The Alberta Journal of Educational Research *Vol. XLIX, No. 2, Summer 2003, 123-137*

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Start at the Top: Successfully Integrating Information and Communication Technologies in Schools by Training Principals

This exploratory study aims to evaluate school principals' perceptions of their ability to assist teachers in the use of information and communication technologies (ICTs) and on factors that facilitate the integration of technology in the classroom. Correlational analyses show that the more principals use ICTs both for technical and instructional purposes, the easier it is for them to support teachers in the integration of technology. Also, the higher their perception is of their ability to assist teachers in the use of ICTs, the more comfortable they feel in supporting them. It would appear, therefore, that ICTs training for school principals, although still uncommon in university programs, constitutes an important prerequisite to the successful integration of ICTs in schools.

Cette étude préliminaire a comme objectif d'évaluer les perceptions qu'ont les directeurs d'école quant à leur capacité d'appuyer les enseignants dans l'emploi des technologies de l'information et de la communication (TICs) et d'identifier les facteurs qui facilitent l'intégration des technologies dans la salle de classe. Des analyses de corrélation indiquent que plus les directeurs ont recours aux TICs à des fins techniques et pédagogiques, plus il leur est facile d'appuyer les enseignants dans l'intégration des technologies. De même, plus ils ont l'impression d'être en mesure d'appuyer les enseignants dans l'intégration des technologies, plus ils se sentent à l'aise à le faire. La formation en TICs pour les directeurs d'école, bien que peu intégrée aux programmes d'études universitaires, constituerait donc un élément important au succès de l'intégration des TICs dans les écoles.

Introduction

The more generalized introduction of information and communication technologies (ICTs) in schools provokes diverse reactions among teachers ranging from enthusiasm to concern (Salomon, 2000). For example, according to United States research (Galagan, 1999, quoted in Rogers, 2000; Cuban, 2001), as few as 20% of teachers reported they felt sufficiently competent to use information technologies in the classroom. Moreover, although they may have a positive attitude toward ICTs, many teachers make little instructional use of them in the classroom. Despite their interest, one reason teachers are hesitant to use ICTs in the classroom is that given the lack of time and rigid working conditions, they

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cannot continue to assume all their current functions while assimilating the latest instructional and technological advances (Lachance, 1999; Cuban, 2001).

According to Pettenati, Guili, and Abou Khaled (2001), in order to promote the effective use of ICTs in schools, teachers not only must acquire new technological skills, but they must also learn how to use ICTs pedagogically. However, even if teachers are offered several forms of training, it has been shown that their ability to take up this challenge successfully depends greatly on the support they receive, namely, from school principals (Bandura, 1986, quoted in Nisan-Nelson, 2001). Faced with the issue of successfully integrating ICTs in schools, the educational system requires leaders who are able to critique implemented policies in this field and offer teachers administrative, pedagogical, and technical support in order to create a more enriching and open learning environment. Unfortunately, we still know little about principals' beliefs, practices, and training needs with regard to the integration of ICTs in schools (Otto & Albion, 2002).

Problem Statement

According to Depover and Strebelle (1996), in order to gain a sense of confidence—essential to the complex integration process that represents ICTs in teaching—teachers require support throughout their learning. Otherwise, when faced with a new problem relating to the use of technology and doubtful about his or her abilities, a teacher will stop using the technology in question (Bandura & Cervone, 1983, quoted in Nisan-Nelson, 2001). Sharratt (1999) states that the successful integration of information and communication technologies in schools depends largely on the leadership and technical knowledge of school principals. Teachers themselves maintain that school principals play a fundamental role in promoting the use of ICTs in schools (Atkins & Vasu, 2000). Despite these findings, support from principals seems to be lacking. This may in part be because principals themselves lack training in this area. Almost 10 years ago, Kearsley and Lynch (1994) suggested that the training of school principals was one of the most frequently neglected aspects of the educational adaptation of ICTs. More recently, in their study on professional development and learning technologies, Roberts, Richmond, Howard, Lecoupe, and Flanagan (1998) confirm that a review of relevant Canadian literature revealed no article that specifically addressed the needs of school principals with regard to professional development and technologies. The fact that principals' preparation programs seldom include training in the pedagogical use of technology adds to the lack of administrators' involvement (Gibson, 2001). Given this situation, our study aimed to evaluate school principals' perceptions of their ability to assist teachers in the use of ICTs and on factors that facilitate the integration of technology in the classroom.

