Professionalism and Teachers' Response to Computers in the Classroom

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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Abstract

During the last twenty years, there have been telling changes in how teachers teach and schools are run. One major reason for this has been the growth of Information and Communication Technologies (ICT). A consequence of the growth of these technologies has been a change in the global economy, which has become increasingly interconnected and dictated by profits. Teachers have had to adapt to this new global landscape. The changes required have not been easy. This study sought to find out more about the implication of these changes in teachers professional lives. The key findings point to a change in the work that teachers do as a result of computer technology and increased attention to market related practices in schools. Teachers have also had to explore different approaches to teaching and learning . These changes have thrust teacher's professional identities into the limelight as the profession adapts to the prevailing circumstances.

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Chapter 1: Introduction

1.1 Overview of the Issues

The last quarter of the twentieth century was characterised by a colossal technological leap. This leap (maybe one could call it a paradigm shift) has placed pressure on all disciplines to evolve and integrate these new emergent technologies, and adapt to using them no matter how, as long as they kept up with the rapid changes. These new technologies have begun to transform the world economy. Castells has argued that, "Under the impulse of new technologies, and flexible forms of organisation and management we are witnessing the formation of a new economy, characterised by rising productivity growth and global competition" (Castells, 2000:152).

Increased global competition has resulted in new intricate economic complexities emerging and higher levels of efficiency being demanded (Friedman, 2000:76). The technological leap has placed new demands on the basic skills needed to cope within the new global economy (where networks play such a decisive role[1]). The consequence of these factors has placed education at the forefront because of its links to the greater society.

What are these links?

Firstly there is the need to educate those that have not closed the technological gap and secondly, there is the task of equipping future generations with the skills needed to cope in our fast evolving world.

The Educational Policy Unit (EPU) at the University of the Western Cape concluded after a study into Information and Communications Technology in the South Africa that:

> The competitiveness of any economy in the global marketplace is to a large extent determined by its effective use of information and communication technologies. Education has been seen both as a solution to preparing citizens for the information age, and as a problem in not preparing them fast enough (EPU, 2000:10).

[1]Castells (2000) believes that information technology is the electricity of the Information Age. He equates the Internet to the electrical engine as he equates the industrial factory to the network of the Industrial Age.

These links must not be viewed through narrow blinkers as Zhao, Pugh, Sheldon and Byers (2002) point out, there is another second fundamental link that must be considered; between technology and education.

1.2 Statement of the Problem

Central to the link between education and technology has been the teacher and teachers' work. Teachers have had to work out how to adopt, adapt to and integrate technology into everyday practice. As Hargreaves and Fullan (1998:10) state, "We have no choice in deciding whether technology will affect us. The only choice is figuring out how we will change ourselves and each other, to respond to it and turn it to our advantage."

Martin Ryder argues that throughout history, education has always been affected by technology, "From orality to literacy, from manuscripts to the printed page, from text to hypertext, the prevailing technologies supporting education have defined its very nature." (Ryder, 1996:1)

I believe that, historically, technological gaps have never been as wide as the one we are facing today, especially in South Africa[2]. Never before has the teaching profession been in such a position. Castells (2000:155) notes that the key issues facing countries today are, "the training of teachers and the reform of the school system into a new pedagogy adapted to the Information Age".

All these thoughts around technology seem intimidating at the best of times, particularly to those who feel left behind and perceive that a gap has opened which may be too big to close. Teachers may feel this insecurity more than most, especially those who have not received any formal computer education, as Information and Communication Technology (ICT) becomes the new buzzword in schools.

Teachers who have received formal computer training may also struggle to use the medium, as often the skills learnt are competence-geared towards utilising new and existing software. Seldom, if not at all, are they taught where to use it, how to integrate it or the processes by which learning could take place (Taylor, 2004).

Olson (1988) citing Blackman, a teacher writing on teacher's professional development in 1987 when computing technology was all brand new, succinctly summed up the

[2] Friedman (2000) believes that a country's connectivity is crucial. This raises the issue of how little bandwidth is available in South Africa.

position of teachers and computing, "The computer and its uses will be a recurring item on our continuing professional agendas, no doubt a threat to some, a stimulating challenge to some and an indispensable tool to others" (Olson, 1988:13).

Teacher insecurities have also been heightened by the impact of the new technologically enriched global economy on the profession itself. Continuing corporatisation and marketing of education has further increased pressures on teachers, potentially isolating them on a professional and individual level. Previous cultures of collaboration, pillars of professional identity and development are fragmenting and being replaced with new individualistic ones linked to performance (Hargreaves, 2000).

School administrations have also found themselves in a precarious position. Budgetary constraints hamper the success of ICT. Successful school computing depends directly upon the amount of effort and investment (both financial and human) that they are prepared to make. This coupled with the need to market education to client/parents further increases pressures on the profession.

There is also the aspect of the effect of the computer medium itself on the learners and how it impacts on the on the learning experience.
This was the starting point for my decision to embark on this learning journey.

During 2001, I completed a course at UCT called the "Communicative Aspects of Teaching" and was given the task of presenting a seminar covering current debates around the use of technology in the classroom and consequent effects on children. One of the key readings prescribed was by Segall (1996), which dissected and analysed of some of the key issues in the debate around children and television.

As I read, the memories of my childhood and school days came flooding back. Statements such as "You can't watch TV until you have finished your homework!" "What are you watching?" and "You can't watch that!" were all too familiar. I may not have had the selection available now, but nevertheless, I was seldom given free reign over the box as adults determined what I watched and I was never allowed to actively engage in the medium. This approach was the dominant one in the school I attended. Suspicious of the medium, use of it was discouraged. If one did watch television then at least watch only the prescribed or permitted programs. I was taught to distance myself from television and encouraged to choose what another thought was good or bad.

them. One lasting memory of these experiences was a classmate giving a teacher a crash course on how to use a video machine. This suspicion of technology was the one that I carried through to university. When other students spoke of doing computer courses I thought that they were mad. The courses were too difficult. If one was not good at maths and science, one would not "understand" and would thus fail. For a long time, I was very intimidated by the medium. It was years later that I mastered some basic skills and developed enough confidence to really tackle new technology.

Since completing my initial tertiary education, some 15 years have passed and the impact of computers has intensified. The result of the technological revolution has been a whole new set of requirements in all traditional disciplines which now demand technological competency. In 1989, teachers were figuring out how to use a video machine. In 2003 a mere 14 years later teachers have had to learn a whole new language, namely how to communicate with a computer and how to use it constructively in teaching and classroom practice. (Cohen, Manion and Morrison, 1996)

Many other teachers have felt the same overwhelming experience that I did as a student, prior to learning how to use computers. Some teachers still feel it.

Teachers and learners are using computers more and more in schools as this has become the norm more than the exception in some school environments, yet amongst some teachers there is a heavy mist around the use of computers in the classroom. Here the problem of understanding the impact of the technological impulse emerges raising questions like:

- How are teachers using computers and what are they using them for?
- What experiences are they having when using this new technology and has it impacted on their professional identities?
- How have school managements responded to the inevitable consequences of technological change?

1.3 Aims of the Research

1.3.1 Main Aim

To examine a group of Grade 2 to 7 teacher's responses to computers in education in some independent schools in the Western Cape of South Africa.

1.3.2 Sub Aim

To investigate how computers may be reshaping teachers' professional identities.

1.3.3 Main Questions of the Study

1) What are teachers' perceptions of and responses to this new technology?
2) What is the nature and purpose of the use of computers by teachers?
3) How is this the work teachers do with this new technology impacting on their professional identities?

Chapter 2: Review of the Literature

The changes to the work that teachers do as a result of computer technology has resulted in changes to their professional identities. Technology has however, always been intertwined with education. This chapter seeks to explore this relationship between education and technology and the consequent impact for teachers work as well as looking into how the this association may evolve in the future.

2.1 The Current Educational Landscape

Teachers cannot deny the rapid rate of change in the classrooms of South Africa over the last 10 years. Aside from the direct impact of political change that has brought both school structures and pedagogy to the fore, other external pressures have emerged. These have been mounting, particularly over the last 7 years, and have the potential to transform the classroom as teachers know it.

These forces are a direct result of a rapidly globalising world in tandem with a technological revolution. Emerging market countries like South Africa cannot afford to ignore the impact of both globalisation and the technological revolution. Castells states that an information technology infrastructure is fundamental to development as the, "Immaterial economy has become the real economy. The performance of firms in this information-driven and information - valued economy determines the fate of people and countries." (2000:154) If countries fail to adapt, they face the risk of opening up a large digital divide. South Africa has been recognised as a regional economic hub with advanced technology solutions on the African continent but this does not mean that no gaps exist[3].

Education has always been crucial in society, but with such rapid technological advances, teachers have been forced to make professional changes, such as skills upgrades, so that as a country, we do not slip into the digital divide. The real precondition for informational development is to improve and expand the quality and quantity of education (Castells, 2000).

[3] South African organisations have recognised the need to close these gaps. One group working on this is the Community IT Foundation, an NGO working in the Western Cape. Part of their mission statement is worded "Real progress in South Africa on all fronts is crucially dependent on ensuring that many more enter the economic mainstream. This means that Information technology needs to become intrinsic to the lives all including the poor and marginalized. The obvious place to launch this is clearly the schools. For a strategy targeted at community–wide penetration of IT to work, the schools need to become centres of innovation."

Littleton and Light note that with the onset of technological change, "Learning to live and work with computers must figure amongst the more obvious 'attainment targets' of any contemporary educational curriculum." (1999:1) No longer can teachers afford to ignore the changes that these developments have had on professional practice. Before one can understand this concept, there needs to be a greater exploration of the notion of professionalism and, more specifically, teacher professionalism.

2.2 What Exactly is Teacher Professionalism?

The answer to this question is a complex one that educationalists have struggled with, requiring them to look beyond the boundaries of the teaching profession itself and to explore the ideas of theorists in other professions. Hargreaves found that,

> Outside education, professions have been represented theoretically, in the image of those who belong to them and advance their interests, as having a strong technical culture with a specialized knowledge base and shared standards of practice, a service ethic where there is a commitment to client needs, a firm monopoly over service, long periods of training and high degrees of autonomy (Hargreaves, 2000:2).

There has been extensive examination of the teaching profession itself for a long time in order to come up with a working notion of what constitutes teacher professionalism, but because of the continuously changing variables to consider, theorists are continually being forced onto the back foot in trying to come up with a broadly acceptable idea. Smyth, Dow, Hattam, Reid and Shacklock (2000) drew on the constructs from the older professions when noting that professionalism is an evolving concept,

> International literature shows professionalism is a malleable term in teaching which has no fixed definition or some universal idea irrespective of time or place (and) is a socially constructed word which changes in relationship to the social conditions in which people use it (Smyth *et al*, 2000:94).

There seems to be one constant that can be agreed upon: the dynamic nature of teacher professionalism as it responds to new impulses that present themselves. These are not always positive ones and may place teachers in a vulnerable position, not knowing how to respond.

Weedon (1995) a teacher writing about change, speculated that predictions about the future are blurred but that some aspects of change cannot be ignored in the decades to come:

- The work that people do;
- The education they need in order to do it; and
- A rapidly increased rate of change.

But how does this change affect the teaching profession, as teachers know it? Becker and Riel (1999) argue that teacher professional identities will evolve when a teacher recognises the need for change and takes the responsibility for that change. Cohen *et al* (1996) recognise the need to accept change for a professional culture to develop. Often these changes call for teachers to begin thinking in ways not previously considered. Hargreaves (2000) suggests that pressures for students to learn new skills such as teamwork and effective use of information technologies have called for innovative techniques in teaching. These are new to teachers as they were not taught in this way as children nor educated in those techniques during training.

