Interventions by school leaders in effective implementation of information and communications technology: perceptions of Australian principals

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ABSTRACT The ways in which we teach, the ways in which children learn, and the ways in which we manage schools are changing as a result of implementation of information and communications technology (ICT). Recent reports in the USA and Australia demonstrate that considerable progress has been made in ICT adoption in schools but that there are huge variations in implementation of ICT from classroom to classroom and from school to school. It is argued in this article that one factor which might explain some of this variation in elementary schools is the way in which principals undertake their responsibilities. The elementary principal has a major role in facilitating the implementation of ICT in schools as he or she can influence the organisational and social culture of the school through his or her interventions. Further, it is suggested that the quantity and quality of these interventions regarding ICT may have impact on implementation of ICT. Research findings from an exploratory study in a regional area of New South Wales, Australia, will be used to illustrate interventions by principals which lead to a higher degree of success in implementation of ICT in their schools.

Introduction

Computers and other forms of information and communications technology (ICT) can change the way children learn and teachers teach. Surveys of computer adoption indicate that the use of ICT is widespread in schools in the USA and is growing as teachers become more proficient with these technologies (Becker, 2001; CEO Forum, 2000; *T.H.E. Journal*, 2001; Technology Counts '99, 1999). A recent Australian study of 400 schools (Meredyth et al, 1999) drew similar conclusions.

However, these surveys also show that considerable variations exist from classroom to classroom and from school to school in the ways in which

ICT is used. While some teachers make extensive use of ICT to change classroom practices, many teachers only use ICT to extend traditional instructional practices or as a reward for pupils after their work is completed (Becker et al, 1999; Cuban, 2001). The challenge is for teachers to incorporate ICT into their pedagogy so that they integrate ICT into the learning processes (New South Wales Department of Education and Training [NSW DET], 2000; Riffel & Levin, 1997). This involves changing the ways in which many teachers work.

It is argued in this article that principals of elementary schools (ages 6 to 13 years) have a key role as architect and communicator of a vision for teaching and learning in their schools and through their interventions they can influence the role of ICT in this vision. They direct budgets and professional development, and either by action or inaction, influence teaching and learning. They have considerable impact on the organisational and social culture of the school through the type and style of the interventions they make and they can be key facilitators in assisting teachers improve teaching practices. Further, the quantity and quality of their interventions have considerable impact on the teachers' implementation of ICT.

The Role of the Principal in ICT Implementation

Examination of literature about implementation of ICT into classrooms, to find strategies for improving learning opportunities, indicates that the focus has been on the teacher and what goes on in the classroom (Jonassen et al, 1999). There is very little literature on the relationship between educational leadership and ICT in education. Recent books (Maurer & Davidson, 1998; Picciano, 1998) and articles provide guidelines for principals in helping their schools make more effective use of ICT (for example, Hoffman, 1996; Michael, 1998; Slowinski, 2000). However, apart from isolated small-scale research studies that demonstrate that ICT is having a huge impact on the ways in which principals work (Gurr, 2001; Yee, 2000), there is a paucity of empirical research on the role of the principal in ICT implementation (Michael, 1998; Yee, 2000).

On the other hand, there is substantial literature which identifies the school principal as a key factor in bringing about successful change in schools (Fullan, 1991, 1996; Hall & Hord, 2001). While investigating the implementation of educational changes over the last 20 years, researchers found that an important factor in successful change was the principal who supported and encouraged those implementing change (Fullan, 1991; Hall & Hord, 1987, 2001; Hallinger & Heck, 1996). Moreover, it was found that the behaviours that principals exhibited while working with teachers who were successfully implementing an educational change or innovation differed and certain principal behaviours led to greater implementation success. Principals often provided the interventions that increased the potential for

the success of a change or allowed it to fail. In the context of the change process, these interventions were defined as '... any action or event that influences the individuals involved or expected to be involved in the process' (Hall & Hord, 1987, p. 143).

Currently, although policy statements and a considerable allocation of funds demonstrate that implementation of ICT is a high priority in educational systems in New South Wales (NSW), whether they are government, or non-government such as the Catholic system, there are no specific ICT standards for students or staff, although each state-determined syllabus identifies knowledge about and appropriate application of ICT as desirable outcomes. In the absence of these standards for subject areas or levels of schooling, it is left to each school to determine a priority for ICT implementation. However, because of the considerable financial commitment involved in ICT implementation and the subsequent changes required in school organization and approaches to teaching, learning and administration, use of ICT is a major change in schools necessitating complex leadership decisions. Investigation of the role of the principal in the ICT implementation process is warranted.

