## Organisational Factors Affecting Teachers' Use and Perception of Information & Communications Technology

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#### Abstract

While the learning benefits of information & communication technologies (ICTs) are widely recognised by academics and practitioners alike, the context in which teachers operate often affects the extent to which ICTs are used to achieve beneficial teaching & learning outcomes. The purpose of the study reported in this paper was to explore what organisational factors affected teachers' use and perception of ICTs, and the use of a new learning management system. Teaching staff across all learning areas at a secondary school responded to a survey. A subset of teachers and school system personnel also participated in interviews. Document analysis was used to place the results in the context of school-system planning. The study focused on three factors affecting the use and perception of ICTs: the characteristics and perceptions of leadership: the nature, relevance and usefulness of training; and, management approaches to IS/IT system implementation. Outcomes from the study are in the form of recommendations to assist the ongoing implementation of a learning management system and the integration of technology in learning The findings of this study have environments. implications for many learning environment that involve the implementation of technological systems.

*Keywords*: organisational culture, perceptions of leadership, training, management approaches to system implementation, technology acceptance, learning management systems.

## 1 Introduction

The links between organisational culture and ICT system implementation, use and perception have been the subject of investigation (Pliskin et.al. 1993). The implementation of ICT in schools and their success factors have also been investigated, including some projects looking at specific organisational cultural

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factors affecting these implementations (Butzin 2001, Manson 2000). This study combines these research areas, with the aim of investigating the link between a specific group of cultural factors and the use of a newlyimplemented learning management system in a school environment, as well as general perceptions and attitudes towards ICT use.

While ICT is heavily used in school administration, its use in teaching & learning varies significantly (Schiller 2003). However, there are many examples in the literature highlighting the benefits that can be uncovered from using ICT in the classroom. In a summary of the literature conducted for the Canadian educational authorities, Wellburn (1996) concluded that the current literature is "overwhelmingly positive" about the use of ICT as a key component in the achievement of educational goals.

Investigating this use of ICT for teaching & learning can be difficult, as ICT is not a single variable: rather, the effect depends on many other factors, such as they way technology is used, its purpose, and the context in which it is used. This study aims to explore some of those factors and their affect on teachers' use of a learning management system and ICT generally.

## 2 The Literature

## 2.1 Factors Affecting Teachers' Technology Use

There are a significant number of factors affecting teachers' use and perception of ICT and subsequent integration of technology into their teaching and learning practices. One survey found several key issues of IT investment effectiveness that determines how ICT is used in academic institutions (Manson 2000).

These indicate that the Principal is critical. Other important factors include the teachers, curriculum planning, technical support, the students, the actual use of IT, training and personal development, the school council, the budget, and the learning technologies committee. (Manson 2000:1).

These factors are similar to those that have been identified in many other studies (for example: Kulik 1994, Butzin 2001). The very nature of the teaching profession and the educational environment mean the interplay between organisational culture in schools and the adoption and implementation of new technology differs from many other industries and contexts (Hodas 1993).

## 2.2 The Role of Leadership

Leadership and management approaches specifically in the IS/IT arena in organisations are important, particularly when viewed in the context of broad organisational objectives. Sabherwal and Kir's work (1994)investigated the alignment between organisational critical success factors and IT capability. IT capability "can help to increase the amount and richness of an organization's information processing". That is, key organisational processes can be positively influenced by the capability to use information technology. Sabherwal and Kir asserted that "academic institutions... may be considered information intensive" and their IT capability not only influences the success of the institutions (in terms of learning outcomes) but is also determined by the critical success factors that are established by the culture of the organisation itself. In addition, the antecedent factors that characterise the organisational structure and culture - including "IT management sophistication" - are also examined. This concept of "IT management sophistication" is relevant for this study: the partnerships between top management and IT executives, for example, and the method for evaluating the success of IS/IT projects.

Leadership characteristics can also affect the context of IS/IT implementation in schools. Yuen, Law & Wong (2003) investigated such links between leadership characteristics and successful IS/IT initiatives in schools. They classified schools based on the model of change management that was being effectively utilised by the school and its leaders. The three groups entailed:

1. The technological adoption model – schools with topdown management, with clear targets for ICT competencies and professional development

2. The catalytic integration model – school principal is the key change agent, exhibiting visionary leadership; staff development and involvement is cultivated

3. The cultural innovation model – multiple leadership, principal not necessarily involved in ICT leadership; teachers free to implement new ideas in supportive and enhancing culture

Yuen et al.'s work is extremely useful in categorising educational institutions based on certain aspects of their organisational culture as it relates to ICT implementation. With the system and technology held constant, it will be factors such as leadership characteristics that will determine the varying levels of IS/IT implementation success, and Yuen et al.'s work identifies useful descriptors of leadership behaviour to assist in both instrument development and data analysis undertaken in this study.