Carlgren, a Swedish Educationalist, posits that the teaching profession is continually evolving, "There also occurs permanent ongoing redefinition of teacher's tasks and competencies. In these ways teachers' work is characterised by ruptures rather than continuities. Teachers' knowledge will therefore be out of date." (Carlgren, 1996:21)

With the dynamic nature of teacher professionalism, one has to come to terms with the complexities of the notion: Responding to impulses, upgrading skills and thinking in innovative ways, unlike any before (Carlgren, 1996).

2.3 Professional Identity and the Influence of Technology

Hargreaves (2000) has identified four broad historical phases of conceptual change in teachers' professional status and professional learning, especially among the Anglophone[4] nations (South Africa's history qualifies it as an Anglophone nation). These can be broadly identified as the pre-professional age, the age of the autonomous professional, the age of the collegial professional and the last, that of the post professional or post-modern.

The teachers in the pre-professional age (late 1900's through to the end of World War 2) acquired professional knowledge through an apprenticeship to another teacher who was skilled and experienced in the craft. The process was a combination of observing teachers as a student, followed by a period of teaching practice or practicum, serving as an aide to an experienced teacher. The pre-professional age was one where the belief was that practice improved practice, however no feedback was given on this learning experience. One can thus understand that the process was limiting and should

[4] Countries colonised by the British Empire who predominately speak English.

be seen through Hoyles' 1974 (cited in Hargreaves, 2000) lens as a period of restricted professionalism (scarcely a form of professionalism at all).

Education through this first period was managerially demanding but technically simple, with boundaries firmly set and not questioned. Teachers had to do what they were told and stick rigidly to set curricula. Seldom was there feedback on professional practice and professional development was usually via trial and error in the classroom. Effectively the notion of teacher professionalism was non-existent.

Teachers were also sheltered from technological developments by the system and by policy makers alike[5]. Part of the reason for this lack of professional development was the pressures education systems faced in these years. Greene (1991a) believes that school reformers of the nineteenth century were preoccupied with creating voluntary compliance with the laws of righteousness.

The ironic aspect of this period however was that the rapid technological change that the world experienced had little impact on education. There was some experimentation with radio as a teaching medium but I believe that it had a marginal effect, as the medium could not sustain itself. Television was not widely available (in the later period) and the technology had not been developed sufficiently for it to be considered as a viable classroom-teaching tool. The dominant classroom technologies were the low impact ones such as the blackboard, textbook and overhead projector. These technologies allowed the teacher to maintain control and discipline in the classroom.

The second age of teacher professionalism was quite different however. It was shorter: 20 years between the 1960's to the 1980's. It was an era of growth in teacher professionalism, innovation and of the appeal of individual teacher initiatives, as the levers of educational change.

Hargreaves (2000) characterises this period as having an egg-crate structure in that teachers' identities were very fragile. Familiarity with the existing educational frameworks created a long, static period inhibiting teachers from imagining something different. There was also a questioning of competence, often leading to self-doubt and

[5] Education in the Anglophone nations could not accommodate even co-educational schools. School rules and policies were extremely rigid so the existing system of the colonies could be perpetuated. In a book of highlights of the 1920's in the United Kingdom there is mention of the emergence of "progressive" co-educational schools. One such school founder was Bertrand Russell who opened a school called Beacon Hill "...where children were given the freedom to develop in their own way rather than having to obey rigid rules which was the common practice at the time." (Longman, 2000).

insecurity, especially in the face of fast developing innovations. Teachers enjoyed a licensed autonomy. Teaching methods and approaches were seldom scrutinised (a characteristic of earlier times). Individualism was the dominant underpinning belief dictating the success or failure of classroom innovations. Hargreaves (2000) explains, "Subject heads might agree on purchasing the materials but how classroom teachers taught them was ultimately left to their individual "professional" judgement – with the effect that the innovations were often used in very ways that the designers intended." (2000:11)

Phillips (1997) notes that the popular educational theory during this period of the autonomous professional was that of objectivism. The main thrust of this approach to learning was the forming of the individual in the classroom. Rote learning, a key learning strategy, meant that motivation for learning was extrinsic and teacher-driven. Students mirrored the teacher as autonomous individuals, "Knowledge is seen as existing independently of any human experience. That is, there is an objective reality external to the learner, which has a structure that can be modelled for the learner." (Phillips, 1997:19)

External knowledge compartmentalised into small boxes that fitted nicely together into an empty vessel was the pedagogy that underpinned this educational approach[6]. The use of technologies in the classroom during this time mirrors this individualism. Technologies were often spoken about by school administrations but seldom used efficiently by teachers (if used at all).

From this second period one must ask:

- Why did teachers not use technologies efficiently, if at all?
- Why did they choose to use the technologies that they did?
- Was it a lack of training or staff skills development that created low efficacy levels amongst staff towards using new technologies?
- Was it as a result of the professional culture of the autonomous practitioner?

Prevailing technologies of this period offer possible answers to the questions posed.

Kent and McNergney (2000) identify two distinct mediums[7] used by teachers: firstly high technologies such as films, television and radio and secondly low technologies

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[6] Phillips (1997) notes that the methodology used to teach in the USA was called Instructional Systems Design (ISD) or Instructional Design (ID), which was based on the work of Gagne (1977). This methodology places strict emphasis on analysing the learning task, defining performance objectives and then developing a hierarchy for instruction and student assessment.

[7] Aside from the emergent computer technologies.

such as the overhead projector, chalkboards and textbooks. They conclude that often the high technologies failed while the low technologies succeeded and identify a number of reasons for this.

The failure of the high technologies, they believe, was a combination of a lack of teacher skills in tandem with an undefined role of the teacher in the classroom, resulting in technologies not being absorbed into the curriculum, "When researchers investigated obstacles to the use of moving pictures they pinpointed the teachers' lack of skills, the cost of purchase, upkeep of the equipment and the inability to find the right fit between films and class lessons." (Kent and McNergney, 2000:24).

Cuban cited by Johnson (1986) notes that teachers have always been ready to change their practice (as they have done with other educational technologies) provided they could see and understand the benefits of the medium in the classroom. Film did not do this as the film producers seldom had educational backgrounds and the administrators did not accommodate the needs and perceptions of teachers.

Another high technology was that of Instructional Television (ITV), an innovation of the early seventies, which failed in the classroom because of a lack of understanding of the teachers' perspective and a lack in the quality of programming. Television producers did the system designs and educationalists were seldom consulted. The consequence of this was that the perceptions and needs of teachers were never addressed (Kent and McNergney, 2000).

Zackman and Walker (1990) in a study looking at the televised classroom, identify system design and teacher immediacy as two of the reasons that may impact on learning and student satisfaction. They cited Rice (1984) as having identified inadequate system design as possibly leading to a rejection of the technology by teachers. System design needs to accommodate both teacher and student.

Ryder (1996) looks to the interactivity of the different mediums as reasons for their failures. The fact that film, radio and television were passive mediums meant that teachers had to stop teaching while using them. It was also difficult for students to raise questions and teachers to answer them during lessons using technology.

Technologies that succeeded were the "low technologies" that Kent and McNergney (2000) identified, just as they had done in previous times. The adoption of these low technologies went hand in hand with the pervading individual autonomy that teachers experienced at the time. These technologies allowed the teacher to maintain control

over both the management and the instructional process. Individual teachers decided how they taught using the medium:

> Such implements as the overhead projector, the chalkboard, and textbooks allow teachers to shape instruction in ways they deem appropriate, even if (as with textbooks) the content is prescribed. These technologies allow teachers to retain control over both management and instructional process (Kent and McNergney, 2000:29).

Teachers' professional practice continued to evolve, yet initially, technological developments were seen as separate to a teacher's own professional development. Use of these technologies was expected to be taught by a specialist teacher (with a computer science background). Schools and Education Authorities were slow to respond to technology. Teachers, already isolated by their existing autonomy, which dominated classroom practice, were being left behind by a modernising world.

Rapid technological advances threatened teachers' individuality but also laid the framework for a major ideological shift from modern to post-modern, the constructed to the deconstructed, one view of the truth to multiple perspectives. Ryder (1996) uses an illustration by Stone. Stone describes an encounter between former quiz kid Van Doren and computer interface creator, Laurel. The encounter took place at the Atari labs in the late 1980's where Laurel was engaged in research in interactivity. Van Doren was working for the Encyclopaedia Britannica company which had began work on a new interactive version on CD ROM. Stone describes the interaction between the two when they figured out they were working on similar projects….

> I've got this idea for an educational thing about whales told from multiple perspectives – whales from an Inuit perspective and then whales from a whaling corporation perspective, and a Greenpeace perspective. Multiple narrative threads, user selectable. It would fit right into your interactive encyclopaedia (Ryder, 1996:8).

Van Doren turned red and began to make a peculiar noise. After a few seconds Laurel realised he was sputtering. Finally he burst into speech and claimed gruffly that Encyclopaedias don't present viewpoints they present the truth.

This example is comparable to the fundamental hinges in the ever-changing identity and role of the teacher. While theories such as modernism and post-modernism do not directly impact on how or what a teacher teaches, the post-modernist conception of the truth and multiple perspectives has placed pressures on the traditional understandings of what a teacher's role is (aside from the implications for teacher education). The full

impact of this ideological shift began to be felt in the last twenty years of the twentieth century.

By the eighties, individual teacher autonomy was becoming unsustainable. Schooling was evolving and becoming more complex, forcing teachers to teach in ways that they had not done before. It was a period characterised by increasing uncertainty.

School management structures were also changing to address a growing need for consultation. Systems started to be structured in different ways to reflect this. Hierarchies were being broken down and replaced with flatter inclusive approaches. These changes were not without pitfalls as new management structures did not always create empowerment and could lead to exploitation. Teachers' roles were expanded to include consultation, collaborative planning and other joint strategies with staff, "This kind of working together can help teachers to pool resources and to make a shared sense of and develop collective responses towards intensified often capricious demands on their practice." (Hargreaves, 2000:17) But

- What caused teachers to realise that they had to work together?
- Was it the complexities of the society?

Davis, Sumara and Luce-Kaplar (2000) believe a professional identity may have emerged through a sense of collectivity, as this is one of the key understandings of post-modernism: that one's sense of personal identity is believed to emerge from one's involvement in signifying systems and practices and may be contained in these.
But schools were also rapidly changing!
So

- Was it the proliferation of what they had to teach?
- Was it the need to accept and cater for the multiple voices in the classroom?
- Was it the need to accommodate the rapid technological advances?
- Was it the need to accept and learn to understand the growing corporate styles of management adopted by school administrations?
- Was it the need to create a sense of community in schools to keep early adolescents from feeling alienated?

One of the most intimidating aspects of the times we now live in is the unpredictability of the future. This is certainly true in education, where as great as the potential is for teachers' professional identities to evolve positively, so is the risk that they may be broken down. Hargreaves (2000) has identified this era as that of the post-modern professional.

A characteristic of this period is the enormous amount of information available through the global networks of the Internet and the greater attention to budgetary constraints

which has placed, teachers in the firing line to produce more and more in the workplace.

This altered landscape has forced teachers to adopt different strategies to deal with a rapidly changing educational environment. Teachers in South Africa were placed under even more pressure as they had to come to terms with a completely new political landscape, which would and has indeed reshaped schooling.

