Faced with increased demands for greater access to educational programs, and concerns for equity among rural and urban schools, provincial governments began to explore ways in which high quality programs could be made available to all high school students through the use of communication technologies. British Columbia focused on the regionalisation of the correspondence school services so that marking was done by local teachers paid on a piece-work basis, and administration was handled by a local school district. Each regional school has explored a variety of technologies including fax machines, computer networks and audioteleconferencing. The advent of the Saskatchewan Communications Network, an interactive video system involving satellite and microwave broadcasting has quickly expanded the options now available to schools in that province. Manitoba Educational Television, begun as a pilot project in 1984, provides a variety of broadcasts which support in-school and provincial correspondence programs throughout the province (Simard, 1989). The Small Schools Project, begun in 1985, initially used audioconferencing and some computer conferencing on the provincial computer system. Using combinations of audio and computer conferencing with print materials, 15 courses were taught each semester to students in over 20 schools across 15 subdivisions in 1988 (Education Manitoba, 1988, p. 34). In 1990, piloting of courses to 45 sites using interactive satellite broadcasts was begun. Newfoundland has begun to use the province's extensive audioconferencing network on a regular basis for high school instruction. As all of these projects indicate, access to modern communication technologies has the potential to transform thinking about high school instruction.

The Alberta Situation

In 1987, Alberta Education initiated a pilot program in southeastern Alberta involving 10 school jurisdictions and ISschools. Called the *Distance Learning in Sjnall Schools* project, it was designed to explore the advantages of locally-based teacher markers, and the impact of technologies such as fax machines and audioconferencing on the provision of high school instruction. The project was so successful both in the increases in numbers of students who registered for courses, and the numbers who completed their courses successfully, that the project was expanded to 28 schools in its second year (Clark & Schiemann, 1990; Gee, 1991). Also in 1988, Alberta Education began a second pilot project, *Distance Learning Project North,* this time in the northwestern sector of the province This project focused on the implementation of computer managed learning software for all high school mathematics courses which accessed a test bank and provided individual tests, as well as recording student scores on an appropriate record keeping system; the use of an audioconferencing and audiographics system; and the development of partnerships among the participating jurisdictions. In 1989, the Minister of Education announced an equity grant for 145 small schools throughout Alberta "to provide qualifying school jurisdictions with funding to enable low enrollment senior high schools to offer a wider range of student courses than under present circumstances" (Alberta Education, 1989, p. 2.2).

Since then, most jurisdictions have joined one of six consortia for the provision of distance education while a small number have chosen to offer distance education within their own jurisdictions. In general, students use the provincially prepared instructional materials, and are often required to attend distance education classes where they work on these materials independently. They have the active support of a teacher on staff and the ability to call their teacher-marker for advice and assistance. The students send lessons by fax and usually receive a reply within 48 hours. The CML data base system is being expanded from mathematics to include other sciences. Some jurisdictions have transferred some of the mathematics programming to a CAI-CML format on Macintoshes, and the extent of audioconferencing varies with the jurisdiction (Hough, 1992).

In describing the variety of models which have been developed, the Alberta Distance Learning Centre has focused on systems of delivery. They have identified four models:

- The first is the traditional correspondence model where students return materials directly to the provincial centre for marking.
- The focus of the second model is computer-managed learning. Students work on their distance education materials under the supervision of a teacher who monitors their use of the CML system for assignments and examinations, and provides additional marking and assistance as necessary.
- In the third model, students' distance education assignments are marked by teachers who are either on the school staff or who are hired specifically to provide this service, often on a part-time basis. While the first model presumes that the student will work independently with little or no formal supervision or support in school, the third model includes the provision of a distance education teacher who monitors the progress of the student and supervises the work often in a special distance education room.
- The fourth model, is really an expansion of the third model, with a network of schools all of whom have implemented the third model, linked through a central consortium director, and all potentially using the same teacher markers (Alberta Education, 1990b, pp. 10-14).

Although these models highlight some of the differences between the traditional correspondence model and the new distance education versions, such as the greater attention to student support and supervision and the use of local teachers as tutor markers, they are unable to surface the pedagogical issues surrounding the implementation and integration of distance education. In a review of schools and consortia in Central Alberta, Hough (1992) described a variety of formats for the provision of distance education from students studying independently with little supervision to students from different schools who formed teleconferenced "classes" and were taught by a teacher at yet another school. There was similar variation among the tutor-marker employment practices used by consortia. Some consortia used an agent board to hire and assign all tutor-markers, while

others left those functions up to the individual jurisdictions. Some encouraged tutor-markers to be part of the school staff, while others employed part-time people who worked from their homes. What is most notable is the variety of ways in which schools and consortia addressed the provision of distance education.