# 2.3 IS/IT implementation approaches and organisational culture

The importance of organisational culture in the success of IS implementation has been recognized in many research projects (Pliskin et al. 1993). In particular, it has been suggested that organisational culture has influenced the successful implementation of several collaboration-focus technologies such as Lotus Notes, CASE tools, advanced manufacturing technologies, and intranets (Ruppel & Harrington 2001, Orlikowski 1993).

IS implementation approaches in schools is the subject of body of research focusing on critical success factors for this complex task. Bitner (2002) summarises many of these factors and presents eight areas of consideration that have been shown in various research projects to be important in allowing teachers to successfully integrate technology into the curriculum – generally regarded as an outcome of a successful IS/IT implementation. The eight areas that need to be managed are fear of change, training in basics, personal use, teaching models, learning-based usage, climate, motivation, and support.

Bennett (2003) developed ten essential elements for successful IS/IT implementation in schools. Some factors emphasised in that article are found commonly in many schools, while others are often overlooked, especially the need for "ongoing monitoring and assessment" (Bennett 2003:24) to address the success of the IS/IT planning and implementation process. As schools are such varied environments, all stakeholders need to be involved in IS/IT planning and implementation, another factor often overlooked.

## 2.4 User characteristics and nature of their roles

Schools, like most organisations, have purchased large amounts of new technology in recent years. This leads to an expectation that teachers will use these technologies in teaching & learning in an effective way:

Educators are urged to incorporate technology into instruction, but the effectiveness of educational technology is determined by teachers' readiness to use it, not by its mere presence in the classroom. (Jones 2001:35)

Teachers' attitudes towards ICT significantly affect their use of those technologies in the classroom. Apprehension, lack of confidence and competence, and even phobia often mean ICT takes a back seat to traditional learning mechanisms (Russell & Bradley 1997; Harris 1999).

However, organisational factors can also serve to enhance existing positive attributes of the individual teachers. Vannatta and Fordham (2004) found that the teacher attributes of time committed to teaching and openness to change combined with the school/schoolsystem attribute of the amount of technology training to be a reliable predictor of classroom technology use. They declared that teacher educators and administrators should not only "provide extensive training on educational technology, but should also facilitate ... [a] contribution to teaching improvement" (Vannatta and Fordham 2004:262). This highlights the importance of providing an appropriate environment in the school via the development of a holistic approach to technology use that permeates all aspects of the organisation's culture. Norris et.al. (2003) adds to this, highlighting the importance of access to technology. The body of literature agrees that many attributes of both the individuals and the organisation contribute to the use of technology in schools. Therefore, an understanding of individual characteristics may be important in the interpretation of broader organisation-wide trends.

## 2.5 Time dedicated to ICT use

In study after study, researchers identify the demands on teachers' time as a major constraint on the adoption and understanding of ICT and its uses in the classroom, and in particular the use of new systems. Researchers agree that a significant barrier to technology use is the time available for training, experimenting with new technologies, and discussing opportunities for ICT integration with colleagues (Hattler 1997; Panel on Educational Technology, 1997; Sherman 1998). Teachers often feel constrained by the lack of time to discuss and develop their skills (Durrell 1990). Significant blocks of time are required to make effective inroads to teachers' individual skills gaps, and infrequent out-of-hours workshops are insufficient (McKenzie 1999, Maddin 1997).

The organisational reality for teachers is that any time spent out of class requires significant administrative preparation – such as setting other lessons, and so on – and, unlike many corporate environments, their tasks cannot wait until the next day. This kind of environment is what makes ICT implementation in schools such a unique and complex process.

## 2.6 Technical support needs

Technical support is deemed essential in many aspects of ICT use, including the use of particular software packages and then in the use of learning management systems for ICT-enhanced lessons (Veen et al 1992). As most regular computer users know, troubleshooting skills are important if ICT is to be used as a reliable tool. One study suggested that teachers need to be educated in basic troubleshooting to improve confidence with using ICT (Maddin 1997).