Smyth advocates that far more complex school environments have left teachers unable to see a clear boundary of where their commitments and responsibilities should end, opening them up to exploitation. "Teaching is undergoing significant change due to the reorganisation of work practices resulting from the application of technologies of control aimed at increased productivity and efficiency in schools" (Smyth *et al*, 2000:127).

Consequently the work teachers do has fragmented and intensified. This has occurred under the guise of teacher professionalism. Teachers no longer have time to advance their skills as they are dealing with parents, meeting deadlines and coming to terms with outsourcing as a result of personnel restructuring. These factors have contributed to the erosion of collaborative practices amongst teachers. Increasing cultural diversity has also lead to uncertainty of teachers' positions in schools and a rising number of internal disputes have began to occur amongst teachers themselves.

The teacher-parent relationship has become more complex, extending way beyond the boundaries of traditional interaction, especially in independent schools. As parents become customers, so they expect to have more and more say on the educational process. This affects assessment, discipline, workload as well as aspects of teaching and learning (Hargreaves and Fullan, 1996; Smyth *et al*, 2000).

The teachers' world has changed from the collegiality of the eighties to one of uncertainty and control resulting in a new identity anxious identity for them. Hargreaves argues this may cause a change in teachers' identities and lead to deprofessionalisation.

The paradox of these relationships is that although it is good to consult parents around educational issues, it does open the door for both professional anxiety and stress, as often there is judgement and criticism levelled towards teachers, by people who have an extremely subjective interest in the educational process and limited knowledge about it. Teachers do need to forge strong ties with parents as they can prove powerful allies in the tussle against dropping funding by government, and to assert demands that may halt the process of redefining teachers' professional identities.

Schools are becoming just another business with balance sheets, fiscal prudence, extensive marketing and a need to appease a demanding clientele. Consequently, there has been a drying up of funds previously allocated towards furthering teachers' knowledge. It should be an institutional entitlement and requirement that teachers extend their professional knowledge so that change can be embraced not marginalized, "Engaging in such a knowledge base is what lifts teachers out of the pre-professional prejudice that only practice makes perfect" (Hargreaves, 2000:17).

Added to this are countries like New Zealand who have been lowering the status of the teaching profession by lowering the demands of academic qualification. There is also the status of Education Departments within universities. Wideen and Grimmet quote a study by Clifton, Mandzuk and Roberts looking at the status of Education faculties. "Faculty of Education standards are low enough that, after a while, one wonders if this is not the last hope for most people who cannot make it in other faculties" (Wideen and Grimmet, 1995:4).

2.4 The Impact of Technology and Teachers Work

Technological developments have placed unforeseen pressures on teachers as well which has implications for the work that they do. These developments must not be seen in isolation but congruently with other realities previously mentioned.

Teachers have had to adjust to working with computers in their daily lives and teaching with a new, potentially disruptive medium in the classroom. They have also had to come to terms with learners in the classroom who may have more knowledge of the medium than they have themselves.

Writing about children in the United States, Strommen (2003) claims that from the technological revolution, has emerged a generation of children who have technological savvy as they have been weaned on multi media and interactivity. This has the potential to make the work teachers do more complex further increasing already existing tensions in the profession.

The complex, dynamic nature of modern computing systems and accompanying software packages has further intensified the impact of the medium on teachers' work. Teachers are now expected to develop an understanding of and ability to utilise (and even teach) multimedia tools. This includes both the hardware and software of programs such as PowerPoint and the accompanying projectors, as well as mastering the interactivity of the Internet.

Russell, Bebell, O'Dwyer and O'Connor (2003:1) found, in a study looking at teacher technology use, that while the medium is being used successfully by teachers outside the classroom, "Instructional practices and school culture have not incorporated computer-based technologies into regular instructional practices."

Schools have struggled to equip teachers with the right skills to use computers successfully in the classroom. Consequently teachers' professional identities are further pressured. In the United States, according to Carvin (1999), citing the Milken Exchange on Education Technology report, 40% of teachers had never received any technological training. Educating teachers on how to use technology in these times is crucial if the real benefit of the technology is to be capitalised upon. The dynamic nature of the medium requires that skills be continuously upgraded. Schools must ensure that teachers are adequately equipped with the right skills as the longer it is left, the greater the gap will be to close, yet the funds for these projects are lacking.

New teaching methodologies that incorporate computers require resources, which in turn require funds and dedication from school administrations so that teachers can be trained to feel comfortable and skilled at using them. Carvin (1999) points out that 25-35% of technology budgets in American Schools are allotted to teachers' professional development, but on a national average only 3% is spent on it. This author argues that, "It seems professional development is budgeted as an afterthought when compared to the costs of equipping the schools with the technology itself." (Carvin, 1999:2)

Along with a lack of funds for professional development, teachers' identities in the classroom are also potentially threatened by the strategies used for this development. Welch, Barlex and Mueller (2001) researched professional development amongst science and technology teachers found that most technology skills development takes the form of one-shot workshops. This does not make a meaningful difference in teachers' lives in the classroom. They posit that professional development must extend beyond single-event activities, which can only suggest new classroom ideas. They contend that professional development must result in positive change in classroom practices through enquiry and self-reflection. This development must be long range and ongoing, and engage colleagues so that communities of practice may emerge. Professional development of this nature requires both time and investment, which seem in short supply when compared to the cost of computer hardware.

Becker (2001) points out that even further investment is required if meaningful teaching is to occur. He found, in a study looking into teachers' use of computers in instruction in the United States, that secondary teachers with 5-8 computers in their classrooms were twice as likely to give students frequent computer experience than those using a

shared facility where more computers were available. There is little integration into the curriculum if computer slots are spaced out:

> The scheduling of classes of students to use computers at wide intervals determined well in advance of need (i.e. weekly or every–other-week use scheduled weeks in advance) makes it impossible for computers to be integrated as research, analytic, and communicative tools in the context of the central academic work of an academic class (Becker, 2001:3).

Skills development, alongside hardware installation, is crucial to empower teachers in the classroom. This will result in more frequent and successful use of technology in instruction. Schools are at the heart of change but are heavily influenced by financial considerations and a lack of understanding of the conditions required for successful technological integration. Where the future lies for the teaching profession is unclear. However this is one of the core consequences of the post-modern condition. Teachers' identities in the classroom at this stage are clearly threatened by some of the characteristics of technological innovation.

2.5 Beyond the Post-Modern Classroom: A Glimpse into the Future

Kent and McNergney (2000) recognise the crossroads the profession finds itself in and claim that, educators must peer into the future to determine what skills and knowledge their students will need in order to work effectively in their classrooms, as they will be decidedly different in the future.

Radically new types of learning environments may emerge as technology transforms the most basic tools used by teachers. This would have many unforeseen consequences.

> Emerging technologies open many possibilities for greater individualisation and student-directed learning. As technologies bring the world into the classroom, the distinction between the classroom and the world begins to blur. The notion of a conventional classroom becomes antiquated and perhaps even obsolete (Kent and McNergney, 2000:42).

An example of one such scenario is that of the Horizon Instructional Systems School in California, which has 1600 students and no permanent classrooms. The basic concept of the school outlined in their charter is that learning is completely individualised. Parents and their children work with an educational specialist. They work as a team to determine educational goals and objectives, to create their individualised curriculum and to work out methods of teaching and learning. The level and degree of involvement of the educational specialist is determined by the parents and may vary

from an advisory and assessment capacity, to one of almost complete administration of the learning process. Students live close to the school. They can work closely with parents in a home schooling environment or primarily with their education specialist. Computer technology links the students with the school and to learning resources. Curriculum catalogues, chat areas, bulletin boards and school newsletters are available through the school's website.

Alessi (1996) sees technology as transforming the classroom in other ways too. By drawing a comparison of how developing countries have leapfrogged wire–based telephone systems for cellular technology, he comments that hand-held computers may evolve to be both reading and writing machines, thus doing away with the need to teach such competencies. That too would again change the dynamics in the classroom.

For me, as a teacher, this seems daunting.

Chapter 3: Related Studies

3.1 Introduction

The related studies referred to in this chapter deal with two broad areas computers and teacher professionalism as well as a combination of the two foci.

Computers play such a dominant role in the society in which we live, and yet there has been a lack of continuity in educational academic research into the complex role of computers in the classroom. Initial research into computers in education was more a result of a spill over from scientific research into the medium. Studies have now been done looking at the use of computers in schools, but there has been a scarcity of research into how teachers respond to, view the medium or even what they use computers for.

Teacher professionalism has been researched in the developed world, especially in the Scandinavian countries, but enquiries into this area of study in education in the developing world, particularly South Africa, is scarce. Trying to find a combination of both computers and teacher professionalism globally has been challenging and in the South African context, even more so.

The result of this has been the need to use Internet databases and education journals to find other studies that have been carried out. There have been numerous large studies done in the USA, Canada and England around computing, learning and teaching. Studies have also been carried out in South Africa but often the focus is on machine shortages or digital divides which are extremely relevant to the country as an emerging market economy.

The related studies referred to in this chapter deal with two broad areas computers and teacher professionalism.

3.2 Related Studies

The first study discussed relates to some of the realities of computer integration in schools while the 3 other studies reveal more of the complex nature of this integration. A further study referred to focuses on teacher professionalism in the era of the post-modern professional.

Computer technology is dynamic. The effects of the rapid changes cannot be ignored especially when considered in the context of education. In the 1980s, teachers were figuring out how to show videos to their students. Twenty years later, teachers have

had to learn a whole new language in Windows, Apple or Linux, and how to use it constructively in classroom practice.

This has major consequences for research. As the technology advances, so study foci evolve. This is evident in the discussion of the studies that follow.

3.2.1 Historical Perspectives: Apple Classrooms of Tomorrow

The United States has been the pioneer in developing the technology, so it should come as no surprise that a lot of the early research into computers and education was carried out there. When Bill Clinton was president between 1992 and 2000, he identified the crucial role that computers would play in society and was very involved in prompting studies to understand what was needed to integrate the medium.

Clinton's ideas were well supported by technology industries in the USA, particularly by Apple, a computer hardware manufacturer and pioneering company in the development of computer technology as we know it. This company was responsible for an early leading study looking at computers in the classroom.

The Apple Classrooms of Tomorrow (ACOT) Study was completed in 1997 by researchers Baker, Gearhart and Herman. According to a review by Centre for Applied Research in Educational Technology (CARET), the main aim of the study was to evaluate the influence of technology-rich environments and staff development on teaching and learning (Kent and McNergney, 2000:12).

This study was an extensive one that took 10 years and employed a variety of research methods, both qualitative and quantitative. These included interviews, correspondence, audio tape recordings and classroom observations after teachers and students were given Apple computers at school and at home. In-depth case studies were also completed in three of the schools. There were also 600 interviews done in conjunction with staff development sessions. The sample area was extensive with data being collected from five schools in California, Ohio, Minnesota and Tennessee. The participants in the study were elementary, middle and high school learners as well as teachers and administrators. The study was also subject-specific so that comparative analyses could be used. The subjects were mathematics and language and extended beyond the classroom to the home environment. It was a grade-specific study ranging from grade 5 to grade 12.

The major findings of the study were varied. Computers did have a positive impact on student attitudes. There was also a shift away from teacher-centred learning toward cooperative learning. Along with this came the development of new learning

experiences, which required higher order thinking. One interesting finding was the comparative study where the ACOT students did not do any better than other groups in standardised tests in mathematics, vocabulary or reading.