Review of the Literature

This review of literature centers on the support principals are to provide to teachers in order for computer technologies to be successfully integrated into the classroom.

School Principals' Influence on the Successful Integration of ICTs in the Classroom

The successful implementation of an innovation in an educational environment relies heavily on the ability of school leaders to establish certain condi-

tions in order to support teachers (Owens, 1998). With regard to the integration of ICTs into an educational setting, a school integrates computer technologies when it promotes regular ICTs usage that would lead to a change in school practices (Depover & Strebelle, 1996). It is worth mentioning that this regular usage must be appropriate and that the changes in school practices must be beneficial to learners. Based on this definition, few teachers in fact practice pedagogically sound computer integration in their classrooms (Cuban, 2001; IsaBelle, 2002; Rogers, 2000; Smerdon et al., 2000).

According to several authors, the ICT integration process must fall within a context that is at once organizational, structural, and cultural. Hence ICT integration in the classroom implies a major change in how we envisage schools. In fact, Sandholtz, Ringstaff, and Dwyer (1997) state that the introduction of ICTs into an unprepared educational setting has little effect either on teachers' pedagogical practices or on academic results.

> Effective use of instructional technology becomes systemic change, that is, a change in the school's culture. Technology causes learners to do things differently. Technology causes teachers to change their methods and strategies. Technology causes the school community to adapt its shared goals and its values and beliefs about teaching and learning to accommodate a new culture. (Maurer & Davidson, 1998, p. 12)

Research underscores the important role that school principals play in adequately preparing the schools for ICT integration in terms of both material and human resources (Basque, 1996; Gibson, 2001; Tardif, 1996). Moreover, it appears that principals' leadership is one of the most important factors that affect the use of information technologies in classrooms (Byrom, 1998). The US study entitled *Teachers' Tool for the 21st Century* (Smerdon et al., 2000) reports:

> Principals who exhibit leadership are instrumental in modeling the use of technology in classrooms. They understand how it can support best practices in instruction and assessment and provide teachers with guidance for its use. Principals may also participate actively in professional development activities related to education technology and provide teachers with opportunities to learn how to use these resources ... For some teachers, lack of principal leadership may prove to be a barrier to their effective use of technology. (p. 6)

Once again it appears that leadership among principals constitutes a key factor in the successful integration of ICTs in the classroom. If principals are to become effective leaders and facilitators of the integration of technology into schools, they need to acquire a better understanding of how pedagogy is affected by this process and of their role in this process (Gibson, 2001; Hope, Kelley, & Guyden, 2000; Maurer & Davidson, 1998).

The Importance of School Principals' Acquiring Technical and Pedagogical Knowledge About ICTs

For school principals to promote the effective pedagogical integration of ICTs in the classroom, leadership qualities alone are not enough. A practical knowledge of how to use these technologies is also required (Bédard-Hô, 1995; Sharratt, 1999). For example, studies conducted by the Office of Technology Assessment (1988, 1995, in Gibson, 2000) confirm that "those administrators who were themselves, informed, comfortable and competent with technology

use in their own jobs also became key players in leading and supporting the use of technology in schools" (p. 373).