Earlier studies by the author found that the interventions by elementary principals were significant in influencing the implementation of ICT in their schools and that an increase in interventions was associated with greater implementation success (Schiller, 1991; 2000). As school leadership had been identified as a factor contributing to variation between NSW schools in teacher use of ICT (NSW DET, 2000), this study sought to answer the question 'is school leadership associated with effective ICT implementation, and, in particular, what sorts of interventions are used by principals where ICT has been effectively implemented?'

Study Design and Methodology

The initial challenge was to determine schools where ICT implementation was regarded as effective. As resources were limited, this exploratory study focused on the perceptions of school district technology advisers, who were each in regular contact with over 50 elementary schools. Two technology advisers, working in adjacent Government School Districts in NSW, and a technology adviser for the Catholic school system in the same geographic region, dominated by a large regional city, were asked to identify elementary schools within their districts that could be regarded as examples of current 'best practice' in the use of ICT for teaching, learning and administration. Best practice was not defined but terms such as 'exemplary', 'leading the way', a 'lighthouse school', 'at the forefront' were used as explanation. Interestingly, each adviser was only able to initially identify four or five elementary schools that fitted these descriptions, from their district of over 50 schools. They suggested that a school demonstrating current best

practice in uses of ICT for teaching, learning and administration would have most or all of the following characteristics:

o use of ICT is well established in most classrooms;
o ICT is used by the majority of teachers;
o a range of uses of ICT for teaching and learning can be observed;
o ICT is used for administration of the school;
o high priority is given to ICT by the school community, particularly the principal;
o ICT is integrated into the life of the school.

The advisers explained that use of ICT varied considerably from school to school and that relatively few schools had developed ICT classroom practices consistently across the grade levels to improve student learning. They suggested that it would be more appropriate to identify schools where particular aspects of ICT were being implemented rather than select a school on the basis of best practice in use of ICT. For example, they could identify schools that had a strong focus on establishing an intranet to facilitate sharing of resources, schools where handwritten or typed school reports to parents had been replaced by computerized reports, schools where 'scope and sequence charts' had been developed to identify levels of ICT skills, and schools where ICT had been introduced for assessment and reporting of pupil learning outcomes. The technology advisers also pointed out that the emphasis taken in ICT use depended on the types of ICT infrastructure that had been set up, not only on the amount of hardware or software available. For example, some schools had been completely networked thereby enabling sharing of software via servers and provision of disk space for development of student portfolios, while others were only partially networked or had not yet begun the process.

The advisers also agreed, however, that, because of the centralized structure of the school system in Australia, each school in their district had the same access to government or system resources on a per student basis. That is, schools of similar size could access funding and resources on a similar basis. For example, all government schools had received large amounts of licensed software at no cost, had received free computers on a per capita basis and were provided with uniform access to the Internet through a state-wide gateway. Similarly, all Catholic schools had access to similar funding for networking infrastructure and computer hardware. In spite of this, the advisers agreed that there were vast discrepancies in ICT implementation between schools of similar size and context as it was up to the individual school to determine the nature and extent of ICT implementation.

The advisers agreed that schools they had identified as 'standing out from the crowd' in terms of ICT use were all led by principals who regarded ICT as an important factor in student learning and who were currently

placing a high priority on implementation of ICT in all classrooms. They also pointed out that several principals who placed ICT high on their school priorities had recently been appointed to schools where ICT implementation could be regarded as 'typical'. Therefore, they suggested that in addition to interviewing principals of the schools where ICT implementation was a strong feature, the researcher should interview principals who were strong advocates of ICT but had recently been moved into schools where very little had occurred, in terms of ICT implementation, during the term of the previous principal. The final sample of principals interviewed is shown in Table I by district and gender.

	Male	Female
Government District [X]	1	3
Government District [Y]	2	1
Catholic District [C]	4	1

Table I. Distribution of 12 elementary principals by district and gender.

Each principal was interviewed by the author as sole researcher using a semi-focused interview. The interviews, which were audio-taped and transcribed, each took between 45-80 minutes and were conducted in the principal's office. Interview questions explored the context in which ICT was being implemented in terms of the ways in which teachers were using ICT, school ICT policies, infrastructure, and current stage of ICT implementation for teaching and administrative functions. Principals were asked to identify who the major players were in the introduction and support of ICT in the school and what their own role was in the implementation of ICT. Staff development strategies were examined and future plans were explored. Principals were also asked about their own use of ICT, their concerns about using ICT, whether it had changed their role as principal and what they regarded as minimum ICT competencies for principals.