The Teachers' Response

Although there was a variety of administrative arrangements for the implementation of distance education in the schools, teachers varied less in their response to distance education. Most of the teachers and principals to whom Hough (1992) spoke felt that while face-to-face instruction was the best method of instruction, a good distance education program was an acceptable alternative. Although he did not explore their reasons for this conclusion, some principals and teachers spoke of their concerns that the provision of distance education would deplete the numbers of students taking regular instruction and hence lead to staff layoffs. One principal explained that the only distance education courses he allowed his students to take were those for which the school could not provide classroom instruction. In contrast, another administrator, faced with this concern by teachers, replied that perhaps students were voting with their feet and classroom instruction needed to become more interesting. Underlying teachers' concerns were suggestions that declining enrollments caused by provision of distance education courses would deplete small staffs in that students would opt for distance education because it seemed easier; that the design of distance education materials was a series of read and do worksheets which denied the complexity of the teaching act; and that distance education could not provide the personal coaching available in a regular classroom. If distance education is to be accepted as a legitimate instructional/learning strategy for students, then these teacher concerns need to be addressed.

The Impact on Staffing

The first concern identified by teachers was the impact of distance education on staffing. Schools throughout the consortia and within jurisdictions adopted various ways of restructuring "school" to accommodate distance education as an alternative within school rather than an alternative to school. No school in Hough's study (1992) had ,to lay off teachers due to the impact of distance education. Instead, principals sought to work with other schools (the Distance Learning Centre Model 4) to ensure that there was sufficient employment for all their teachers. In a school where students were permitted to take any course they chose, the principal noted that the demand was for a widening diversity of courses. He pointed out that the school was now better able to provided appropriate instruction in courses of interest to non-university or college bound students; courses which the school could not have offered without distance education. Many principals were able to provide alternatives without staff reductions; those principals who were least supportive of distance education seemed to find the threat of declining enrollment leading to staff layoffs to be a convenient rationale

for retaining the status quo.

Principals could try to maintain the status quo and limit distance education, thereby negating promises of access and equity, or they could seek alternative structures which would employ teachers in ways other than as a classroom teacher. Preferences for established routines was another aspect of this issue. While some principals chose to consider their students as a captive audience, and assigned them all to classroom instruction, others gave teachers the option of using distance education in a combined class of a single grade but multiple ability levels. In some cases, teachers chose to teach the average and high ability students directly, while lower ability students were assigned to distance education (Clark & Haughey, 1990). This marginalization of those students who had the most difficulty reading and staying on task meant that discipline problems, absenteeism, and non-completion were likely outcomes, fueling the teacher's reluctance to allow high ability students to become involved in distance education. Also, some teachers found it difficult to move away from the presentation of ideas to the facilitation of learning.

Many teachers at the high school level saw themselves as subject specialists. They enjoyed an instructional format which involved them as expert in presenting information and engaging students in questions. When their students took a distance education course, these teachers spoke of their loss of enjoyment of the drama of teaching, and their loss of frequent contact with "good" students who did not need their advice and assistance. They found it difficult to spend time aiding students to find information rather than in providing the information directly themselves. They were concerned that the students might not absorb the information correctly or see where it related to other ideas. They worried about their ability to monitor individual learning. This diversity was most evident to them in their loss of control of the pace of instruction; instead they were faced with constant marking which was inevitable when every student was at a different place in the course.

Implications for Teacher Education

There are immediate implications for teacher education. While elementary teachers are expected to provide a facilitative environment which allows students to progress at their own pace, high school teachers have tended to stress the transmission of information to a much more homogeneous group of students. Distance education provides an opportunity for teachers in training to explore alternative pedagogical approaches to learning. Such training needs to involve greater attention to student characteristics such as learning styles, as well as to teaching and management strategies which allow for individualization of instruction.

The Loss of Interaction and Immediate Feedback

Teachers were concerned that distance education did not allow for the coaching and interaction of a regular classroom. Earlier experiences with correspondence programs with a failure or non-completion rate of close to 70% (Gee,

1991) were taken into account when the first pilot program, *the Small Schools Project*, was designed. A staff member in each school was assigned to be the distance education coordinator and was responsible for monitoring student progress and providing advice and encouragement. A completion rate of close to 90% (Hough, 1992) confirmed the importance of personal support for students who were unused to taking responsibility for their own learning.