Conclusions of the study highlighted the complexities of computers and the demands on teachers if computer technologies were to be successfully integrated into classrooms. The study identified 5 phases[8] of teacher behaviour during the process of technology integration into the classroom. These phases highlight the range of skills required by teachers to use these technologies successfully in the classroom. Level 4 - appropriation requires an extensive understanding of modern computers, "In this phase, teachers show a personal mastery of the technology as they begin to introduce new instructional strategies in their classrooms." (Kent and McNergney, 2000:12).

The recommendations made in the study offered insights as to how the medium fits into classroom practice, but if one considers that the study was done in 1997, much has changed since then highlighting the subsequent dynamic nature and shifts in study foci.

One salient finding that remains crucial is the cost of staff training to bring teachers up to the level of appropriation (4) and the added stress that this training would bring.

The study however fell short of tackling and making sense of the issues around teachers and computers such as teacher efficacy and their responses to and attitudes towards computers. Also, there was no focus on the role of school administrations in skills development, which is crucial. Another focus area given little consideration was where computers fitted into classroom practice.

3.2.2 Understanding Professional Development: Becker and Riel (1999)

Becker undertook a later study with Riel in 1999, which included teachers across the United States. Carvin, editor of an online magazine Digital Beat has noted that the study was one of the first to, "Examine the complexities of how teachers use computers and the Internet in their instruction" (Carvin, 1999:2).

The main aim of the study was to examine teachers' individual orientation to the work of teaching, from private practice to collaborative practice, as well as the school culture that prevailed in their environments, and to understand how these prevailing

[8] Level 1 - Entry, 2 - Adoption, 3 - Adaptation, 4 - Appropriation and 5 - Invention

environments impacted upon meaningful use of technology by teachers (Becker and Riel, 1999).

The Becker and Riel study had a very large sample. There were 4000 teachers from 1100 schools involved.

The research methodologies were both quantitative and qualitative. The quantitative approach included a survey booklet of 21 pages about teacher beliefs, access to computers, actual teaching practices and the use of computers as a teaching resource and as a tool for professional development. Qualitative approaches included in-depth interviews carried out with teachers and principals as well as an individual in each school selected by principals as the "technology coordinator". Three hour-long classroom observations were also carried out.

The findings of the study provide a greater understanding of some of the reasons behind the success or failure of technologies in the classroom as they focus on the teacher and the machine.

Firstly Computer Usage: An important determinant of whether computers were being used constructively in the classroom was access to computers: Subject teachers with access to more than 5 computers in the classroom gave their students more chances to use computers in their classes. On the other hand, teachers' lack of expertise inhibited classroom use.

Secondly Teachers' Practice: Teachers were either engaged in collaborative strategies in schools or were individualistic in their methods. This scale was a horizontal one, with private practice at one extreme and collaborative practice at the other. Private practice identified teachers who defined their work as primarily located in the classroom and who placed low value on interaction with their peers. These teachers focused on the implementation of mandated policies. Collaborative teachers on the other end of the scale actively engaged with their peers at school and other educational institutions via electronic mail, attending or giving workshops. They also often mentored other teachers.

Thirdly School Cultures: these were assessed on a horizontal scale from bureaucratic to professional. The manner in which the curriculum was administered as well as educational philosophy were defining factors in the classification of a school culture. The nature of the school culture had a strong influence on teachers' practice.

If the school culture was one where teachers had a level of procedural autonomy but were restricted from involvement in curricular or administrative decisions as they were set by external administrators, then generally, teachers believed their job was to present information and to stick to set routines of activities. The researchers grouped these characteristics together categorising it as bureaucratic culture At the professional end of the scale teachers gave up a degree of procedural autonomy in order to have a greater say in the principles and philosophies of their educational enterprise. "The image is one of professionals planning their enterprise, sharing beliefs that they, as well as students, are learners, in an evolving structure adapting to individual needs and changing circumstances." (Becker and Riel, 1999:22)

The conclusions of the Becker and Riel study are important in the context of this one. Firstly, that a teacher's individual educational philosophy was crucial to the successful implementation of technology in the classroom is a relevant consideration for any technological implementation in a school. Secondly, that professional development would only occur when a practitioner culture emerges, recognises the need for change, and takes on the responsibility for that change is also worthy of consideration. Many different kinds of impulses may lead to the creation of this practitioner culture. External drives may come from academic institutions, while internal ones may be a consequence of a strong principal. They may also be a result of networked communities. This kind of professional culture is quite different from the more traditional and common practice of knowledge transmission to train teachers. Pedagogical changes have an external origin and are superficial, resulting in no clear indication that instructional reforms will follow organisational reforms.

The shortcomings of the Becker and Riel study were that emergent software applications were not given enough consideration. The changing nature of educational software cannot be excluded as a hurdle for co-operative practices in the classroom.

The researchers also did not focus upon existent school conditions such as a knowledgeable support staff and computers that functioned efficiently. Even the most collaborative practices amongst teachers take inordinate amounts of time to resolve technological problems that an expert may sort out quickly.

3.2.3 Conditions For Classroom Innovation: Zhao, Pugh, Sheldon and Byers (2002)

This study one was smaller than the previous two, focussing on the teacher. It was undertaken to gain a better understanding of some of the intricacies of technological integration in the classroom. The findings of the Zhao *et al* (2002) study are important

in the context of the research undertaken in this paper even though the methodology and aims were quite different to mine.

The main aim of the research was to gain a better understanding of the intricate process of integrating technology in classrooms; which conditions were required for innovation and what may facilitate or hinder teachers' use of technology in their classrooms.

The methodology was qualitative in design. Recipients of a state technological innovation grant carried out the research over a period of a year. Resources were provided directly to class teachers who were able to integrate technology to increase student achievement, as well as to innovative educators who had previously not used technology in their classrooms.

Individual teachers were allocated grants of up to $10 000 to support their use of technology in the classroom. To receive the grant, teachers had to apply and were subject to set of criteria. These included collaboration across school and district boundaries, the ability to make a difference to student learning and to follow curriculum requirements while replicating other learning environments.

The sample was made up of the 120 K1-12 teachers who had received technology grants.

Data analysis was based not on a hypothesis but on a constant comparison approach. Teachers were asked to provide detailed reports that were given one of three ratings: Successful, Mixed Success or Failed. Through constant examination by researchers, several themes emerged which formed the basis of the results.

The main findings of the study were firstly that a teacher's technological proficiency played a major role in determining how they used computers. This, however, extended further, to the school's understanding of the enabling conditions for the technology, "An additional dimension of technology proficiency plays an equally important part: knowing the enabling conditions for a technology, that is, knowing what else is necessary to use a specific technology in teaching." (Zhao *et al*, 2002:493) What was found that a school's infrastructure determines the enabling conditions. The infrastructural makeup should include flexible and responsive technical staff and an aware group of communicators who can assist the teacher to understand and use the technologies.

This infrastructure extends beyond personnel and "would also include institutionalised policies and procedures related to technology issues, such as hardware and software

purchases, professional development, and student access to computers and the Internet" (Zhao *et al*, 2002:503).

The second finding was that technological innovation in the classroom is related to pedagogy: integration will occur with teachers who reflect on their practice and goals, and who use the technology in a manner consistent with teaching beliefs.

Another determinant of successful integration was the existent school culture, which determined whether teachers' ideas were a success or a failure. This extended beyond school management to the collaborative nature of the relationships amongst educators in the schools in which the study took place.

The shortcomings of the study were that in reality teachers would not normally receive such a budget. Allocating teachers a technology budget affords them the opportunity to embark on classroom activities with ease but what about the financial constraints that teachers feel without it. Added finances also affords teachers easier access to systems management, which is an often missing but essential component to successful computer teaching.

3.2.4 Beyond the Classroom: National Grid for Learning (2001)

The NGFL study of 2001 was funded by the Department of Education and Skills in the United Kingdom. It was a three-year longitudinal study. The size and scale of the study are most impressive as it was undertaken by a combination of teachers, professional researchers and pupil researchers who employed a variety of research methods. There were three strands to the project; the analysis of test data in relation to ICT; an investigation into how students use ICT's outside of the schooling context; and a collection of case studies using video diaries and electronic journals created by teachers and pupils reflecting their ICT use.

The sample included sixty schools: 30 primary, 25 secondary and 5 special needs and was not grade specific. Within the sample, another was drawn of twenty-five children who had to produce a monthly ICT report.

The methodology was both qualitative and quantitative. Along with classroom observations, interviews were done by professional researchers. An Internet survey was also used to identify what students used the Internet for. Detailed case studies were done in six schools and there was also the analysis of national test scores in relation to ICT. These statistics were used to predict results, which were then compared to actual student achievement.

The study found that home computers were a crucial component of successful technology teaching and learning. The confidence gained by both teachers and students were linked to owning a computer in the home environment. This affected a teacher's capabilities and efficiency with the medium. Teachers also needed adequate time to learn new software technologies. The learning process thus changed their positions from lecturer to mediator affording them a chance to understand problems learners may encounter.

However, the researchers also found that many teachers were not confident to use computers. Consequentially they seldom got students to engage in related higher order thinking skills, as they did not possess the adequate ICT skills for these activities. Teachers only taught simple skills, which the students already possessed, so their skill levels were seldom, if ever, advanced.

The conclusions were that the overall success of instituted ICTs depended upon the desire of school management, as its funding and guidance are crucial to successful integration of the medium. This integration is also dependent on the enthusiasm of individual teachers and head teachers towards the medium.

3.2.5 Threats to Teachers' Professionalism: A Small Independent School Study in Australia

So far all the studies that have been discussed have been undertaken to gain deeper understanding of the impulses of technological change and the necessary conditions for successful integration of computers into the classroom. The research has suggested that teachers' professional development is crucial to successful technological integration in the classroom. Whether teachers expand their professional horizons is dependent upon the nature of the individual schools in which they work.

A study in teacher professionalism was done in a small independent school in Australia. The school shares many characteristics with independent schools in South Africa which formed the sample in my study. The findings are relevant in the context of the current study as they offer a window into a teacher's world in an independent school.

The main aim of the study was to investigate the changing nature of teacher professionalism and how this affected teachers' lives. The sample was made up of 8 teachers in one school.

The methodology was qualitative rather than quantitative as it focussed on teachers' lives. It was undertaken by an ex-teacher at the school who had returned as a

researcher and worked closely with the eight teachers to draw up authentic teacher accounts. The researcher had the advantage of being an insider, having worked there. This meant a working knowledge of the history of teaching and learning at the school, as well as the organisation of curriculum and administrative structures existed. This insider status allowed the researcher access to the lives of the teachers at the school.

The main findings of the study were firstly, an intensification of teaching tasks. Teachers identified that as student numbers decreased, economic pressures increased. The consequence of this was that teachers were being expected to teach more and have less time for work collection, marking or furthering their skills.

Secondly, teachers experienced fragmentation of their work as a result of the intensification. This fragmentation led to a reorganisation of work practices at the school. The desire of the school management, which was structured on technologies of control, was increased productivity and efficiency. This is often done under the guise of teacher professionalism.

> The call for teachers to take on more teaching, more duties, additional responsibilities, and extend their involvement in co-curricular activities for the good of students and the school, through an appeal to their sense of professionalism, led to chronic work overload (Smyth *et al*, 2000:142).

This study raises important issues that teachers face daily at schools. Increased work demands for the good of the students and the school impacts heavily on teacher professionalism and professional development.