ICT Leadership Findings

The major finding from this exploratory study was that, although implementation of ICT was a stated priority in all the study schools, and although the Government or system had demonstrated ICT as a priority through funding and provision of resources, there were marked variations from school to school and from classroom to classroom in terms of implementation of ICT for teaching, learning and administration.

Each principal explained the current uses of computers for teaching and learning purposes in their schools and indicated that all teachers in their schools used ICT, although with considerable variation in terms of proficiency and types of activities. All teachers provided basic computing opportunities to all pupils, such as drill-and-practice activities and word

processing to extend traditional practices, but several principals pointed out that teachers in their schools also made extensive use of more learner-centred strategies such as *WebQuests*, *PowerPoint* presentations and problem-solving activities based on exploration of spreadsheets and databases. Some teachers were beginning to use electronic pupil portfolios to store pupils' work. There were relatively few examples of teachers using computers for administrative work other than for maintaining class lists and attendances. Several schools have moved towards computerized record keeping of pupil outcomes based on standardized measures and the use of computerized reporting to parents of pupil progress.

In responding to a question about the current stage of development of ICT for teaching and learning, all principals indicated that most teachers were still in the early stages of development of ICT, with the majority using ICT to extend traditional classroom practices. Relatively few teachers were using ICT for pupil problem solving or for authentic tasks that integrated computer use across traditional subject boundaries.

Interventions of Principals in ICT Implementation

To determine their involvement in encouraging and supporting use of ICT in their school and to identify the range of interventions used, each principal was asked 'what is your role in the implementation of ICT in your school?' Each principal indicated that their involvement was considerable and that it took a variety of forms. First, each principal provided assistance to their staff in terms of implementation of ICT. A variety of terms were used in that principals saw their role in ICT as that of facilitator, helper, guide, mentor, coach, and counsellor. Second, each principal saw staff development as a key issue in their school. They saw staff development at two levels: teacher personal competence in use of ICT, and teacher competence in integration of ICT into classroom practices to improve student outcomes. Each principal stated that they had a critical role to play in both these processes and that they intervened regularly to facilitate staff development. One principal commented:

> I guess that's the area I've worked on most in the last few years – trying to get an effective training and development model for staff ... critical in this is the principal giving the staff the leadership, the kick in the backside sometimes, the enthusiasm, the interest, the opportunity. (Male principal, December 2001)

The principals promoted and encouraged involvement through attendance at workshops, 'hands-on' workshops during staff meetings, providing release time, visiting other classrooms, and talking with other teachers to share ideas. Collaboration and sharing was seen by all principals as crucial. Their role as facilitator of peer tutoring was seen as critical as they regarded this as one of the most effective staff development strategies in their school.

Third, the principals agreed that they needed to apply both pressure and support if changes in use of ICT were to take place. Pressure for integration of ICT in the curriculum was through expectation of participation in team meetings, requiring scope and sequence charts to be developed for all year levels, encouraging visits to other classrooms, and expecting reports to parents to be completed on a computer. Fourth, the principals intervened regularly to ensure that the hardware and software was available to all teachers and in working order. Fifth, modelling by example was a key intervention mentioned by most principals. All of them had computers on their desks and used them frequently. However, they were realistic in their expectations of themselves and saw their own use of ICT as helping them understand the use of ICT by their staff. As one principal said:

> I don't believe you have to be the expert computer wizard to do that,
> but you do have to have the vision and the understanding of just what
> people are going through. (Male principal, 29 November 2001)

Six, most principals viewed their own involvement in the decision-making processes regarding ICT as important. Most principals were members of the ICT committee at their school. If not a member, they had the committee report to them on a regular basis. Through these committees or through other collegial mechanisms such as working parties or interest groups, each principal was directly involved in policy development to ensure that ICT was incorporated into class teaching programs or that scope and sequence charts were developed for the school so that each teacher could see the expectations for ICT at any particular age or skill level of the pupils. Seven, some of the principals highlighted the importance of their supervisory role to monitor what was happening in classrooms to ensure that implementation was taking place. These types of interventions included one-on-one discussions with teachers, observation visits to classrooms, scrutiny of lesson/program plans, and stating minimum expectations, for example, that all staff were required to complete pupil reports for parents on a computerized reporting form. Finally, most of the principals identified a second person with whom they worked regularly. This person, sometimes a deputy principal, sometimes a teacher, or sometimes the ICT coordinator in their school, was also heavily involved in ICT. This person was an important change facilitator in that the principal could rely on them to share experiences, work with other teachers and generally support the initiatives of the principal.