In one recent Australian study, teachers often commented that reliable, on-site technology support is essential for their day-to-day use of ICT:

"I need quick, easy access to someone with technical support skills - not having to rely on a teacher who cannot possibly support all colleagues when there are hardware problems, decisions about ongoing planning or development to be made." (Schiller 2003).

The study also highlights the link between technical support and professional development, as on-site technical support can assist teachers who wish to "learn as they go" and quickly develop new ICT skills when required (Schiller 2003).

## 2.7 Organisational context of ICT in schools

Much of the research discussed above was consolidated when Tearle (2003) investigated the use of ICT in a broad, interpretive case study focusing on a single school in the UK. The project aimed to identify "features which may have been influential in achieving widespread use of ICT by staff" and any "whole-school characteristics which may have been supportive in the process of achieving whole school ICT permeation" (Tearle 2003:568). Tearle's analysis of the results leads to three distinct areas influencing ICT at the school – external influences; characteristics of the whole school, its staff and internal processes; and the ICT implementation process itself. The area most relevant to this project is the characteristics of the whole school, especially

- Strong leadership;
- Excellence across the school's operations;
- Positive ethos and collaborative culture; and
- Well-motivated and caring staff.

Further, Tearle asserts: "The focus on the technology, as opposed to the need to apply it to the situation of teaching and learning, has dominated many studies, and it may be this that has led to the common belief that [ICT in schools] is a technology-driven activity" (Tearle 2003:578), when in fact the process is about change management and how the organisation supports the use of the technology as a change enabler. This serves as an underlying premise for the study: ICT use and perception in schools is about the organisation's people, processes and policies, not the infrastructure in use.

The outcome of Tearle's study was the development of a complex model for the interaction between factors influencing the use of ICT at the school, shown in Figure 1. Actual ICT use is at the centre of the model – highlighting its importance – with whole-school characteristics and ICT implementation attributes forming two ellipses of influencing factors. Tearle observes that the issue is not the relative importance of equipment, support or training, but a "much broader debate about mindsets, assumptions, beliefs and values of individuals and organisations" (Tearle 2003:581). Tearle's model strongly influences this study's design.

## 3. Research questions: three important factors

Three main factors identified in the body of research and represented in Tearle's model presented in Figure 1 - appear central to the success of ICT in schools and the use and perception of ICT by teachers. These three factors - leadership characteristics and perceptions, training characteristics and perceptions, and management approaches to IS system implementation were derived from the overview of factors affecting teachers technology use, discussed previously. It was evident from the body of literature that these factors represent some of the most challenging and complex pieces of the wider school ICT usage puzzle. There is evidence that leadership, training, and implementation approaches are deciding factors in many schools use of ICT, and that these areas need to be working in tandem to achieve the often lofty goals set by the school and the school system. Other areas, such as time allocation to ICT use and technical support availability, are also worthy of close inspection. However the three areas to

be investigated in this study were selected due to their relevance to the entire school system as well as individual schools, and the opportunities for more generalisable recommendations that could be applied in situations in which time allocation and technical support are perceived as being less important.



Figure 4: Model of whole school characteristics

Figure 1: Tearle's model of whole-school characteristics (2003:580)

As such, the relative importance of these three factors led to the development of the following research questions:

- 1. How do characteristics and perceptions of leadership affect the use of a learning management system in an educational environment?
- 2. How does the type of training and the perceptions of the usefulness and relevance of this training affect the use of a learning management system in an educational environment?
- 3. How do management approaches to IS/IT system implementation affect teachers' use of the system?

These questions reflect the overall aim of investigating organisational factors influencing the use of a learning management system in a school environment.

#### 4. The Research Approach

Case study research is a widely-used approach to qualitative inquiry in education. A case study approach was selected to address issues in which understanding is sought in order to improve practice (Merriam, 1988). An interpretive approach offers the opportunity to collect data about particular instances of phenomenon, with the intention of interpreting how participants feel about their experiences. Case studies draw this detail from multiple sources of data to portray the viewpoint of participants.

#### **4.1 Research Process**

The research process included three stages:

- Administration of a survey to all teaching staff in the selected school.
- Conducting interviews.
- Collection and analysis of relevant documents provided by the school system and the individual school.