Although several authors underscore the necessity of creating a common vision and language both in pedagogical and technical terms (Jukes, 1996; Sharratt, 1999), it appears that principals do not attach enough importance to this aspect (Sharratt, 1999; Wells, 2001). Furthermore, technology training for principals is rarely part of professional development programs, either initial or ongoing. According to the school principals surveyed by Roberts et al. (1998), a variety of problems limit ICT integration in their schools, for example,

> the time allotted to professional development, the grants, the need to reach all teachers, easy and fair access to technological means, *the perception that faculties of education are lagging behind and are not following what is happening in the schools* [our emphasis]. (p. 21)

Principals believe that professional development programs should reflect the reality of the classroom and office, be both theoretical and practical, and encourage collaboration and teamwork at all levels (Roberts et al., 1998). On the same subject, Schoales (1998) suggests that technological training should be compulsory for all school personnel, including principals, and that training objectives should be linked to more general educational objectives and to other change initiatives. According to Hope et al. (2000), school principals are indispensable in the process of transforming schools through technology. This transformation requires school administrators: (a) to understand technology terminology; (b) to be knowledgeable about the power, features, and capacities of technology; (c) to understand the role of technology in schools; (d) to act as role models and encourage the use of technology; (e) to provide problem-solving and technical assistance; and (f) to be agents of change who help facilitate the integration of technology into teaching and learning.

Research Questions

Given the links established in the literature between the successful integration of ICTs in schools, the level of ICT knowledge and skills among school principals, and the level of support they can provide to teachers, the goal of this study was to answer the following three questions.

1. What use of ICTs do school principals make?
2. How do they perceive their ability to assist teachers in this area?
3. What is their perception of the factors that facilitate the integration of ICTs in schools and obstacles that limit this integration of ICTs?

Methodology

The instrument used for data collection was the Survey on School Principals' ICTs Integration Strategies (*Stratégies d'intégration des TIC par les directions d'écoles*) by Chiasson and IsaBelle (Chiasson, 2000). The questionnaire comprised four parts. Part 1 queried respondents on their demographics and requested general information about place of employment and a description of both their personal and professional use of computer technology in their role as principal. Part 2 identified the various forms of ICT training received. Part 3 indicated respondents' perception of their ability to assist teachers in ICT acquisition. Finally, Part 4 dealt with respondents' general perceptions about the factors that facilitate the integration of ICTs into the classroom.

The non-probabilistic sample was composed of 36 New Brunswick French-language school principals and vice-principals from 23 elementary schools. In order to increase the response rate, the surveys were hand-delivered and returned via internal mail. Of the 36 surveys distributed 28 were completed and returned, a response rate of 78%.

The data were sorted with the aid of SPSS software. Descriptive statistics allowed for a description of the respondents' profiles and of their responses to the various sections of the survey. Correlational analyses were then conducted to establish relationships, first, between the personal and professional use of certain computer programs among principals and their perceptions of factors that facilitate the use of ICTs in schools and, second, between their perception of their ability to assist teachers in the use of ICTs and their general perceptions of the factors that facilitate the integration of ICTs in schools. We wish to emphasize that although the results tend to indicate a relationship between school principals' theoretical and practical knowledge of ICTs and their perception of their ability to support teachers, given the limited size of the sample, its non-probabilistic character, and the fact that 89% of the respondents occupy both an administrative and a teaching position, generalizability is not possible.

Results

Profile of the Respondents

In total 14 women and 14 men responded to the survey. The majority of respondents (61%) were principals and 39% were vice-principals. Of those surveyed 54% held a principal's certificate[1] and had worked an average of 4.8 years in their positions. It is important to note that 89% of the respondents had dual roles: that of both principal (or vice-principal) and teacher, which could influence the leadership dynamic. On average the schools where the respondents worked had 278 students and 15 teachers.

Use of ICTs at School and at Home

Results indicate that 96% of principals and vice-principals used computers at school for administrative purposes, and 86% of them had a computer at home. Respondents indicated that on a weekly basis they used school computers for professional purposes on average for 8.5 hours (*SD*=6.89) and their home computer for 4.4 hours (*SD*=5.18). Moreover, they used computers for personal purposes for a weekly average of 2 hours at school (*SD*=2.91) and 3 hours at home (*SD*=2.74).

When asked which computer programs they used, all the principals confirmed using a word-processing program both at school and at home. An overwhelming majority of respondents reported using electronic mail (92.9%), whereas a smaller number used the Internet for research purposes (53.6%); 78.6% reported using a budget management program, and half of the respondents reported using CD-ROMs as reference material or the Internet for teaching activities. Fewer than 10% of respondents had ever participated in an on-line discussion group (see Table 1).