The specific circumstances for distance education students seemed to vary by school, and was influenced by size of school population, number of distance education students, availability of staff, and appropriate facilities. Hough (1992) described schools where students taking distance education courses studied independently and were supervised on a casual basis by a teacher who had other responsibilities. Sometimes these students sat at the back of a classroom and obtained help when the teacher was available. Some studied in the library or counsellor's office and phoned or faxed their teacher-marker for assistance. In these situations, distance education was viewed as an independent alternative to class instruction.

Hough also described schools where principals had reorganized school timetables so that all students taking distance education courses had these courses at specified times, and were expected to study in the distance education room under the supervision of a specifically assigned teacher. This teacher monitored their work, provided advice and encouragement, faxed their assignments and recorded their grades. For educators in these schools, the provision of support and assistance was considered integral to success in distance education. They saw distance education courses as needing teacher intervention to be satisfactory learning experiences.

In those situations where students were assigned to a distance education room, the designated teacher was often required to supervise students who were simultaneously working on a wide range of courses. Students could call their tutor marker or talk to another teacher in the school when they had a specific problem which the supervising teacher could not address. Students' success rate, which varied little among all the schools Hough (1992) surveyed, offers some evidence that while students benefitted from the concern and support for their progress provided by the distance education teacher, they did not require the specific coaching and interaction which the teachers thought was necessary.

Implications for Teacher Education

As Goodlad (1990) has pointed out, much of what passes for instruction in classrooms involves extended amounts of teacher talk, a point identified much earlier by Jackson (1968). Teachers need to be more cognizant of and proficient in providing learning opportunities which engage students in actively constructing their own understandings from the information available. They should also know how to help students assess critically what they read so that they can move more quickly beyond assimilation of the facts to integration of the information.

The Design of Distance Education Materials

Teachers' concerns about distance education were most evident in their reactions to the use of prepared materials and their lack of knowledge of the instructional design process. According to Ullmer (1989) the most common view of instructional design

> usually entails a teaching regimen which emphasizes instruction-centred, verbal exposition; an associated image of the learner as a largely passive, word-processing, fact-storing mechanism; and a governing ideology that calls for little more than orderly information transfer and assimilation. The implied instructional design mandate is to supply materials that enable teachers, like farmers, to "cover the ground", (p. 96)

Kerr (1989) in an examination of teachers' reactions to technology, pointed out that the highly structured, systematic format closely associated with instructional design is in many ways the antithesis of what we know about teachers' planning strategies. In reviewing a variety of studies on teachers' approaches to planning, he concluded that "in all these cases, emerging evidence highlights aspects of the teacher's work that are ambiguous, uncertain, difficult to cast into the molds educational technologists have wrought" (p. 8). Kerr went on to point out where teachers put most emphasis in their planning for instruction: "Teachers' ideas of their work, then, focus on the 'wisdom of practice,' and on the value of their individual connections with students" (p. 8) and he stressed that teachers "create for themselves a classroom world which reflects both their assumptions about teaching and their preferred ways of working with students" (p. 8). It is little wonder that teachers were dismissive of materials which did not match their own designs for instruction and which did not include much personal interaction with individual students.

Teachers in planning for classroom instruction most often begin with a specific teaching strategy related to a particular concept or set of ideas. As they teach they try to include examples which will provide learning bridges for their students. Sometimes the strategy involves using media other than print, chalkboard, or overheads but in many classes, especially at the high school level, the textbook is still the most important resource for students and teacher. It is not surprising then, that teachers found the easiest way to incorporate distance education materials into their classroom teaching was to adopt them as texts.

Unlike teachers' classroom practices which are essentially private and temporary (Jackson, 1968; Lortie, 1975), distance education materials are public documents and are thoroughly evaluated before they are released for publication (Thorpe, 1988). In Alberta, this usually begin with the appointment of a project manager, a practicing teacher or teacher consultant who is seconded to the Distance Learning Centre to develop a modular outline for the course based on the provincial Program of Studies. This outline details the instructional design of the course including both the sequence of topics and the probable instructional strategies for each topic. Once this design outline has been approved by an advisory group, a number of teachers are hired to work on development of

individual modules, usually over the summer period. After receiving information about appropriate print designs, the teachers work collaboratively to write the text and questions and design assignments for each module. The teachers vet each other's work, providing advice and critiques on a weekly basis. In this way the module writers develop similar ways of addressing students, consistency in expectations for students, and a similar level of language use for the modules. These modules are then reevaluated for consistency of development, for appropriate progression of ideas, for accuracy of content, and for variety in level of questioning from recall to synthesis and from concrete to abstract. Where necessary, the modules are rewritten to meet these expectations. They are evaluated for gender, and racial bias. Finally they are organized to meet design specifications such as the amount of white space, standardized levels of headings, and use of graphics and drawings. After a final vetting, they are printed and packaged (Stanley, 1990).