The shortcomings of this study are in the context of technology. Teachers' stories captured the realities of an independent school feeling the financial constraints of dwindling student numbers and the immediate consequences for classroom practice. The study did not seek teacher stories as a solution for the existent circumstances. One solution could have been a technological one, where machines may have relieved the work of teachers and aided in the learning process. Only one teacher makes comment of this in the accounts when he claims, "I think technology has scared teachers, but they are now starting to realize that it can help them. (Smyth *et al*, 2000:129)

3.2.6 A South African Study: Complexities of the Digital Divide

In 2000 the Educational Policy Unit at the University of the Western Cape completed one of the leading studies done in South Africa. The study focused on schools that were technologically well equipped as well as those that were not. The findings of the study highlighted the threat that a digital divide poses. Some of the main foci of the

study are not related to the current one so only the relevant key findings have been discussed.

The sample of 4791 schools was not grade specific but included 231, which possessed one computer or more, and 2480 without any computers in South Africa. It was not grade or subject specific.

The methodology was mainly quantitative using two postal surveys, one for resourced schools and another for under-resourced ones. A further survey was conducted amongst key members of the private sector. Interviewing formed part of the qualitative approach to gathering of survey data.

The main findings of the study that relate to this thesis, are firstly that effective use of computers in schools is directly related to teachers' attitudes towards computers. If they are positive towards the medium they embrace and use it. If teachers are negative towards technology, the incidence of usage is low. Secondly, teachers' attitudes towards the medium are shaped by the kind of training that they have received. Thirdly, schools are not using computers as comprehensively as they should because of a low level of computer literacy amongst teachers and an absence of a comprehensive curriculum for teaching computer skills. Financial considerations are also vital as a lack of funds is a major hindrance towards successful integration.

3.3 Summary of the Literature

The literature and research findings expose the dynamic nature of technological revolution that the world is experiencing which, coupled with the post-modern classroom, have created an awkward space for teachers to be in.

Teachers' work in and out of the classroom has changed, potentially undermining their professional identities. Hargreaves (2000) has argued that new, more inclusive ways of learning have been embraced. These include consultation with parents, focus on group work and technological integration. Integrating technology is complex and requires a re-examination of school cultures and teachers' instructional practices. Education has also been marketed and schools have come to resemble small businesses with attention to profit and loss.

How schools adjust to these changes is dependent on school cultures. The Becker and Riel (1999) study findings offer a construct to understand school environments but also expose barriers that may limit successful professional development needed to tackle to classrooms in the 21st century. How schools change will affect teacher identities.

The Apple Classrooms of Tomorrow study concluded with a step-by-step approach to equip teachers with the skill levels to integrate technological change. What emerged from the study were the potential limitations of teachers' professional development as a result of the high costs. If schools were not prepared to make the financial outlays then teachers would not gain the skills necessary to be confident enough to use computers successfully in the classroom.

The National Grid for Learning study in the United Kingdom found that learners possess a range of skills, which influences classroom practices. How a learner uses computers in the classroom is influenced by whether they have a computer at home and if they have parental assistance. Researchers, Zhao, *et al* (2000), found that an efficient human infrastructure and ongoing teacher development, along with an allocated budget, are crucial for successful use of computers in the classroom.

Teachers are thus at the heart of technological integration in schools. Teachers in independent schools are at greater risk in the current educational environment because the financial pressures of a business (as most independent schools are) will always squeeze its staff in a way that a public school is unlikely to try. Research carried out in an independent school in Australia concluded that financial pressure; because of falling student numbers has an influence on a teacher's work. Independent schools are exposed to market forces with the consequence for teachers of increased workloads and blurred work definitions. Once again teachers' professional identities are threatened.

The South African educational landscape is a complex one and poses greater challenge to teachers and administrators than in the more developed countries. The study completed by the University of the Western Cape highlights the complexities of technological integration in South African schools and the identifies the consequences and challenges of a digital divide. Crucial aspects of technology integration included trained teachers and a coherently structured technological curriculum for schools.

In each of the studies discussed, focus areas do coincide to varying degrees with the study that I have undertaken but the size and scale vary greatly. Comprehending the current debates and literature around the medium as well as analysing the results offers inspiration to the novice researcher such as myself, but also emphasizes the complexities behind a study into technology.

There are gaps in the understanding of the use of technology in independent schools in South Africa. Independent schools are financially driven and thus teachers are

exposed to balance sheets, profit and loss, with an impact on their identities. This aspect of teachers' lives in this country is under researched.

These are my challenges as a teacher-researcher.

Chapter 4: Research Design

Punch defines research design as "All the issues in planning and executing a research project" (Punch, 1998:21). This includes situating a researcher in the real world and connecting the research questions to the data. Research design for a study into computers is a challenging task at the best of times as there are many variables to consider. These range from teacher sensitivity in answering controversial questions, to the rapidly changing pace of the technology. These variables set a question to the researcher from the start, that is; how does one structure a research strategy that is inclusive of all these aspects?

4.1 Methodology

To answer this question, the researcher must establish what kind of data will be gathered. This classification is simple. Data can be either empirical (or quantitative), in the form of numbers, or qualitative, which is not, or a combination of the two. Deciding which research path to follow is not as easy as it first appears and requires a careful analysis of the problem. According to Punch (1998), how one researches depends on what one is trying to find out.

This was a key aspect in my research strategy. From the start, I needed to identify what I wanted to research about computers and why. Previous studies I consulted varied from ones with samples of over two thousand respondents while others were extremely in–depth qualitative studies, intimately probing teacher experiences in the classroom.

After unpacking my aim, to understand teacher responses to changes in technology and working through the key aspects of the importance thereof, it was obvious that my research area was more humanistic in nature as it dealt with teacher responses rather than technological issues. Brainstorming questions led me to decide that the majority of my data would not be empirical and something that I needed to correlate and comment on, but rather questions that would focus on teacher's opinions on how technological development had impacted on the teaching experience. Consequently this had a definite influence on my methodological approach.

Another important aspect that I had to consider in formulating my methodology was my role as researcher. Where would I stand in my study? Would it be as an external observer or would it be looking through a lens from the inside out? Answering this question would provide the start of my research infrastructure.

Examining my role of researcher would define whether I should pursue an objective style of research or a subjective one, or maybe an integration of both styles. Both styles

of research bring different social realities. What really underpins these approaches though is the nature of knowledge being sought. "Is the knowledge hard and tangible and only capable of being transmitted in a tangible form or is this knowledge softer and more spiritual in nature, based on experience and personal insight?" (Punch, 1998:20).

Deciding on the nature of knowledge gives the researcher a better idea of whether to follow a quantitative methodology or a qualitative one.

4.1.1 Qualitative Approaches

Burgess (1985) defines some characteristics of qualitative research; firstly a researcher works in a natural setting and studies can be designed and redesigned and thus are very flexible. Qualitative research is less committed to perspectives but rather more concerned with social processes and meaning. Collection of data and its analysis occurs at the same time. Qualitative research's principle concern is with an understanding of the way in which an individual creates, modifies and interprets the world. "Indeed data are not usually collected to support or refute hypotheses but categories and concepts are developed during the course of data collection. The theory is therefore not super imposed upon data but emerges from the data that are collected" (Burgess, 1985:9).

Punch (1998) argues that qualitative research's principle concern is theory generation rather than theory verification. Methodologies used depend on the dynamic nature of the social world, as situations need to be understood in their own context thus the framework of qualitative research study is variable and non-interventionist.

Cohen and Manion (1985) argue that this style of research is very subjective. They believe that subjective reports are incomplete and misleading and propose that, "The very process whereby one interprets and defines a situation is itself a product of the circumstances in which one is placed." (Cohen and Manion, 1985:37)

It is very important for the qualitative researcher to consider that he or she has the power to impose their definitions of situations upon the participants. As a researcher, one has to overcome this subjectivity triangulating the data through the inclusion of other research strategies that will objectify the data by isolating potential biases (Cohen and Manion, 1995). This will become clearer as the chapter progresses.

4.1.2 Quantitative Approaches

Quantitative research (also known as positivistic research) is structured around objectivity. This simple fact has been used to argue that it should be the only acceptable route to knowledge of the social world.

The implicit assumption of this style of research is that there is no qualitative difference between the natural worlds and the social worlds (ironically this forms a major platform of the anti-positivistic stance), so empirical methodologies can be used to frame an objective reality in the real world. A consequence of this is that researchers can intervene in the research setting and construct it for research purposes.

Hitchcock and Hughes (1989) believe quantitative research design is based on preconceived ideas rather than formulated ones. The social world is investigated as meanings and action rather than cause and effect. They argue that the hard mechanistic view of reality cannot be squared with the fact that individuals express themselves in unique ways.

Two main strands of quantitative design have been identified. Firstly there is the comparison between groups based on the T test and analysis of variance as its main statistical features. The second strand is relationships between variables based on non-experimental reasoning with correlation and regression as its major features (Hitchcock and Hughes, 1989).

Cohen and Manion (1985) note that central to this style of research is the survey. This method is used to gather data at a particular moment with the intention of describing the nature of existing conditions or identifying standards against existing conditions. Surveys may also determine relationships that exist between specific events. Surveys also vary in complexity. They may be administered in the form of structured or semi-structured interviews or questionnaires. Standardised tests have also been used (Cohen and Manion, 1985).

Punch (1998) points out that the word "survey" has different meanings. It is sometimes used to describe any research which collects data (qualitative or quantitative) from a sample of people. It may take the form of a simple descriptive study usually concerned with different pieces of information, which are studied one piece at a time. Variables may be involved and continuous variables are unlikely. This style of survey is sometimes called the Normative Survey. Its main purpose is a sample in terms of simple proportions and percentages of people who respond in this way or that way to different questions (Punch, 1998).

4.1.3 Integrated Methodologies as an Effective Research Strategy

Where does all this theory leave me, a teacher, who is also a researcher, carrying out an investigation into teachers using technology?

My research demands did not allow me to select one particular path of research. Working as a teacher in a school while researching in that same school immediately removed the objectivity from this thesis. But my research also had to extend further so that I could gather some sense of the attitudes on computer use from a larger number of teachers. This would lay a foundation for another methodological approach.

Understanding teacher responses to computers was the frame of my study. The nature of the data that I wished to collect focussed on teacher's experiences using technology. A qualitative methodological approach in my situation would generate the richest data however my chief research tool was a Normative Survey originating from a quantitative methodology.

I adopted this research methodology but after analysing teachers' survey responses, certain trends emerged that required further investigation if I was to gain a deeper understanding into how teachers really felt about using computers in their professional lives. The need emerged to also gather more data so other research methodologies were included. Interviews and classroom observations, both qualitative strategies, were incorporated as research methods for data collection. This integrated methodological approach is not unique and has been suggested as a research approach by Burgess (1985). He posited that a combination of strategies should be considered. Citing Sieber (1973), he suggested that educational researchers should not look at different methods alongside each other but rather adopt an integrated approach as fieldwork can assist in the analysis and interpretation of survey material.

4.2 Site

The sites selected were three primary (or preparatory) independent schools in the greater Cape Town area. They are independent as defined by the South African Schools Act of 1996, i.e. they are privately owned but receive some state funding and operate through a different school network to that of the Western Cape Education Department, the state school network of the area. All three schools are affiliated to the Independent Schools Association of South Africa (ISASA) and may be classified as privileged as they cater for learners from middle to upper income households. (According to brochures provided by the three schools, the annual fees are between R18 000 and R26 000).