In summary, the interventions of the principals in this exploratory study included support, provision of assistance, modelling, coaching, monitoring, collaboration, and visioning, combined with an expectation that teachers would implement ICT in their classrooms. They regarded many of these interventions as crucial to increasing the degree of implementation success in their school.

Discussion

The twelve schools identified by the technology advisers as being exemplars of effective ICT implementation, or as examples of typical schools where ICT had not been a priority but had become a priority with the arrival of a new principal, were all led by principals who held a strong vision of how they wanted their staff to use ICT to improve student learning. Even though the ways in which they did this varied and the emphases they placed on various aspects of ICT differed, each of them was very proactive in terms of facilitating the use of ICT for teaching, learning and administration in their schools. As indicated in the previous section, they reported that they constantly intervened to facilitate the implementation processes.

The common feature of the 12 principals was that they were heavily involved in using ICT themselves as well as encouraging ICT use in teaching, learning and administration throughout their schools. The schools had been selected by district-level technology advisers as exemplars of effective implementation or as schools where ICT had not been a priority but the interventions of the new principal had made it a priority and significant changes had already taken place in that all teachers were using ICT in some way. The overall conclusion from this study is that the role of the principal in ICT implementation, through the interventions he or she makes, is critical.

An explanation for the interventions or behaviours of these principals in facilitating ICT implementation may lie in the concept of Change Facilitation (CF) Style, which has been developed from analysis of moment-to-moment and day-to-day interventions by principals over time. Style represents the overall pattern and tone of a leader's behaviours. Three different CF Styles have been identified, namely Initiator, Manager, and Responder (Hall et al, 1984). These CF Styles are summarized in Figure 1.

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o   *Initiators* have clear, decisive, long-range policies and goals that transcend but include implementation of the current innovation. They tend to have very strong beliefs about what good schools and teaching should be like and work intensely to attain this vision. Decisions are made in relation to their goals for the school and in terms of what they believe to be best for students, which is based on current knowledge of classroom practice. Initiators have strong expectations for students, teachers, and themselves. They convey and monitor these expectations through frequent contacts with teachers and clear explication of how the school is to operate and how teachers are to teach. When they feel it is in the best interest of their school, particularly the students, Initiators will seek changes in district programs or policies or they will reinterpret them to suit the needs of the school. Initiators will be adamant but not unkind, they solicit input from staff and then decisions are made in terms of the goals of the school, even if some are ruffled by their directness and high expectations.

o   *Managers* represent a broader range of behaviours. They demonstrate both responsive behaviours in answer to situations or people and they also initiate actions in support of the change effort. The variations in their behaviour seem to be linked to their rapport

with teachers and central office staff as well as how well they understand and buy into a particular change effort. Managers work unobtrusively to provide basic support to facilitate teachers' use of an innovation. They keep teachers informed about decisions and are sensitive to excessive demands. When they learn that the central office wants something to happen in their school, they become very involved with their teachers in making it happen. Yet, they do not typically initiate attempts to move beyond the basics of what is imposed.

○ *Responders* place heavy emphasis on allowing teachers and others the opportunity to take the lead. They believe their primary role is to maintain a smooth running school by focusing on traditional administrative tasks, by keeping teachers content, and by treating students well. They view teachers as strong professionals who are able to carry out their instructional role with little guidance. Responders emphasize the personal side of their relationships with teachers and others. Before they make decisions, they often give everyone an opportunity to have input so as to consider their feelings or to allow others to make the decision. A related characteristic is their tendency to make decisions in terms of immediate circumstances rather than longer-range instructional or school goals. This seems to arise in part from their desire to please others and in part from their more limited vision of how their school and staff should change in the future.

Figure 1. Descriptions of three Change Facilitator Styles (Hall & Hord, 2001, p. 132).