Ability to Assist Teachers in Operating ICTs

To identify what form of ICTs support they could provide to teachers, principals and vice-principals were asked to evaluate on a scale of 1-3 (unable, more or less able, or very able) their ability to assist teachers in using ICTs.

Table 1
Principal-Teacher Perspective on Computer Use at School and at Home

Computer use	School				Home		Not used	
	Principal		Teacher					
	n (28)	%	n (25)	%	n (28)	%	n (28)	%
Word-processing	26	92.9	18	64.3	21	75	0	0
Electronic mail	26	92.9	7	25	11	39.3	1	3.6
Internet research	15	53.6	14	50	13	46.4	2	7.1
Budget software	22	78.6	2	7.1	1	3.6	5	17.9
Software for mapping, poster-making, etc.	13	46.4	12	42.9	13	46.4	5	17.9
Spreadsheet	18	64.3	3	10.7	6	21.4	10	35.7
Offline educational applications	4	14.3	15	53.6	2	7.1	11	39.3
Group scheduling	15	53.6	2	7.1	1	3.6	12	42.9
Educational CD-ROMs as reference material	1	3.6	12	42.9	4	14.3	14	50
Teaching activities on the Internet	8	28.6	13	46.4	4	14.3	14	50
Music appreciation	2	7.1	1	3.6	7	25	19	67.9
Computer-aided drafting	4	14.5	6	21.4	4	14.3	20	71.4
Discussion group participation	0	0	0	0	2	7.1	26	92.9

Number of respondents exceeds 28 because they were allowed to check more than one answer.

With a maximum rating of 3 (very able), the results in Table 2 reveal that 77% of respondents felt very able to assist teachers in the use of word-processing programs (M=2.77, SD=0.43), and 75% felt very able to assist teachers in the use of e-mail (M=2.75, SD=0.44). In other words, school principals felt capable of assisting teachers with computer programs they most often used themselves, that is, word-processing (100%) and e-mail (92.9%, see Table 1). However, respondents reported feeling more or less able to assist teachers in the use of all programs, specifically spreadsheets (M=1.88, SD=0.1), databases (M=1.78, SD=0.67), and presentation software (M=1.3, SD=0.81). They felt more or less able to assist teachers in the pedagogical uses of ICTs related to subject matter (M=2.25, SD=0.59), in the selection of CD-ROMs (M=1.84, SD=0.69), and in the use of more sophisticated technical equipment for instructional purposes (M=1.54, SD=0.65).

Correlational Analyses

The relationship between the use of ICTs by school principals and their perception of factors facilitating the integration of ICTs in schools

Following analysis of data from Table 1, three conceptual categories were created from the items listed. The *Pedagogical* category includes items pertaining to off-line teaching practices, teaching activities on the Internet, and the use of CD-ROMs as reference material. The *Technological* category includes the use of computer applications such as word-processors, spreadsheets, Internet browsers, and e-mail. The *Techno-Pedagogical* category combines all the items

Table 2
School Principals' Perceptions as to Their Ability to Assist Teachers With Certain Applications

Applications	*N (28)*	*UA%*	*+/-A%*	*VA%*	*M*	*SD*
MS-Windows Use	25	8	52	40	2.32	0.63
word processing	26	-	23	77	2.77	0.43
electronic spreadsheet	24	25	62.5	12.5	1.88	0.61
database	23	35	52	13	1.78	0.67
presentation software	28	35.7	35.7	28.6	1.93	0.81
Internet use for educational purposes (finding web sites)	27	3.7	48	48	2.44	0.57
E-mail to communicate with other schools	28	-	25	75	2.75	0.44
Educational application of ICT to specific subjects (math, French, etc.)	28	7.1	60.7	32.1	2.25	0.59
Use of particular computer programs for certain subject areas	27	11.1	59.3	29.6	2.19	0.62
Selection of CD-ROMs	25	32	52	16	1.84	0.69
Use of computers to develop individual learning programs	25	28	52	20	1.92	0.70
Educational use of multimedia tools such as digital cameras, digitizers...	26	53.8	38.5	7.7	1.54	0.65