These distance education course modules differ from textbooks in a number of significant ways. First, they are developed by experienced practicing teachers to meet the particular objectives of the provincial curriculum so they include all of the required areas and are designed to extend the knowledge base learned in previous grades. At the same time, when a unit requires knowledge of a previously learned specific procedure or skill, an optional, mini update unit is provided for those students who wish to review their knowledge prior to proceeding. The modules themselves are designed to set out clearly what the student is expected to learn through a variety of activities, and in-text assignments, where the student can test how much has been learned before moving on to the next section are provided. Such a format, however, is not limited to read, think, and write exercises. Just as is possible in teacher-directed instruction, a full range of instructional strategies including problem-solving, games, discovery learning and information-seeking is provided to engage learners in tasks which will likely help to facilitate their learning. Activities are chosen to cater to different learning styles, thinking levels and interests and where possible a number of alternative exercises are included to provide choices for the learner. At the end of a unit, both "extra-help" and "enrichment" exercises are provided. As Shulman (1987) has pointed out, experienced specialist teachers have developed a repertoire of information specific to the content area including knowledge of likely student mistakes, preferred instructional strategies for specific content areas, and knowledge of the teaching structure of the subject as distinct from the structure of the discipline. When distance learning materials are developed by a cadre of such teachers, the instruction is likely to be richer than that provided by a single teacher who has had fewer opportunities to teach that curriculum.

Implications for Teacher Education

One of the most important aspects of teacher education is the development of expertise in the design of instructional materials. Students are required to be able to plan for instruction in ways which take into account individual students' learning styles, their level of prior knowledge, and stage of development as well

as showing evidence of their own knowledge of the subject matter. Often, students begin with teaching plans which are highly teacher controlled. Unfortunately, since practicing teachers have limited opportunities to observe each other teach or to discuss the merits of various teaching strategies, their opportunities to develop a wide repertoire of teaching strategies are limited. This is especially so when they teach in small schools where they may be the only specialist in that area on staff. Too often, the emphasis in teacher education has been on the development of generic teaching skills such as the development of objectives, the presentation of information, the provision of practice questions and the closure of the lesson. These skills focus on the teacher rather than the learner and, while important, give no recognition to the development of what Schulman (1987) referred to as the teaching structure of the subject. More attention needs to be given to the development of strategies which focus on the learner and the pedagogy of the subject.

Approaches to Learning

Many teachers support a curriculum design which is based on a systems model of objectives, activities and evaluation, and subscribe to a theory of knowledge as information dissemination. For these teachers, teaching involves transferring information to learners. Other teachers, who assert that the curriculum should bedesigned to allow individual students to construct their own understandings, subscribe to a constructivist theory of knowledge. For them, knowledge is constructed by individual learners who make sense of information in terms of their own experiences and teaching is the facilitation of this learning. In these situations, the classroom teacher's task is to provide enough information to challenge students' thinking, to help them work through information critically, and to relate information to their own experiences. At first glance, it would seem evident that systematic teachers would support the use of distance education materials while constructivist teachers would not. But the increasingly sophisticated designs used in distance education materials are based on a learner-centred philosophy which provides support, encouragement, and instant feedback to students through solutions, diagrams, explanations, and guides, and allows for student choice (Stanley, 1990).

Facilitator manuals which outline various ways to use the materials are also provided to teachers so that the materials can be used effectively by teachers with differing philosophies. The facilitator manuals stress the importance of each component of an open learning system: The learning package, student support, and management. The need to be cognizant of student reading levels is also addressed. Teachers are encouraged to make their teachingmore learner-centred by promoting learner self-confidence and providing support and guidance to individuals and small groups, and more student-active through the use of strategies which involve students in designing and working through problems and questions.

In an earlier review of distance education practices in schools, Haughey (1990) identified four learning models based on distance education. These may

provide a basis from which teachers can explore their curricular assumptions and the patterns of interaction which direct their teaching. These four models are as follows:

- Teacher-controlled, whole class, learning;
- Teacher facilitating, small group learning;
- Student-controlled, teacher-supervised, learning; and
- Student controlled, independent learning.