An earlier Australian year-long replication study by the author with seven elementary school principals demonstrated that these three CF Styles had validity in the Australian context and that the interventions of principals led to different degrees of implementation success in terms of introducing computer education into these study schools (Schiller, 1991). The concept of CF was useful in examining why some schools were more successful in implementing ICT than other schools. It was found that the elementary schools where principals exhibited an Initiator or Manager CF Style were more likely to be associated with implementation success of computer education in their schools (Schiller, 1991). In simplistic terms, Initiator principals 'made it happen', Manager principals 'helped it happen' and Responder principals 'let it happen' (Hall & Hord, 2001, p. 136).

The principals in this exploratory study all exhibited characteristics of an Initiator CF Style. They had developed a vision of how ICT would contribute to change in their schools. They held high expectations of their staff in using ICT and provided infrastructure and training support to ensure that teachers could make effective use of ICT. They used a range of successful ICT staff development strategies including regular ICT discussion, workshops, one-on-one practice sessions, peer tutoring, team teaching, seeking assistance from friends and colleagues who are more computer-literate, and appointment of 'technology leader(s)' in the school. Further, each of the elementary principals interviewed stated that they expected their staff to use ICT in their teaching and learning, and gave illustrations of what they did to monitor this usage. These interventions appeared to be indicative of an Initiator CF Style of leadership.

It is important to note that the staffing for most schools in Australia, and certainly in the schools in this study, was determined outside the school, either at the district or state level. These principals had no part in the hiring of their staff, nor did they have any say over the removal of a staff member. In other words, they had to work with the staff assigned to their school. Data from a recent national Australian study of computers in schools (Meredyth et al, 1999) indicate that although most teachers possess the basic skills required to use computers, those most likely to lack basic skills in using ICT are over 50, female, and teach in elementary schools. As the teaching staff of the schools in this exploratory study tended to conform to this profile, staff development was a major challenge. Initiator CF principals are most likely to be successful in bringing about change through the use of ICT.

Another element of the Change Facilitation Style framework suggested by Hall & Hord (2001) is the way in which an Initiator CF principal often works with another change facilitator, usually in their school. When each principal was asked to identify who were the major players in the introduction and support of ICT in the school, most admitted that they included themselves in this role but several identified another member of their staff who worked with them. The second change facilitators identified during the interviews with principals included the deputy principal, an enthusiastic ICT teacher, or the school librarian. This second facilitator worked collaboratively and supported the initiatives of the principal, sometimes in terms of influencing opinions of colleagues on staff through addressing the concerns of teachers and assisting them in a one-on-one basis at times when they needed specific assistance with aspects of ICT, or by demonstrating through their own use of ICT that it was workable and could benefit classroom processes. This Change Facilitation team approach is critical to successful implementation of change and is consistent with recent literature on the facilitation of change (Hall & Hord, 2001).

Although this exploratory study has indicated the importance of the elementary principal as a change facilitator in effective ICT implementation and the types of interventions suggest that each of the principals uses an Initiator CF Style in their approach to change, a number of limitations of the study are evident:

o only self-report and perceptions of the principals and the technology advisers were used;
o there was no actual measurement of change or of ICT implementation success;
o more systematic data collection is necessary to establish support for a particular CF Style;
o interventions of a greater number of principals in relation to ICT implementation in schools are required to explore other CF styles.

These limitations are being addressed in a second phase of this study, currently underway, in which case studies are being developed at each of the schools to more accurately determine the impact of the interventions by the principals over a 2-year period.

Conclusion

This exploratory study indicates that the interventions principals make regarding ICT in their schools are significant in assisting teachers to use ICT in their classrooms. Certainly, from the perspective of technology advisers and principals in this study, principals have a key role to play in facilitation of successful ICT change in schools. At a time when ICT is being integrated into the daily life of classrooms as a tool to assist learning and teachers are being asked to consider changing teaching practices to place greater emphasis on student learning through ICT, principals who demonstrate an Initiator CF Style are more likely to achieve success in facilitating these changes. More research is needed to find out how principals influence integration of ICT in schools. There are significant implications for principal professional development, as summarized by one of the interviewees:

> When we look at the role of principal, I think the future role of principal is going to involve ICT enormously more than at present. I would find it most unlikely in the future, in the next few years, that a principal could be employed in a school if they didn't have more than a good understanding of uses of technology and demonstrate that they have an understanding, not only of the use, but of the 'how to' and the 'why'. I think they are really burning issues because it is one of those areas that I hear people say: 'well, I can't hide anymore, I guess I'd better do it', which is a bit scary. It is an area that is embraced at different levels of enthusiasm but the bottom line for new people taking on the role of principal is that the expectations are now so much higher. (Male principal, December 2001)

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