UA: Unable, +/-A: More or less able, VA: Very able.

from the first two categories. Table 3 shows the analysis results, which determine Pearson's correlation coefficient between each of the three conceptual categories and certain statements regarding the perception of school principals concerning ICTs. It seems that the more principals and vice-principals conduct pedagogical activities using ICTs (*Pedagogical*), the more obvious it becomes that ICTs improve their efficiency in their functions (r=0.37) and the more they are able to assist teachers in the classroom (r=0.38). Also, the more respondents used ICTs in teaching activities, the more they expressed interest in taking ICTs training sessions on educational software (r=0.42), the more they felt it was important to create a committee of experts to facilitate the pedagogical integration of technologies in school (r=0.42), the more comfortable they felt in supporting teachers in the pedagogical use of ICTs (r=0.37), and the more they thought that in the future computer technology would play a greater role in the education system (r=0.65).

The data in Table 3 also suggested that respondents who used ICTs from both a pedagogical and technical perspective (*Techno-Pedagogical*) found it easy to use new instructional methods with ICTs (r=0.41), felt more comfortable supporting teachers in the pedagogical use of ICTs (r=0.42), and believed that in the future information technology would play a greater role in the education system (r=0.51). With regard to the *Technological* category there are few significant correlations. However, for *Techno-Pedagogical* and *Technological* categories, the data indicated that the more respondents used computer software such as spreadsheets, word-processing, Internet, and e-mail, the more they

Table 3
Correlation Between the Use of Computer Programs by School Principals and Their Perceptions About Factors that Facilitate the Use of ICTs in Schools

Statements about perceptions		*PED*	*TECH*	*TECH/ PED*
I feel competent using ICT at school. (*n*=28)	*r*	0.30	0.26	0.36
ICT helps me improve my efficiency as a principal/vice-principal. (*n*=28)	*r*	0.37*	0.08	0.28
At school, teachers expect me to use ICT. (*n*=28)	*r*	0.35	0.47*	0.53*
I feel comfortable supporting teachers in the educational use of ICT. (*n*=28)	*r*	0.37*	0.29	0.42*
It's easy to use new educational methods with the aid of ICT. (*n*=28)	*r*	0.45	0.22	0.41*
ICTs are useful for teachers in the classroom. (*n*=27)	*r*	0.38*	0.04	0.25
I would like to take training sessions on ICT educational applications. (*n*=28)	*r*	0.42*	–0.11	0.17
Training sessions on the educational use of ICT should be compulsory for all teachers. (*n*=28)	*r*	0.07	0.30	0.25
Training sessions on the educational use of ICT should be compulsory for all principals. (*n*=27)	*r*	–0.11	0.03	–.05
It is important to create a committee of experts to facilitate the educational integration of technologies. (*n*=27)	*r*	0.42*	-0.11	0.17
It is important to create a learning community (administration, teachers, parents, etc.) to facilitate the educational integration of technologies. (*n*=28)	*r*	0.03	–0.10	-0.05
In the future ICT will play a greater role in the New Brunswick educational system. (*n*=28)	*r*	0.65*	0.19	0.51*

r: Pearson's product-moment correlation; *n*: number of subjects; *$p \leq .05$;
PED: the *Pedagogical* category outlines the items pertaining to teaching activities on the computer, educational activities on the Internet and educational CD-ROMs;
TECH: the *Technological* category includes the use of word processors, spreadsheets, Internet and electronic mail;
TECH/PED: the *Techno/Pedagogical* category groups items from the first two categories.

believed that teachers expected them to use ICTs at school, respectively (r=0.53) and (r=0.47).

The relationship between the perception of the ability to assist teachers and the perception of factors that facilitate the integration of ICTs in schools

Analyses based on Pearson's *r* were conducted between the perception regarding the factors that facilitate the integration of ICTs and the feeling of being able to assist teachers according to four conceptual categories: the *Programs 1* category includes respondents' perceptions about their ability to assist teachers in the use of a word processing program and presentation software; the *Programs 2* category includes respondents' perceptions about their ability to assist teachers in the use of spreadsheets and databases; the *Pedagogical Process* category brings together the themes that measure respondents' perceptions about their ability to assist teachers in the pedagogical use of ICTs, whereas the *Network Components* category contains the themes that measure respondents' percep-

tions about their ability to assist teachers in the use of e-mail to communicate with other schools and the Internet for educational purposes.