#### 4.2 The Survey

The survey used in this study builds upon a measure developed for use by Education Queensland that focuses on the integration of ICT in the curriculum by classroom teachers (Proctor 2003). This survey addresses how ICT is used in the classroom by students, and captures the current and preferred levels of student use, as perceived by teachers. Its strengths for use in this study include: its development and testing in an Australian environment; the relevance of the questionnaire to this study; the previous testing of the survey in Queensland and the pilot testing and careful revision of the instrument by Proctor (2003) that heightens the validity and reliability of the instrument.

Three sets of additional questions were developed for this study to address the specific areas identified in the research questions. The questions were based on aspects of common aspects of ICT training, implementation and support such as usefulness, relevance, level of consultation, understanding, confidence, and executive support. These questions were added to the base questionnaire with the intent of discovering more about the attitudes and perceptions surrounding ICT use, and questions were designed to uncover implicit organizational factors affecting the use of ICT in the school context.

The survey was piloted with teachers in a school not involved in the final study. Changes that resulted from the pilot were: the grouping of questions together in a more logical order and the modification of some question phrasing to highlight the subtle yet important differences between some similar questions.

## 4.3 Interviews

Interviews were selected as a second data collection technique because of the way an interview methodology can complement a survey to add depth to the case study approach. This study utilised a semi-structured interview structure, with guiding questions developed ahead of time. The initial analysis of the survey results influenced interview questions, in particular the questions about faculty-level ICT strategies and system use. This factor emerged as important during survey analysis and thus was included in interviews with teachers, the principal and school system staff.

#### **4.4 Document Analysis**

Document analysis was selected the third data collection mechanism for this study as it provided the opportunity to identify recurrent themes and messages in policy documents and training manuals, and compare the trends of those themes and messages to those emerging from study participants.

In particular, documents were used to provide an understanding of the context in which schools and the school system operated, focusing on IS implementation approaches and professional development strategies. Analysis of these documents assisted in understanding the reactions and feelings captured in the survey and interviews, ensuring results were placed in the context of the school's environment.

## 4.5 Participants

The particularly focused nature of this case study meant the participating institution had to be carefully identified. In a form of purposive sampling (Neuman 2003), the school was selected with the assistance of school system's central planning office. Such sampling is appropriate when the study requires cases that are particularly informative, and a particular type of case is needed for an in-depth investigation into particular factors (Neuman 2003).

First, a set of criteria was developed by which the school could be selected. These criteria included school type, size, grades taught, and exposure to recent ICT initiatives. The aim was to select an average-sized secondary school teaching all grades 7 to 12 that had had recent exposure to

the school system's learning management system, with a fair level of involvement in ICT training. The school that was identified and agreed to be involved in this study was a co-educational secondary school with approximately 900 students, and 61 staff members.

All staff were invited to participate in a survey, and the interview participants were selected on the basis of their position in the school. The school's Information and Communication Learning Technologies (ICLT) coordinator was interviewed, along with a Computing Studies teacher and the Principal.

#### 5. Results

The questions in both the survey and the interviews addressed teachers' perceptions and attitudes towards ICT training, ICT implementation approaches, and ICT support. These three areas directly inform the research questions. The results are thus organised into sub-sections based on the key factors identified the literature:

- Characteristics and perceptions of leadership
- The nature, relevance and usefulness of training
- Management approaches to IS/IT implementation

#### 5.1 Characteristics and perceptions of leadership

Teachers were asked questions about the support provided by executive staff and their perceptions of executive staff priorities. In general, survey and interview results revealed the teachers had positive perceptions of the executive staff. The survey covered a variety of leadership questions, results of which showing that teachers felt executive staff were involved in the implementation of new ICT tools and systems (84%), that generally executive staff help communicate the benefits of new ICT tools and systems (61%), and that on the whole the use of ICT at the school is seen as a priority by executive staff (73%). Fewer teachers felt that executive staff understood how ICT implementation will affect their role as a teacher (58%), despite interviews with executive staff reflecting they did harbour this concern. In fact, the principal specifically mentioned the importance of not "taking teachers out of their environment" for training due to the adverse impact on the teaching schedule, and the challenge of meeting "increasing expectations" with regard to training and system use. Another interviewee questioned the "priority of IT at the school", given the situation that few resources were available to make inhouse training available on a regular basis.