In the first model the teacher continues to teach the class as a group and uses the distance education materials as a text. The teacher introduces the lesson, the students work individually on the unit, the teacher brings the unit to closure, provides a review, and evaluates the students' work. There is high teacher control of the learning situation, and block pacing. The benefits of distance education are in the detail and variety of the individual units which are usually designed to be more interactive than a textbook. Teachers who were required to teach a subject which was not their specialization found this method helpful as did teachers who wanted to explain concepts or introduce ideas themselves in ways they thought would be clearer for students than the introductions provided in the distance education materials.

In the second model, the teacher divides the class into small groups based on student ability and allows these groups to proceed at variable rates. While the teacher still introduces new units and monitors and evaluates students' work, the student group becomes the learning unit and often uses cooperative learning strategies to ensure that all members of the group are all able to proceed together.

In the third model, students work on distance education materials independently or in small groups and the teacher evaluating their work may not be the teacher in the classroom. The classroom teacher works with students individually but does no large group instruction. Where the teacher is a specialist in the subject, students in difficulty may receive individual assistance and the teacher will evaluate the students' work. Where the teacher is not a specialist, the teacher may provide individual encouragement and assistance with general comprehension or management questions but will encourage the student to contact the teacher who will evaluate their work for specific advice and direction. Students may pace themselves and keep their own record of marks for their work or the teacher may be required to monitor and chart the students' progress, fax assignments and record grades. In this model evaluation is separated from the other aspects of instruction and often coaching or tutoring was also provided by someone other than the classroom teacher.

In the fourth model, the student is solely responsible for completing the distance education materials. There is no assigned classroom where the teacher is responsible for assisting students, monitoring their pacing and recording their grades. Instead, some students sit at the back of a regular classroom while another class is in progress or in the library, while others study at home or work. The student has the opoortunitv to contact the teacher who will mark their

assignments for advice and tutoring, hence the most common name for these teachers who are not assigned as a classroom teacher is the "tutor marker", highlighting the two most common functions which they provide.

Although these models highlight the progression from teacher control of the pace, content, presentation, and evaluation of instruction to student control of the pace of instruction, the Distance Learning Centre's control of the content and presentation, and the tutor marker's responsibility for evaluation of the work, they do not include the situations where teachers are given combinations of students, sometimes a mixture of distance education and face-to-face students for the same subject. In some schools, teachers who did not have enough classes for a full teaching load were assigned to be tutor markers for students in other schools. Another alternative was for teachers who had few students in their classes, to be assigned distance education students from other schools who registered for the equivalent distance education course and were considered part of that class. In some of these "classes", the teacher taught both their in-school and distant students using the prepared curriculum materials from the Distance Learning Centre. In situations where in-school teachers were markers, students were encouraged to contact the teacher for advice and encouragement. Although some teachers treated this situation as similar to an independent study, others were able to integrate distance educations materials into their regular teaching. Some teachers wrote additional materials, tests and assignments to match their own teaching interests, and some teachers made videotapes of science experiments to help their distant students' understanding.

What is evident in these uses of distance education materials as part of classroom instruction was the ways in which teachers were able to move beyond the use of the distance education materials as texts. Some teachers focused on providing a supportive climate for learning while others thought it essential to provide bridges between the new materials and what had been taught before. These teachers were critical of the way some concepts were presented and sought to enhance and simplify student learning by teaching the concepts themselves. As teachers became more familiar with the structure of the materials, their concerns lessened. Because the distance learning materials included all the concepts and skills required for that course, some teachers permitted students to proceed at their own pace rather than be tied to the progress of the class (Clark & Haughey, 1990).

Implications for Teacher Education

Teacher education programs should not only provide opportunities for students to explore differing philosophies of education but should also model learner-centred, student-active education.

The variety of strategies for the provision of distance education which have been developed by practicing teachers highlights the importance for teachers of being able to recognize and articulate their own assumptions about teaching and learning, of recognizing which strategies might be best in which situations, and of being competent in the provision of the strategy itself. These teachers had well

developed repertoires of teaching strategies which complemented their understanding of the subject matter. Perhaps too much attention has been paid to the development of generic teaching skills at the expense of developing skill repertoires which are linked both to specific subject fields and to teachers' actual planning strategies.