Time and finances influenced the site selection. Being a principle breadwinner working as a full-time teacher while doing academic research created time and financial constraints that could not be ignored. To alleviate these pressures as much as

possible, I selected the school at which I was employed[9] as one of the principle research sites.

This school is independent and this became a criterion for decisions on research sites. It is located in east of the city and identified as School C. It is a co-educational school catering for learners from grade 1 to grade 10. Coincidentally, at the time, there were also two independent schools in the area in Cape Town in which I live, known as the city bowl, identified as schools A and B.

School B is not co-educational but single sex. It has a student body that ranges from grade 1 to grade 12. The school is located on a single dwelling.

School A is unlike School B or C in its structure. It caters for learners from grade 1 to grade 12 but divides them differently. It has a junior school, a middle school and a high school. The middle school caters for learners from Grade 7 through to grade 9 and the high school from grade 10 to 12. It is also co-educational. Fortunately, for research purposes, the junior school and middle school are located across a road from each other.

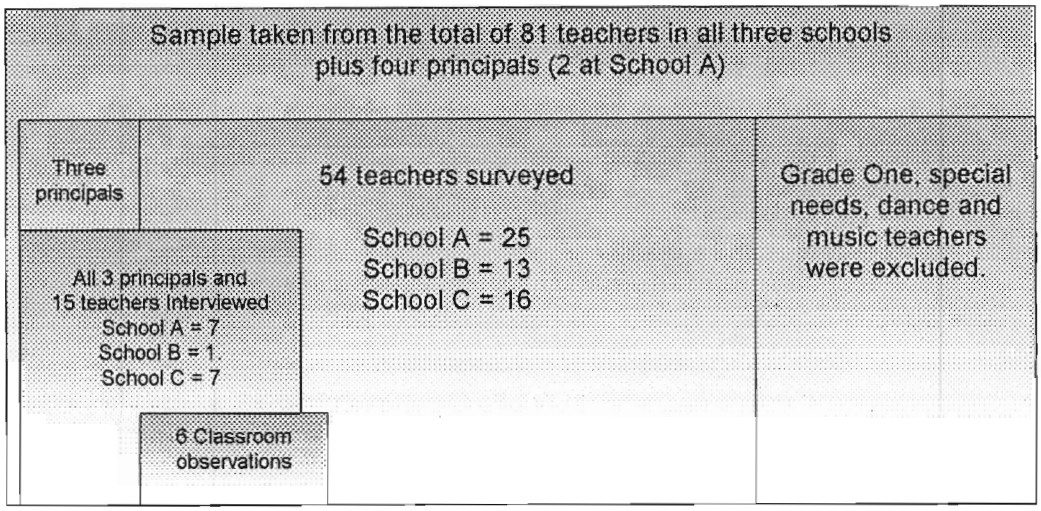
Initially I had also applied to conduct research in another school, which met my site criterion. After an initial agreement with the principal, I began to prepare a research schedule to follow in that school. The principal had said to me that prior to starting research, I must send him a copy of the research instrument. Upon reading it, he decided that the questions were threatening to the school as they may reveal teachers' ideas. He claimed these ideas were unique to the school and exposing them may jeopardise market position in relation to the school at which I was employed and he decided that I could not carry out any research in the school.

4.3 Sample

The sample was comprised of 3 schools, the principals that worked there as well most but not all teachers involved with learners from grade two to seven. See table below for visual breakdown.

[9] Teaching computer skills and two grade eight subjects.

TABLE 1: SAMPLE



4.3.1 Survey Sample

The methodology behind selecting the sample was a mixture of Convenience Sampling as teachers were used from the school that I worked at, and Purposive Sampling at School B and C. This selection approach as a strategy allows a researcher to handpick the cases to be included in the sample on the basis of judgement of their "typicality" (Punch, 1998:103).

The sample for the survey did not allow for much choice due to the limited number of schools involved in the study. All teachers from grade 2 through to grade 7 in each school were involved[10]. None of the schools had specialist computer teachers and class teachers took their class for computer lessons regardless of their subject speciality.

The total sample was 54 grade 2 to 7 teachers from the three schools. There were 25 teachers from School A, 13 teachers from School B and 16 teachers from School C. Special needs, dance and music teachers were excluded. The principals at all three schools were also interviewed although they did not answer surveys. One other principal (of the middle school i.e. gr7 at School A) was not interviewed as the necessary information was available from the other principal.

A characteristic of School A and B was subject teaching from Grade 5 onwards, unlike School C where a class teacher taught everything. Some teachers were responsible for teaching more than one subject with the responsibility of teaching three or more subjects in the intermediate phase as well as being class teachers. The same structures were not in place in the foundation phase at these schools.

[10] I chose not to include grade 1 teachers as the learner's limited capacity constrained computer teaching.

School C's structure was different as teachers in the intermediate phase and year one of the senior phase were responsible for their own classes. Respondents from School C were, once again, most teachers involved with learners from grade 2 to grade 7.

4.3.2 Interview Sample

Another sampling strategy was utilised to select who would be interviewed at each of the schools and how many classroom observations there would be. This secondary qualitative methodology was only adopted after initial survey analysis to capture qualitative information that may have been missed in the surveys. This sample was smaller than the first one.

At School A, 7 teachers were interviewed while at School B there was just 1 interview. At School C there were also 7 interviews. Even fewer classroom observations took place. At School A, there were 2 while none occurred at School B. Four classroom observations took place at School C.

The primary sampling strategy adopted was Convenience Sampling at Schools A and B. The reasoning behind this approach was time constraints as teachers were not always available to be interviewed when I was afforded study leave by School C. Those that were available when I could plan interview and observation time were thus included in the sample.

A Purposive Sampling strategy was utilised at School C, where teachers were picked to be interviewed or observed. As a researcher and teacher at the school I was able to pick teachers according to typicality but once again time constraints acted as a ceiling to the number of interviews and observations that occurred.

4.4 Method of Data Collection

My research strategies were integrated, drawing from both Qualitative and Quantitative Methodologies. My primary instrument was a questionnaire with a complex blend of biographical, open-ended questions and ranking questions. Along with this instrument, I used interviews, classroom observations and documentary analysis. This integrated approach was adopted so that along with survey data ,teachers experiences using computers could also be captured providing richer picture behind the complexities of technological integration in schools.

4.4.1 Questionnaire

See appendix 8.1 for instrument.

Making sure that the questions draw answers that are relevant to focus of the study is the primary challenge for researchers developing an instrument. Issues that immediately surface while an instrument is being developed are reliability and validity. Are the questions contained in the instrument consistent over time? Punch suggests that one ask, "If the same instrument were given to the same people under the same circumstances but at a different time to what extent would they get the same scores" (Punch, 1998:127).

Key building blocks of an effective survey are brevity and clear, concise questions. The use of technical jargon must be avoided at all costs[11]. Also, questions needed to be in logical groupings with no overlapping responses.

Validity, according to Punch (1998), is concerned with the extent to which test results serve their intended use or more specifically, how do we know this instrument will measure what we think it proposes to measure (Punch, 1998). Carrying out a pilot study can help circumvent this problem by revealing weaknesses. This was done to help develop my instrument. I used two different groups of teachers[12] not included in my sample to carry out pilot studies that enabled me to work on the validity of the questionnaire.

Teacher feedback from these studies highlighted language subtleties, which required revision in order to avoid inaccurate data being returned. Furthermore the pilots also facilitated the elimination of questions, which produced data irrelevant to the focus of the research. Invaluable suggestions from my supervisor also helped me to work on the validity of the instrument.

The pilot studies also highlighted the limitations a survey style of research and awakened me, the researcher, to the need to draw upon other research methods to supplement my data.

The school intranet was used to distribute the final questionnaires at Schools A and C. I was fortunate that the school computer network at School C was fully functional during the research period. I was not as fortunate at School A as only 15 out of the 25 respondents completed their surveys on the school network. Initially I was under the impression that there had been network complications but upon analysing teachers'

[11] A study focussed on computers demanded careful attention not to use technical jargon in the instrument.

[12] From a public school in the city bowl and gr1 teachers at School C.

survey responses, it occurred to me that some teachers may not have had the skills needed to utilise the school network. These 10 surveys had to be administered personally at another time. School B did not have a functioning network so all 13 surveys were personally administered.

4.4.2 Interviews

Interviewing, my first additional method, was the next strategy included in my research design. This research approach allowed more flexibility than a questionnaire as space was created for teachers to express and reflect upon their ideas and emotions. A combination of structured, semi-structured and unstructured interview approaches shaped the format. Hitchcock and Hughes (1989) argue that structured interviews are rigid by their nature, as a set of questions need to be adhered to whereas semi-structured and unstructured interviews affords the interviewer the opportunity to probe and expand interviewee responses. I aimed to understand how teachers responded to computers in their professional lives, as a result I needed to utilise all three interviewing strategies to capture subtleties of teachers' feelings which may not have emerged in the survey.

Time constraints proved a hurdle to carrying out the interviews as teachers often excused themselves. I countered this by scheduling interviews in the early morning at School C. Conducting the interviews at Schools A and B meant that I had to apply for study leave and conduct them at a convenient time during the school day. Here again time constraints were an unfortunate influence.

A complication during the interview process was that teachers at each of the schools had requested that that the interviews not be recorded. Consequentially brief notes were scribed in the interviews and expanded upon at the soonest opportunity after the interview.

4.4.3 Classroom Observations

Formal and informal classroom observations became my next additional research strategy. Ball (1985) identifies two approaches a researcher can follow when embarking on formal observations. Firstly, the hard-line position where the researcher shares in the activities of the researched and secondly the soft-line position where the researcher observes activities of the researched.

The soft-line position, the one that I used, Hitchcock and Hughes (1989) argue is a contentious methodology, as often researchers overlook the need for objectivity. This was something that I was acutely aware of because of my situation, as teacher-researcher at School C where teachers would ask me for assistance during a classroom observation due to our familiarity.

Completing the research at this School C proved significantly easier and more convenient. These observations could take place in my free lessons, provided classes to be observed were having lessons in the computer classroom. Informal observations also occurred.

Completing classroom observations at School A was somewhat more difficult. Synchronising time and lessons proved challenging and limited the number of observations that took place. Objectivity was not as big a concern, as I had no prior connection with the teachers being observed (aside from brief interactions during the interview process or survey administration).

During the observations notes were scribed that were elaborated on immediately the lesson was completed. This method of data collection was used at both Schools A and C. There were no observations at School B because teachers consistently did not show up for scheduled classroom observations.

One drawback to observing computer lessons is that often they are continuations from a previous lesson and teachers spent most of the class resolving learners' technical complications. This limits the scope of what can be observed. It must be noted as well that the teachers giving lessons during the observations seldom relaxed and appeared reluctant to allow ideas to develop or expose themselves to learner questions about technology that they did not feel comfortable with.

4.4.4 Documentary Analysis

Analysing documents was another research (minor) strategy used. Hitchcock and Hughes (1985) identify two potential documentary sources: primary and secondary. A primary source is one that came into being during the research period whereas a secondary one may only emerge as commentary or interpretation after the research period. Sources may be external such as a Parliamentary Act or newspaper article. They may also be internal in the form of a school pamphlet or school policy document.

I gathered primary external and internal sources to supplement my research data. These included school reports, newspaper articles, school brochures and NGO fact sheets. These sources were not critical evidence but assisted in providing necessary background information to the complex nature of teachers' lives and how they use computers.

4.5 Data Analysis

Some data analysis was made easy by modern technology. Using Excel, I was able to table several questions from the survey. Other question responses were typed up on Word documents and grouped according to category. This was a time consuming task though as one has to enter all the data from the surveys into the computer.