Cooperation between teachers with regard to ICT use seemed common, with more than half reporting that they regularly asked their colleagues for assistance with ICT use, and three-quarters reporting they felt comfortable asking the head of their faculty for support with ICT use in the curriculum. This was further supported by interview data, in which it was highlighted that faculty heads recognised the challenges involved in ICT use. Despite this recognition of leadership in faculties, many of the issues in the IS/IT implementation section pointed to further work needed to develop ICT strategies at this organisational unit level.

## 5.2 The nature, relevance and usefulness of training

Over 95% of survey respondents agreed that the school recognised the need for ICT training, with 71% feeling they receive appropriate or adequate amounts of general ICT training. However, only 21% felt they received appropriate amounts of training for the learning management system (LMS). Similarly small proportions of teachers felt the training they received for the learning management system was relevant to the subjects they teach or useful in meeting teaching & learning goals – that is, the goals of the system. Additionally, while teachers reported that general ICT training increased their confidence in using ICT in a classroom situation, only 29% of respondents felt that the learning management system training they received had the same effect.

Interview participants also expressed concern at the relevance of the LMS training. While training was seen to provide "time to play" and become familiar with the basics of the system, varying levels of skill in training participants and the variety of different teaching areas represented meant extracting more value from the training was difficult, as one interview participant expressed:

"There was too little presented, with not enough time. It just wasn't appropriate to my level. I'm more experienced than other teachers, but I'm in training with novices, so I end up just playing around."

Training for the learning management system was not seen to be as "hands-on" as other ICT training, a view reported in both surveys and interviews. In addition, training for the learning management system was seen as too "high-level", compared to the "step-by-step" training needed. The support booklets provided to schools by the school system highlighted this concern: the booklet provided only a single page of "step-by-step" instruction, compared to 3 pages of high-level conceptual information about the system, 4 pages of an overview of system components, and 6 pages of professional development planning.

The difference in training approaches between the school system and the individual school is also highlighted, as one school system official said:

"I believe the [ICT liaison team] is best able to provide solid support to a key person or two in the school and then these people deliver the PD [professional development] to their staff."

This contrasts with the experience in the individual school, where it was understood that while that model has some merit, "there is no time or opportunity to do it". Workshops were provided after school hours for interested staff, but numbers soon "dwindled" - not out of lack of interest, but because of the fact that staff were simply too busy. When specialised offsite workshops were offered, few staff members were interested because of the impact on their schedules. The principal highlighted his concerns with this model, feeling that staff should not be taken out of their environment for training.

## 5.3 Management approaches to IS/IT system implementation

Despite none of the survey respondents feeling that their school is a leader in the use of ICT when compared to others in their school system, there were a number of positive results for the way ICT and the learning management system were implemented at the school.

The survey results revealed that two-thirds of teachers felt they knew where they could obtain support with both integrating ICT with the curriculum and obtaining general ICT technical support. However, just over half felt they knew where they could obtain technical support for using the learning management system. Teachers indicated that the level of both technical support and curriculum support has affected their use of the learning management system. A majority of teachers (76%) felt that executive staff did not work to ensure an appropriate amount of ICT support was available. In reality, this is a responsibility shared by the school system and the school, with the delineation between different types of support needing clarification. The school principal flagged a number of upcoming measures, including the provision of on-site technical support, aimed at meeting these concerns. The 'Catholic Schools Going Forward Together: Diocese of Broken Bay Systemic Schools Annual Plan 2004' document features "learning technology support' structures [to be] established in all schools" by the end of 2004, in tandem with a full implementation of the learning management system. However, the annual plan focuses on technology for administration, rather than learning:

"Objective: Improved school system administration through the effective use and implementation of [ICT] and a Diocesan interactive web-based communication system."

This is reflected in the interview with the principal revealed he felt there was "no central policy" in the school system that handled the "teaching side" of the ICT equation.

While the school-wide leadership questions yielded positive results, 76% of teachers felt the needs of their faculty/key learning area were not closely considered when new ICT tools or systems were implemented. Similarly, 77% of teachers felt there was a lack of clear direction on the use of ICT in classes. Due to the positive results regarding executive-level support for ICT in the school, this would suggest that strategies need to be in place for faculty- or key learning area-level ICT support and implementation. This correlates with the results appearing in Quadrant 2 of Yuen's model of dimensions of ICT use.

While 63% of respondents felt their faculty had developed strategies for using ICT in their particular curriculum, only 18.5% reported faculty-level strategies for using the learning management system in classes. In fact, interviews with class teachers highlighted faculty-level ICT strategies, ICT-curriculum mapping, and targeted training as the priorities for moving forward with ICT use in the school.