The results shown in Table 4 did not indicate a significant correlation between the perception of principals and vice-principals about their ability to assist teachers in the four conceptual categories (*Programs 1, Programs 2, Pedagogical Process,* and *Network Components*) and their perception that the use of ICTs helped improve their efficiency in their work or that training sessions on the pedagogical use of technology should be compulsory. The limited size of our sample may explain these results. It is also possible that for certain items where the *r* rating is relatively high, more significant relationships might have been observed had the sample been larger. However, the analyses showed significant correlations between certain variables. First, the more respondents reported feeling able to assist teachers in the educational use of ICTs (*Pedagogical Process*), the more they believed that information technologies would play a greater role in the educational system (r=0.40). Second, the more they reported being able to assist teachers in using e-mail and the Internet for educational purposes (Network), the more they enjoyed working with ICTs in an administrative capacity (r =0.51).

After analysis of Table 4, it was noted that the more principals and vice-principals reported being able to assist teachers in using word-processing programs and presentation software (*Programs 1,* r=0.38), in using a spreadsheet program and a database (*Programs 2,* r = 0.43), in using ICTs for educa-

Table 4
Correlation Between the Perceptions of School Principals With Regard to Their Ability to Assist Teachers and to Factors that Facilitate the Successful Integration of ICTs in Schools

Statements regarding perception		*PROG. 1*	*PROG. 2*	*EDU. P.*	*NETWORK*
ICT helps improve my efficiency as a school principal/ vice-principal.	*r*	0.34	–0.04	0.03	0.34
	n	28	24	28	28
Training sessions on the educational use of ICT should be compulsory for all school principals.	*r*	–0.13	0.03	–0.12	–0.04
	n	27	23	27	27
I enjoy working with ICT at the administrative level.	*r*	0.26	0.03	0.20	0.51*
	n	27	23	27	27
I feel comfortable supporting teachers in the educational use of ICT.	*r*	0.38*	0.43*	0.66*	0.41*
	n	28	24	28	28
In the future ICT will play a greater role in the New Brunswick educational system.	*r*	0.01	–0.05	0.40*	0.29
	n	28	24	28	28

r: Pearson's product-moment correlation;
n: number of subjects;
*$p \leq .05$;
Prog 1 = programs 1, Prog 2 = programs 2, Edu. P. = educational process, Network = network components.

tional activities (*Pedagogical Process*, r=0.66), and in using e-mail to communicate as well as the Internet for educational purposes (*Network*, r=0.41), the more comfortable they felt supporting teachers in the educational use of ICTs. These results indicate that a certain relationship seemed to exist between the comfort level school principals felt in supporting teachers in the educational use of ICTs and their perceptions about their ability to assist them in the use of all types of computer programs.

Factors that Facilitate or Limit the Integration of ICTs in Schools

To identify principals' and vice-principals' perception of factors that facilitate or limit the integration of ICTs in schools, we provided them with a list of factors and asked them to determine and rank which three elements best supported the pedagogical integration of ICTs in schools and which three impeded it the most. For each category (supports or impedes), the first factors were given a value of three points, the second two points, and the third one point. Table 5 shows which factors are perceived as supporting the most successful pedagogical integration of ICTs in schools.