Analysing the interviews required transcribing the jumbled short hand. Initially my aim was to tape conversations but respondents asked me not to use the device as it made them feel even more uneasy. Unfortunately this method of data capturing may have resulted in some information being missed.

Notes were made during classroom observations and needed to be expanded and checked later when the data was typed up to ensure no details had been left out.

4.6 Limitations of the Study

There are limitations in all educational research. These may vary from a researcher's over-involvement in an ethnographic study to a rigorous adherence to objectivity in a survey. As an education researcher, one has to be aware of and counter these.

One of the major limitations of my study was the potential bias that existed because of my being a teacher at one of the research sites. Even though my survey was conducted over the school intranet, constant involvement with my respondents as work colleagues jeopardised objectivity. Responses (which under normal circumstances) may not have been entirely honest but influenced by a desire to impress, or at least to not appear lacking in skills may have been more prejudiced by my knowing the respondents. My familiarity with colleagues may have also biased interviews and classroom observations in a similar manner. Classes may have been planned around a perceived expectation rather than what may have been usually done.

Another limitation of the study was the size and nature of the sample. While a sample of 54 teachers for the survey provided plenty of evidence to work with, the limited number meant that the results can not be generalised but are more valuable from a qualitative perspective, which was the intention. The secondary sample of interviews and classroom observations was even more limited but this is balanced again by the greater degree of qualitative information provided. This was even further limited at School B where teachers consistently did not show up for scheduled classroom observations or interviews or which were constantly rescheduled until I gave up. The only interview at School B occurred by chance when I bumped into a teacher on the

corridor who consented to an interview. This may have been due to the school having a new principal, who acted as a gatekeeper, frustrating my efforts.

Further probing of teachers around issues that emerged from secondary survey analysis (interviews) did not occur as a result of study limits. This left a few questions unanswered around the contradictory responses with regard to teachers and management decision–making.

Chapter 5: Research Findings

The aim of the study was to develop a greater understanding of teachers' perceptions of, responses to and use of new technologies in the classroom. More specifically it was to answer the following questions:

1) How have teachers in three independent schools in the Western Cape responded to this new technology?
2) How are teachers using computers and what are they using them for?
3) How have computers influenced teacher practice and their professional identities?

The results are presented in two parts. Using observational, documentary and survey data, section 1 of the results provides a contextual profile of the schools involved in the study so that an understanding can be formed of the environment in which the teachers work. Included in this are learner and teacher profiles, the latter including the age, experience and training teachers received in the use of computers. The profile also provides an indication of the computer resources in each school.

Section 2 of the results includes the main findings of the research. These results were derived from data obtained through survey and documentary analysis, interviews and classroom observations. All proved valuable strategies in unearthing complexities of teachers work and their professional identities under the influence of rapid technological change.

5.1 School Profiles

5.1.1 Description and Location of the Schools

All three schools were located in the greater Cape Town metropolis. Schools A and B were situated in close proximity to each other in the city centre. The third, School C, was located about 23,5 kilometres north-east of the city. All three schools were affiliated to the Independent Examination Board (IEB) and Independent Schools Authority of South Africa (ISASA).

School A catered for co-educational learners from pre-school to grade 12. Class sizes varied between 20 to 30 learners and subject teaching started from grade 5. As an observer, one got the impression that there was a relaxed teaching environment, as the learner's uniforms were casual and teachers were informally dressed.

The school had a large play area; a basketball court and swimming pool. A variety of children's art decorated corridors and offices. The school was also actively involved in

social responsibility programmes around the city. One such programme was an arts-based initiative for underprivileged learners on the Cape Flats. Sport was also deemed important. According to the principal, teachers were expected to be fully involved in all activities on offer at the school.

School B was an all-girls school catering for learners from pre-school to grade 12. Classes varied in size with between 25 to 30 learners per class. Subject teaching took place from Grade 5 onwards. The school's old buildings and rolling lawns were neatly maintained. Children were obliged to wear a school uniform of which blazers were a compulsory part. Teachers were obliged to dress quite formally as this befitted the ethos of the school, and they were required to be involved in all aspects of life at the school.

Procedures for entry into the school were strict. Visitors were required to go through a lengthy bureaucratic procedure in the office before they were able to meet with teachers or Heads of Department. From observations regarding entry to the school and the formal dress code of the school, one got the impression that the teaching environment was likely to be as rigid and procedural.

The school placed emphasis on sport and cultural involvement and was involved in social responsibility programmes, particularly environmental education.

School C was a new co-educational school in a new, fast-growing suburb. The school was just over six years old at the time and consequently had quite a different appearance to the other two schools. It did not have the fields, gardens or sports facilities characteristic of both Schools A and B. The buildings were new with still being built giving the school the slight feel of a building site.

Upon entering the offices, one was struck by the learners' art and projects on display. Uniforms at the school were very casual: chinos, skirts and fashionable shirts. There was no blazer as part of the uniform. As a male teacher working there, I was able to wear shorts and a T-shirt on any given day; something that I had not experienced before at any of the schools in which I had previously worked.

Management at School C went to great lengths to improve the cultural and sports involvement at the school. The principal explained that teachers were expected to be involved in all aspects of school. At the time of the study the school was not involved at all in any social responsibility programmes.

5.1.2 Learner and Teacher Profiles

Table 2 below provides a description of the learner and teacher profiles of the respective schools in the study.

Profile	*School A*	*School B*	*School C*
Learners Gr2 – 7	500	360	420
Single Sex/ Co Educational	Co-ed	Single Sex – (Female)	Co-ed
Computers available in a school	50+	50+	50+
Educators gr2 – 7	40	16	25
Educators involved in Study	25	13	16
Male Educators involved in Study	5	0	2
Females Educators involved in Study	20	13	15

TABLE 2: LEARNER AND TEACHER PROFILES

5.1.2.1 Learner Profiles

There were five hundred co-educational learners between grade 2 and 7 at School A while at School B there were three hundred and sixty girls. There were 420 co-educational learners at School C.

5.1.2.2 Teacher Profiles

Number and Gender

As table 2 indicates, in grades 2 to 7 there were 40 teachers employed at School A, 16 at School B and 23 at School C. A striking feature of the teacher profile was the low number of male teachers in this phase of the education band. The male teachers employed at all three schools therefore made up a small percentage of the staff. It was therefore not surprising that only 10% of the teachers surveyed were male. Examined individually though, School A had the highest number of males on the staff (5 out of 25) while School B had none at all. At School C only 2 out of the 16 members were male.

The paucity in male representation was also evident at managerial level, particularly at Schools B and C where no males were involved in the school managerial structures. School A, however, had 2 males as part of the management structure of the school.

An interesting feature of the teacher profile to emerge from the data was that there were no male teachers under the age of 30 employed at any of the three schools. One of the respondents (T1) at School C noted in an interview, that since he started working as a teacher 18 years ago, he had seen an alarming decrease in the number of male

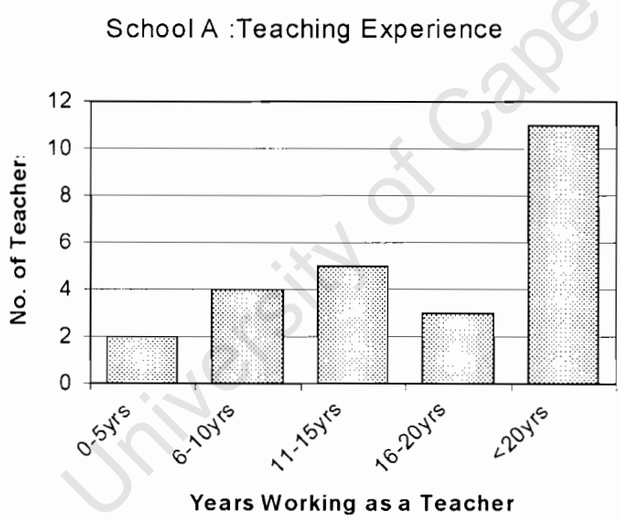
teachers in the profession. His interpretation was that this decrease was largely due to male teachers being unable to "make ends meet" on a primary school teacher's salary. He went on to suggest that

> *Primary school teaching is fast becoming a female profession. Just look around and tell me how many males you see and think back to when you were at school*

It must be noted that none of the three schools had an active policy of recruitment at leading tertiary institutions. All had passive recruitment strategies such as "word of mouth" or using the ISASA schools network[13]. Occasionally posts would be advertised in the local newspapers. Interviews with all three principals revealed that staff turnover was small in all the schools. At School B, a teaching post had not been available for two years; while at School C, the school's numbers were growing, resulting in an average of 3 posts a year being available. School A had an average of 2 posts a year offered. All three principals intimated that recently, one of the requirements for hiring teachers was that they needed to be computer literate.

Teacher Ages and Experience

Teachers ages at the three schools ranged from 20 to over 50 as the respective pie-charts below illustrate. Interestingly though, teacher age did not always mirror experience as tables 2, 3 and 4 below illustrate.



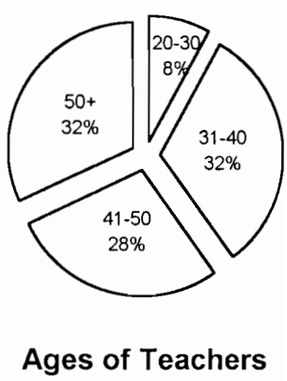


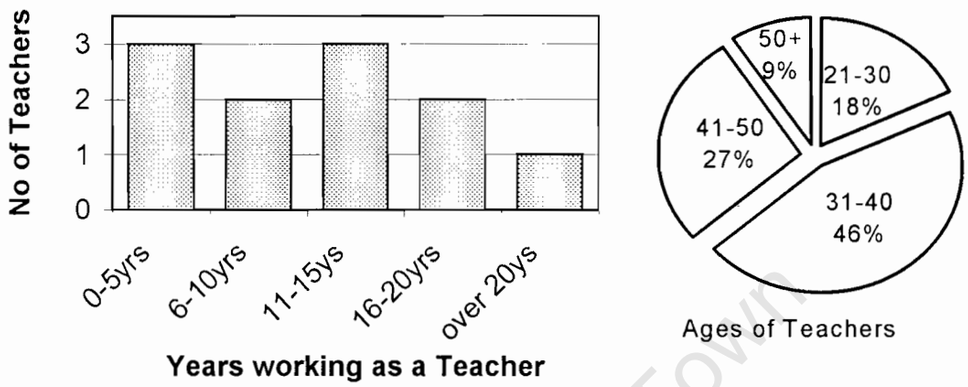
TABLE 3: TEACHING EXPERIENCE: SCHOOL A

[13] ISASA has a well developed email network between its member schools that has a bulletin board where employment opportunities and teacher availability can be placed.

School A

In School A, eight of the 25 teachers were over 50, while just two were under the age of thirty. Another eight were between the ages of 31 to 40, while seven were between the ages of 41-50. In this school, teacher age was reflected in teacher experience with at least 12 of the teachers having over 20 years experience and five having 11 to 15 years of experience.