#### 5.4 The impact of ICT on teaching

Interviews revealed that both teachers and executive staff had concerns regarding the demand placed on teachers to use ICTs more regularly in teaching & learning. While the value of the learning management system was accepted in principle, it was also seen as yet another demand on teachers' time. The additional training, support and preparation time needed to use the learning management system successfully - and confidently - in a classroom environment was viewed as significant. Despite the preference exhibited in the survey data towards using ICT more frequently, it was felt that some of the time and access issues must be resolved in the short-term before further progress can be made. Some questioned whether the school system had "really thought out" the implementation of the learning management system and the model for providing professional development and support to schools. Generally, the school system was seen not to understand the pressures placed on teachers on the "front line" of technology use in the system's schools.

#### 5.5 Access to technology

Technology access remains a key concern in the school. The school has three computer labs, two of which are timetabled for regular classes, and all heavily booked for class use, with the principal viewing this was a "positive reflection" on the use of ICT at the school. Interviews revealed that both teaching and executive staff felt that as technology improves, ICT use across the school will also improve, as richer experiences can be provided for students. In particular, wireless technology was highlighted as a substantial growth area for the school, allowing PCs to be used in classrooms previously lacking ICT facilities. The "freedom and flexibility" offered by such technology was seen to provide an opportunity to improve the "immersion" of ICT into the classroom, improving the uptake of the learning management system and helping teachers more easily achieve their preferred higher level of ICT use in their classes.

## **5.6 Integrated training opportunities**

Again at both the teaching and executive staff levels, concerns were raised about the nature of training opportunities. The current model for training involves "lumping together" staff from many different backgrounds and key learning areas. It was felt that this practice reduces the synergy that can result from having like-minded individuals experiencing professional development together, as it was pointed out teachers would regularly share ideas for how ICT - and the learning management system in particular - could be used in their classes. The nature and timing of training clearly had a significant impact on how ICT was being used at the school. While teachers indicated they generally felt ICT training was of a high quality, they also felt it was not targeted at their particular needs as teachers in a given key learning area.

#### 6. Discussion

#### 6.1 Leadership characteristics and perceptions

The leadership approach at the school can be seen to be moving along the spectrum of categories identified by Yuen et al. (2003). The school is currently between the technological adoption model - exhibiting top-down management and clear ICT targets for professional development, although not necessary in teaching - and the catalytic integration model, in which staff development is cultivated and the principal's visionary leadership positions him or her as a key change agent. While the principal's role in ICT usage is seen as critical in the literature (Veen et al. 1992; Vanderwilt 1993), there were signs the school was moving towards Yuen et al's third category of schools, utilising the cultural innovation model. This model entails multiple leadership in ICT, with teachers free to implement new ideas in a supportive and enhancing culture. The principal was keen to establish a number of key technology users -"technology champions" - across key learning areas that would drive relevant, applicable, tangible ICT use in those key learning areas. The way technology is managed at the key learning area level was seen to be crucial in the ongoing success of ICT at the school and the increased integration of ICT with the curriculum.

Certainly it can be seen from the results that the principal's approach to technology involves a broad vision that is communicated relatively well to teachers, but not necessarily cascaded down the management structure to faculty heads to ensure smooth end-to-end implementation. Faculties or key learning areas in the school are not seen as the focus for professional development or indeed the understanding of the relevance of ICTs to teaching & learning practice; instead, wholeschool level understanding is cultivated. This results in a good basic understanding of ICT across all teachers, but a lack of specialised, key-learning-area-specific skills that would be required to achieve the 'preferred' level of ICT usage indicated by the teacher group as a whole. This was recognised by the principal when he expressed his concerns at the focus on basic ICT skills forming the basis of ICT professional development for teachers, when in fact the use of ICT in context should be the central theme of such programs.

So the impact of the characteristics and perceptions of leadership can be seen at two levels: the whole school, and the particular faculties or key learning areas. With strong leadership at the school level, such as in this case, the general positive climate for ICT use is established, and along with it the support and infrastructure that is needed to progress forward in the use of ICT in teaching and learning. However, without similar guiding leadership at the faculty level, teachers suffer from a perceived lack of relevance and usefulness in terms of ICT technology, training, support and systems. It is important to note that this ICT leadership at the faculty level would not have to be sourced from the head of the faculty: certainly the head of the faculty would need to be supportive of ICT use, but any staff member in the faculty could serve as the ICT leader for the key learning

area, providing guidance to other teachers in the area with practical assistance such as team teaching, joint development of ICT-integrated lesson plans, and step-bystep support in using the learning management system to achieve goals appropriate to the key learning area. Both teachers and the principal indicated the need for this kind of front-line support to overcome obstacles that have been faced in the past.