Using Various Media

Teachers involved in distance education most often work with combinations of print; fax; telephone; videotape; audioconferencing, often with audiographics; and computers. Of these, the combination of print, fax, and telephone is the most common. Where materials have to be accessible to students whether studying at home or at school, and regardless of economic background, the addition of specific hardware technologies is limited by the level of acquisition of society in general. Now that videotape players are easily accessible, distance education materials should include more visual materials to enhance the understanding of students. In one school, the science teachers had made a number of videotapes to help students see the experiments being performed. Such tapes are easily made and can be updated as teachers obtain feedback about what students need to see. They also have the advantage of instant replay and multiple repetitions which are controlled by the student learner.

Audioconferencing among schools, which had been specifically encouraged in the *Distance Learning Project North* pilot because of its success in the *Small Schools Project*, has not been implemented in Alberta as widely as originally planned. Mainly, this has been due to the need for coordination of school timetables within and across jurisdictions, a difficult task in small schools in particular. Where teachers have used audioconferencing to support and extend distance learning materials as well as where audioconferencing is the main teaching medium, students and teachers have found the system to be successful. (Bohnet, 1992). Teachers have found students to be appreciative of the interactive nature of their instruction, and the intervention of an on-site moderator to monitor student behavior has not been necessary. The use of audiographics, especially where they are transmitted and stored ahead of time, has also been an additional bonus in enhancing students' learning. Successful audioconferencing is highly interactive, both student to student across sites as well as student to teacher. This means that each student has to be responsible for reading and working independently through much of the material which the teacher would proclaim in a classroom situation.

In general, the use of computers has been confined to accessing the CML mathematics data base for tests, exams and scoring of responses. School boards expressed some dissatisfaction with the particular generation of computer which was first introduced and which within a year or two needed upgrading to handle the increasing capacity of the database or fast retrieval for multiple stations (Haughey, 1992;Gonnet, 1991; Hough, 1992). Although most of these problems have been overcome, the budgetary implications resulted initially in somewhat less support and interest in sustaining the CML program at the senior adminis-

trative level. At the same time, those teachers who have learned to use the program and set their own parameters for their students, have found the program to be very helpful in encouraging and sustaining students' interest in the subject. The mathematics program also acquainted teachers with a range of resources from graphics programs for thecomputer, to videotapes which illustrated difficult concepts. In reviewing teachers' use of CML, Clark and Haughey (1990) found that all four learning models were present suggesting that the philosophy of the teacher towards distance education was the major factor in the implementation of this technology.

Implications for Teacher Education

Across Canada, a number of pilot projects are in operation in both elementary and secondary schools. They stress technology based education, independent study, and integrated multi-media systems such as the use of sophisticated authoring programs to involve students and teachers in designing appropriate learning events. As educators take seriously the demands to provide appropriate technological education, the numbers of these projects will increase and teachers need to be prepared to work with a variety of media to create new learning opportunities for students.

Teaching institutions need to include instruction involving a variety of media. Kerr (1989) also raised this point:

> Teacher training clearly needs to incorporate more information about and experience with educational technology, both hardware/software and process. But presenting these concepts in an isolated class reduces new teachers' abilities to see how educational technology might be connected with their own teaching field, (p. 12)

First, they need to model it themselves thereby giving students experience in this form of-learning and some practice in appropriate designs for learning, and where possible, beginning teachers also should have opportunities to experience the successful use of technology in the classroom.

Second, media should become an integral teaching medium since it can enhance student opportunities to learn at their own time, place, and pace. Third, teacher education graduates should be aware of the ethics of technology (Franklin, 1990) and consider technologies as more than mere tools for extending instruction. Just as they should give greater attention to various models of instruction, beginning teachers should also have explored the implications of instructional design and distance education as technologies themselves. While these technologies have the potential to focus on the possibilities for learner-centred education, they can also be used to provide a more covert form of teacher-controlled mass education.

Fourth, students in schools are already media-literate. Not only are students sophisticated consumers of video, and experts at telephone talk, they are increasingly at home with computer programs. Beginning teachers need to better understand how these technologies can be integrated for instruction. The use of

recent innovations such as dbases on CD-ROM and video discs is expanding the options available for teachers (Gee, 1991). Teachers have to develop strategies for working with distance education students which include more of these options. Since teachers' own discipline-specific knowledge is a major influence on the ways they might employ distance education, moreemphasis needs to be given to models of teaching other than the generic teacher-centred model. Finally, distance education may be the avenue for teacher continuing professional education. Like their distance students, non-urban teachers are often penalized by lack of access to university programs. Using a variety of distance education formats to provide access to graduate programs, would not only provide equity to teachers in terms of programming, it would also help them continue to explore teaching and learning options which they could then implement in their own schools and jurisdictions.

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