According to the principals, "a proper access to computers" was by far (41 points) the most important factor in the successful pedagogical integration of ICTs in schools, which supports Dexter, Anderson, and Ronnkvist's (2002) and Bédard-Hô's (1995) findings. The next two factors, both ranking at 18 points, were "students' positive attitude towards ICTs" and "teachers' computer literacy." The third most important factor identified by school principals was "the receptivity of younger teachers" (14 points). According to Heide and Henderson (1996), students and teachers contribute significantly to the creation of multimedia classrooms, noting that "the enthusiasm and hard work of the teaching team have transformed concepts into realities of the complex and demanding classroom environment" (p. vii). It is interesting to note that "school principals' openness to ICTs" came only seventh with eight points equally with "the presence of a resource person in the school," "renewed

Table 5
Factors that Facilitate the Integration of ICTs in Schools

Factors	*Points*
A proper access to computers	41
Students' positive attitude towards ICTs	18
Teachers' computer literacy	18
Receptivity of young teachers	14
Adequate training of teachers	9
Hiring a resource person	8
Receptivity of school principals	8
Renewed pedagogy among teachers	8
Teachers' positive attitude towards ICTs	8
Receptivity of administrators at the Department of Education	7
On-site training for teachers	6
A proper access to resources in French	4
The provincial program: *L'École renouvelée*	4
Receptivity of school board administrators	2

pedagogical practices of teachers," and "teachers' positive attitude toward computers." These results indicate that although the literature emphasizes the role school leaders play in the successful pedagogical integration of ICTs, school principals themselves are not so much aware of their potential influence.

On the other hand, the main three obstacles to the successful integration of ICTs in schools (see Table 6) are identified as being "the insufficient number of computers" and "the lack of instructional support for teachers," both with 22 points, "teachers' computer illiteracy" (20 points), and "the lack of technical support" (16 points). Again, these data support Bédard-Hô's (1995) findings that barriers to efficient integration of new technologies in schools are "the lack of computers and of appropriate computer programs, the lack of time allocated to teachers for training as well as the insufficient time available to develop and prepare class activities" (p. 41). Here again, it appears that school principals do not regard themselves as pedagogical role models and leaders, but tend to look for other people to bring the required expertise.

Discussion

The results of this study tend to support the conclusions reached in other studies about the necessity of pedagogical and technological training for school principals if integration of ICTs is to take place in schools. The statistics suggest that the more respondents use ICTs in both a pedagogical and technological capacity, the easier they find using new educational methods with ICTs, the more comfortable they feel supporting teachers in the integration of ICTs, and the more positive their views are about the future of ICTs in schools. Furthermore, the data indicate that the more respondents use ICTs for pedagogical purposes, the more they feel that ICTs help improve their efficiency. Moreover, the more respondents use ICTs for educational purposes, the more they would like to receive training in their pedagogical use.

The feeling of being able to assist teachers in communicating by e-mail and the Internet is also significantly linked to various respondents' perceptions

Table 6
Obstacles that Impede the Integration of ICTs According to Principals

Obstacles	*Points*
Insufficient number of computers	22
Lack of instructional support for teachers	22
Teachers' computer illiteracy	20
Lack of technical support	16
Material too old-fashioned	13
System too slow	11
Difficulties encountered by teachers and students when using Internet	8
Lack of relevant computer programs in education	6
Non-compatibility of computer programs and curriculae	5
Lack of equipment	4
Lack of interest and motivation among teachers	3
Other reasons	7

about the factors that facilitate the use of ICTs. For example, the more respondents felt able to assist teachers in the use of e-mail and the Internet, the more they found ICTs useful in their administrative functions. Finally, it should be noted that the more able school principals felt in supporting teachers in the pedagogical use of ICTs, the more comfortable they were doing so. Although these results are hardly surprising when the two variables involved measure two aspects of the same phenomenon, they nonetheless demonstrate to what extent a sense of competence is related to the degree of comfort that one can have in playing the role of leader and role model in the successful integration of ICTs in schools. The results of this research corroborate the positions taken by Bédard-Hô (1995), Sharratt (1999), and Jukes (1996), who underscore the importance of school principals possessing sufficient technological and pedagogical abilities in the area of ICTs to provide efficient support to teachers, as well as those of Schoales (1998) and Smerdon et al. (2000), who believe that training in this area is essential for school principals. In effect, when referring to the link between a sense of competence and leadership capacity, Lapointe (2002) proposes a pyramidal model that emphasizes various levels of leadership required of school principals. At the base of this five-level pyramid is the need for principals to have a sense of control and self-efficacy. According to Lapointe, this allows for self-empowerment in school principals, an essential condition for transformational leadership as opposed to transactional management (Owens, 1998).