## 6.2 The nature, usefulness and relevance of training

While ICT training was seen to be worthwhile and recognised as a priority at both the school level and the individual teacher level, few teachers seem to have gained true teaching and learning benefits from training and the model under which it is provided to schools. This concurs with the literature, with Rhodes & Cox (1990) finding short courses provided very little guidance on how to actually use systems in the classroom context, and Yoder (1991) discovering that only after teachers were shown possible lesson plans for using multimedia did they adopt the technology in their classrooms. Teachers did not find their learning management system training to be relevant to their role as a teacher, useful in teaching, or available in an appropriate amount. Interview participants felt that training sessions were too general, focusing on high-level concepts, when in fact step-by-step training was needed, with demonstration of core technology and systems. A number of researchers agree, finding that many training courses offered by schools just weren't relevant: teachers needed to be shown what was possible for their teaching area (Neiderhauser 1996; Zehr 1997). In addition, McNabb (1999) found that offsite training workshops were often ineffective, a feeling echoed by the principal as well as classroom teachers. This may be alleviated by the presence of subject-specific experts and hands-on rather than conceptual training in such circumstances. The material provided with training also needs to be more relevant for teachers, including the provision of more "step by step" guides.

Training needs to be more closely aligned with teaching & learning practice rather than with logistical or conceptual ideas about how the system should be used.

## 6.3 Management approaches to IS/IT system implementation

The close-knit culture observed at the school and made evident in interviews and documents bodes well for IS/IT system implementation. Ruppel and Harrington (2001) found that an ethical culture with an underlying sense of mutual trust was an important factor in the early stages of the adoption of intranet-based systems, such as the learning management system in this study. Enthusiasm for adopting the system can be seen in the preferred levels of ICT use and the feedback on the use of ICTs generally in specific grades.

Implementation of new technologies in schools necessarily involves three main activities, according to Fullan (1992):

• the use of new hardware and software materials;

- the adoption of new activities, behaviours or practices; and
- changes in beliefs and understanding.

As Yuen et al. (2003) emphasise, the first activity can be relatively easily supported in schools, while the second and third are where particular IS/IT management approaches to implementation will influence the success of ICT and ultimately the use of ICT in the classroom. In this particular school, support was provided by the school system to drive the adoption of new activities, behaviours and practices. However, that adoption was haphazard because the support was not provided in the ways teachers needed to be able to be successful in ICT curriculum integration. Teachers felt they needed to be more involved in the system implementation process, as they understand the context in which the system will be actually used. This is also reflected in the results showing teachers did not feel that their faculty or key learning area needs were considered when new systems were implemented. While the system is seen as a positive step, few teachers felt like there were overwhelming reasons to use the system as they had not been shown how it was relevant to their role as a teacher. The willingness to increase the level of ICT use must be harnessed before it is too late: with 77% of teachers indicating they did not agree they had clear direction when it comes to the ongoing use of ICT in classes, initiatives must be put in place to provide support and development at all levels to ensure uptake and understanding of the learning management system and ICTs generally.

#### **6.4 Recommendations**

The recommendations presented here aim to provide concrete platforms on which the school and the school system can work together to improve the ICT experience for teachers. The recommendations address the shortcomings as addressed in the results for each of the three research questions investigated in the study

## 6.4.1 Development of a 'technology champion' support program in key learning areas

With school-level ICT leadership proving effective, a technology champion program could drive the ICT benefits into the classroom by providing support and enthusiasm at the faculty level. Results show that teachers need the relevance and usefulness of a system demonstrated to them in the context of their key learning area, so technology champions could develop lesson plans that are then shared amongst staff to provide an indication of what is possible with ICTs. Faculty-level technology champions can also serve as a liaison officer with school-level learning technology coordinators, who can then implement school-wide initiatives with regards to the accompanying professional development, support and infrastructure required for ICT use.