In order to ensure the successful training of teachers with respect to the integration of ICTs in schools, it appears essential to conduct further studies on the ICTs training needs of school principals themselves. Future research could also look at the relational qualities that principals should possess in order to facilitate the use of ICTs among teachers. For example, what kinds of actions should they undertake to encourage this integration? On this subject, Maurer and Davidson (1998) noted four behaviors that could be associated with leader-innovators in the use of ICTs in school: (a) these leaders are "transformational" and are involved in effective relationships with school team members in the sense that they inspire them to set higher goals; (b) they use a line organization system based on collaboration; (c) they believe that schools have specific needs that can be met by the school culture; and (d) they measure the effects of the change in relationship to the improvement of academic results.

Future studies could also compare the attitudes and behaviors of school principals with regard to the level and kind of support provided to teachers, for example,

- respecting the beliefs and rhythm of all teachers in their pedagogical use of ICTs in the classroom (Sandholtz et al., 1997);
- creating and updating (with school team members) a plan for the integration of ICT in school that reflects the three main aspects: teacher training, pedagogical content, and accessibility to equipment (IsaBelle, 2002; Tardif, 1998);
- practicing transformational management methods to stimulate the emergence of a community of learners (Maurer & Davidson, 1998);

- creating an ICTs committee that involves the principal and/or the vice-principal, teachers, parents, and students (IsaBelle, N'Kambou, & Dufresne, 2000);
- providing time for teachers to put into practice in an educational context the technical knowledge acquired during training (Sandholtz et al., 1997; Meltzer & Sherman, 1998, in Roberts et al., 1998; Gibson, 2001);
- providing training to teachers who are in a learning situation alongside their students (Maurer & Davidson, 1998; Roberts et al., 1998);
- recognizing teachers who use ICTs (Rogers, 2000);
- developing practices that encourage teachers to become mentors to their colleagues (IsaBelle et al., 2000; Maurer & Davidson, 1998; Sandholtz et al., 1997) and to participate in and to present workshops at conferences on ICTs (Sandholtz et al., 1997);
- evaluating regularly the effect of ICTs usage on teachers' and students' learning processes and on their cognitive and social skills, and so forth (Maurer & Davidson, 1998).

Conclusion

Our research evaluated school principals' perceptions of their ability to assist teachers in the pedagogical use of ICTs and of factors that facilitate the integration of technology in the classroom. Although this study clarifies certain aspects of this problematic, it does so within certain limits. First, besides the inherent limits due to the size of the sample and its non-probabilistic character, it must be remembered that it is composed of school principals and vice-principals of whom 89% also work as teachers. It would, therefore, be of interest in a future study to investigate school principals who do not have a teaching role.

According to other studies conducted on this subject, the type of leadership that school principals demonstrate proves to be a key element in promoting the development and harmonization of practices, knowledge, and abilities that teachers must acquire with ICTs. Their educational leadership must also test the ability of teachers to identify computerized learning activities that meet the needs of their students. Collaboration and innovation projects undertaken by various universities and colleges provide interesting pathways that lead toward the professional development of school principals in the area of ICTs and the continuing education of active schoolteachers (Alexandrowicz et al., 2002; Laferrière, 1999; Scardamalia & Bereiter, 1991).

The results of our investigation indicate that ICT training for school principals constitutes an important prerequisite to the successful integration of ICTs in schools. By building their sense of control and self-efficacy with regard to both technical and pedagogical use of ICTs, educational leaders are empowered and can then better empower others.

Note

1. The former Act, now the Education Act (1996), stipulates that school principals must hold a principal's certificate. Until recently this certificate was awarded if one passed six specific graduate courses in school administration. It should be noted that this certificate has undergone a revision and that a new principal's certificate will be approved shortly.

Acknowledgment

The study reported here is part of Monique Chiasson's master's research. She received her MA from the University of Moncton and is currently principal of a school in New Brunswick.

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