Technology champions could receive additional professional development in key learning area cohorts to improve their level of skills and understanding to maximize their position within the faculty as a kind of technology evangelist. Electronic collaboration – e-mail

lists and discussion forums using the existing learning management system infrastructure – could serve as the ongoing link between technology champions in the same key learning area across the school system, providing opportunities for further innovation and the development of best practices within a focused, relevant environment.

Importantly, the head of the faculty does not need to take on this role of 'technology champion' – in fact, classroom teachers would see more relevance to their practice if another teacher with fewer administrative burdens had the technology-focused role. Within the school, the support for ICT use evident within senior executive would continue to be essential in ensuring logistical support for such technology champions – including relief time when required. The senior executive can work to build on this culture of mutual trust, whereby multiple leadership in ICT is achieved, with teachers feeling they have direction on ICT use at both the faculty and the school level.

## 6.4.2 Targeted, KLA-specific ICT training

Survey and interview data highlighted concerns with ICT training relevance and usefulness, with interviews especially highlighting the lack of development opportunities provided during training sessions.

Future training sessions for the learning management system and other ICT initiatives need to target one particular key learning area, with the session participants solely comprised of teachers from that key learning area in either secondary or primary school contexts, but not both. This 'immersion' approach builds on one of the teaching professions' strengths: teachers tend to discuss teaching approaches amongst themselves and suggest approaches to new content or curricula. By bringing together teachers from the same key learning area, training synergy can be achieved by which the participants learn more from each other than from the training itself. Such sessions would create a culture of innovation and best-practice: study participants agreed that sometimes teachers just need to be shown the possibilities of what can be achieved with ICT in teaching and learning. Such an approach to training could allow this to flourish across the school system. With regard to the learning management system in particular, this kind of training approach would allow teachers to understand the concepts and relevance of the system in the context of their own work, thus allowing them to use the system in the most effective way for their key learning area. In addition, the opportunity to meet other 'technology champions' from other schools could result in an informal or formal network of KLA-specific learning technology support providers and innovators, helping schools achieve best-practice use of ICT across the school system.

## 6.4.3 Recognising the teaching impact of systems

Building on the two previous recommendations and the results of the study describing the ICT implementation experience, strategies need to be put in place to ensure that ICT is implemented in such a way that compliments the professional development being offered, the leadership positions in ICT at the school, and most importantly, teachers' professional practice. While the learning management system itself clearly provides good options for the teaching & learning practices of teachers in the school system, the way in which the system is implemented within individual schools can be improved. The school system's approach was discussed in an interview with the central IT support officer:

"The ICTL team has provided training to [learning management system] facilitators, who are the people in the school responsible for training others at their school in the use of [the learning management system] for ... teaching and learning."

However, the results indicate that this is not an effective model. Survey results regarding the usefulness and relevance of training, coupled with comments from interviews at the school that the school system "hasn't really thought out" the way training and support were implemented, show this area needs improvement.

Therefore, the final recommendation is to change the whole model of system implementation so that the learning technology coordinator and the group of 'technology champions' within each school are provided with school-system-facilitated training. Technology champions then return to their key learning area and provide professional development, curriculum support and general "moral support" for teachers integrating ICT into their classroom practices. The learning technology coordinator can work with the school's senior executive to ensure that the other important parts of system implementation, including infrastructure and school-level technical support are in place and easily accessible. This availability of technical support is actually crucial to the success of the 'technology champion' model. The technology champions must be allowed to focus on the teaching impact of systems, with some practical assistance tailoring the use of the learning management system, for example, to the needs of teachers in their key learning area: technology champions are regular teachers, and they do not have time to provide technical support across the school on an ongoing basis.

By shifting the model for IS/IT implementation to be wholly focused on the teaching impact of systems at all stages and levels of implementation, the school system can achieve a positive, enthusiastic ICT culture that supports teachers in the use of their technology from multiple angles.

## 7. Conclusion

This study focused on understanding the factors affecting ICT use at an individual school, and as such have limited generalisability. The findings do, however, provide insights into factors that are potentially influential in the successful implementation of technologies in a broader range of learning environments. Recommendations concerning 'technology champions', 'targeted specific training' and 'recognition of the teaching impact of systems' all offer opportunities for contemplation and trialing in other educational contexts.

There is no doubt that the use of technology in education is complicated by the unique environment in which the users of systems and technology work. Through further studies that investigate the perceptions and use of this technology in the contexts of different organisations, there is the potential to expand these findings to identify successful technology implementation strategies that may be generalized to broader educational contexts.

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