TABLE 4: TEACHING EXPERIENCE: SCHOOL B

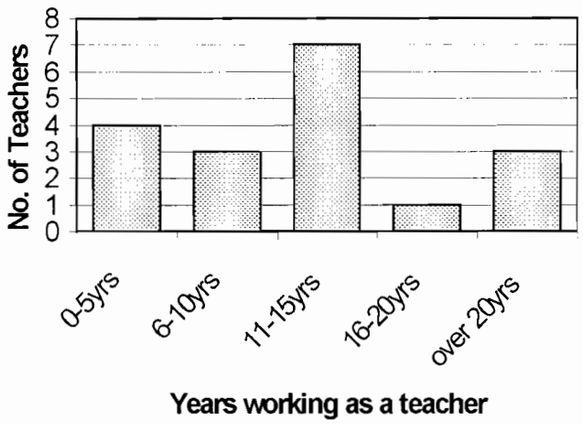


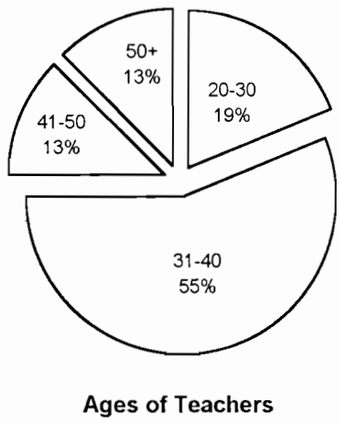
School B

The staff ages and experience at School B indicated above show that 5 of 13 teachers were between the ages of 31 and 40 while only 3 of the 13 were between 41 and 50. There were only two relatively young staff members between the ages of 21-30 and only one member of staff of the age of 50.

Even though almost half the staff were around the same age this was not mirrored in experience. There were the same numbers of teachers (three) with 0-5 years experience as with 11-15 years working in the profession. Two teachers had between 6 and 10 years experience while only one teacher had over 20 years of teaching experience.

TABLE 5: TEACHING EXPERIENCE: SCHOOL C





School C

As indicated in the pie-chart below, than half of the staff (9 out of 16) at School C was between the ages of 30 and 40. A further 19% were between the ages of 21-30.There was a small percentage of teachers between the ages of 41 and 50 and over 50 respectively.

The average teacher age at School C mirrored experience. Seven of the 16 teachers involved in the study had been in the profession for between 11-15 years. There were three teachers with more than 20 years of teaching experience. This school had four teachers that had teaching experience of between 0 and 5 years.

Teacher Training

Only 29 out of the sampled cohort of teachers (54) had received some training in the use of computers. About half of the staff at each school had received training. At School A 14 of 25 teachers had received training. At School B, six of 13 teachers had, while at School C nine of 16 teachers had obtained some measure of training.

While it may be true that these teachers were involved in some training programmes, the level nature and duration of the training varied. It would seem that, for the most part, teachers received very limited formal training. Fourteen teachers responded in the survey that they had learnt mostly through "trial and error" and through observing others use the medium.

The rest of the teachers had either taken courses at university or teachers' training colleges or they had attended evening computer literacy courses at institutions like

Damelin House. At School A, three older teachers (over 50) had completed a Microsoft ICDL course through a local computer college.

During the time of the research, eleven were still acquiring skills, mainly through informal arrangements. As one teacher in School A claimed on her survey "My husband taught me some basics over the weekends but it was watching my teenage daughter's confidence to try different programs that inspired me to really try". Another teacher in School C expressed that her "...teenage boys love doing it for me!"

Age and Training

Teacher ages were compared to their computer training in order to gain an insight into the interrelationship between age and computer use. Considering that younger teachers may have had a greater exposure to computers in their education, especially those falling within the 21-30 age group, one would have expected that many of these teachers to have received some form of computer training. However, the data revealed that the older cohorts of teachers were the ones who had undergone some formal training. In total, twenty teachers in total sample who fell between the ages of 30-40 had undergone training.

A striking feature in this regard was that ten of the 13 teachers who were over 50 had received training. Within the younger band, only six of the 20 teachers between the ages of thirty-one and forty had received any training. Eight out of 13 teachers between the ages 41 and 50 had received training.

Computer Resources

The school brochures revealed that access to computers for learners was used as a marketing tool by the various school managements. All three schools were equipped with computer hardware and software. Each school had more than fifty computers accessible to staff and learners. Observations of the facilities revealed that the educational software in schools A and C was of a high educational quality in that it was relevant to curriculum and appeared to be regularly upgraded. School B's software appeared in need of an upgrade, as many programs were seven or more years old.

In interviews with the principals of the three schools, it emerged that the arrangements for classes to use the computers was similar. Classes were allotted an hour slot per week in the computer lab. While this may have been the case, it seemed that teachers were not always free to take classes to the facility whenever they chose due to timetabling constraints. All three principals claimed in interviews that the broader vision of the schools was to equip every teacher with a computer in their classroom. This

process seemed underway because 19 out of 54 teachers had a computer in their classroom. The upshot of this scenario as it related to teachers work was that it required them to be flexible in engaging with the tool.

Geographically, teachers at schools A and C had fewer problems accessing computer facilities for classes as the laboratories were centrally located. More teachers at these schools also had units in their classes. In School A, nine of the twenty-five teachers each had a unit in their classrooms. At School C the number of units was higher; nine out of sixteen teachers having one in their classes.

Teachers at School B experienced the greatest difficulty accessing computer resources because of class location (in relation to the computer laboratory), the age and the size of the school. The age and layout of the buildings had caused a myriad of problems in the installation of equipment leading to high costs in establishing a functioning LAN (local area network). As such, only one of the 13 of the teachers at School B involved in the survey had a computer in her class. Classes were not located in close proximity to computer laboratory[14], an issue which teacher described as problematic. Teachers felt that there was too much time wasted moving from venue to venue which, in turn cut down learners' hours at the computer.

Summary

From this biographical background on all three schools, one can identify many similarities between them. They were all independent and provide learners with resourced learning environments as evidenced in the functioning and well-maintained computer laboratories. School management at all three schools was also aware of the value or currency of technology and so aimed to employ teachers who were computer literate. While each school had resourced computer centres, principals expressed the aim to continue improving the existing facilities and upgrade software but financial limitations were a concern.

At all three schools, a low number of teachers had received computer training. The most common manner in which training was said to have occurred, was usually self-

[14] According to Nova Systems, a leading company involved with the supply of computer hardware to schools in the Western Cape, if there is more than 100m distance between a class or building and the existing school network the difference in costs is significant. No longer can the different points be connected by cable but by radio antennae potentially adding around 15000 rand to network instillation costs.

initiated and by 'trial and error'. Teachers who had received some form of formal training happened to be older, an unexpected feature of the findings.

Location and access to computer resources posed problems to teachers too. There were no separate computer facilities for teachers at the schools. This meant that those teachers who did not have units in their classes or at home, had to be flexible in using the computers only when they were available. Resources had to be shared with other classes even though each school had over 50 computers available to learners. Teachers were not free to take classes to the laboratory when they chose to but had to comply with school timetabling constraints and demands. At School B this situation was further exacerbated by location. Classrooms were not in a close proximity to the computer centre.

This school profile provides a picture that served as a backdrop to understanding the next section of the findings. It highlighted two interrelated issues. Firstly, it illustrated the importance of *context* in this study. It would seem that teachers work cannot be understood outside the context in which they work. Their perceptions of, responses to and use of computers was situated in a space, place and time that worked in complex ways to define their professional identities. In the second instance, this profile began to highlight the complexity of the factors that shaped this professional identity.

5.2 Main Findings

In this section the teachers' responses to, use of and the role of computers at the three schools was examined in greater depth. The key question posed was what were teachers using computers used for and does this usage vary in the different schools and shape their professional identity?
In this section three broad themes emerged:

- Computer Usage.
- Teachers and the Role of Management.
- Computers and Student Learning.

5.2.1 Computer Usage

The complexities behind the use of computers in education are many. This was highlighted in the responses from teachers in the survey when they were asked to complete a ranking frequency suggesting what computers were most commonly used for. The results presented identify what the sample of teachers used computers for, as well as what they didn't use them for. The picture that emerged was that computer usage varied across school in frequency and nature. This meant that the most common use in one school was not necessarily the same for the other two schools.

In order to gain a deeper understanding to teachers responding to this question, the use of computers was analysed using the following categories: *Computers as an Administrative Tool*, which included both administration and lesson planning; *Computers an Educational Resource* which, included worksheet creation and information searches and *Computers as an Interactive Tool* comprising communication. The findings are presented in the table below.

Computer Usage		Total (54)			School A (25)			School B (13)			School C (16)		
		mostly	rarely	never	mostly	rarely	never	mostly	rarely	never	mostly	rarely	never.
Administrative Tool	Administration	40	7	7	18	3	4	9	3	1	13	1	2
	Lesson Planning	28	12	14	11	8	6	6	3	4	11	1	4
Educational Resource	Worksheet Creation	40	7	7	17	3	5	10	2	1	13	2	1
	Information Searches	26	21	7	10	11	4	5	5	3	11	5	0
Interactive Tool	Communication	22	11	21	9	4	12	4	5	4	9	2	5

TABLE 6: COMPUTER USE IN SCHOOLS

5.2.2 Computers as an Administrative Tool

The category, computers as an administrative tool, comprised of administration and lesson planning. Administration in this instance meant tasks linked to classroom and lesson organization and included activities such as assessment, reporting, outing arrangements and lesson planning, being all tasks linked to the planning of learners' academic activities in the classroom.

5.2.2.1 Administration

Of the 54 teachers involved in the survey, 40 of them ranked administration as the function that they used computers for the most. In all three schools this pattern was similar. At School A, 18 of the 25 teachers ranked administration as the task they used the medium for the most. At School B, nine of the 13 teachers also used it most frequently for this reason, while at School C, 13 of the 16 teachers ranked it as the most frequent reason for use. Within this category, assessment capturing seemed by far the most frequent reason for the use of the computer.

At School A, all teachers were required to use them as assessment capturing tools. Ten teachers noted on their responses how complicated this procedure had become since the introduction of computerised methods. Interviews with two teachers revealed

that many members of the staff lamented the reporting process. Teacher (T3) summed it up by suggesting that:

> *The school had improved its image with new computer reporting processes but teachers were under far more pressure as a result, especially if they did not have computers at home*

Another teacher (T4) who had been employed by the school for a while suggested that before the use of computers, management took more responsibility for daily administration. He stated that:

> *Before the creation of the computer lab, class lists were given to us but now we are expected to do this as well on top of calculating averages, converting to percentages and analysing results*

Another interview with teacher (T5) revealed how computers had impacted upon some teachers' lives, highlighting the demands placed on them by school management that class lists and assessment procedures should be completed. This teacher intimated that technological skills had to be upgraded with no incentive to do so. The need for upgraded skills was also realised in the classroom, placing even more pressure on teachers. She went on to say that:

> *Two years ago I was able to use Word comfortably but now school management expect me to know how to use Excel and Publisher as well. There were no incentives offered to learn these programs and they expect me to be able to use these programs in the classroom too.*

Eight teachers pointed out in their survey responses that assessment procedures were intimidating because their skills were limited and they typed slowly. They felt that this placed an added burden upon them to conform. In addition, as a process, it had become very time-consuming.

School B had also changed their reporting methods by incorporating computer technology. Five teachers suggested in their responses how much longer it took to complete feedback procedures. The process had also pressured teachers to improve their computer skills. One teacher's survey response summed it up succinctly;

> *While it has become easier to make, the whole process has become a lot more time consuming, especially if you do not have a computer at home and you are unsure of exactly what to do*

At School C, 10 of the 16 teachers responded that they use the computer most frequently for administration. As a teacher/researcher at this school, I was very aware of the pressure brought about by the expectation that all assessment tasks needed to

be presented as mark sheets generated in an Excel format, a program that few teachers were familiar with. All teachers were required to attend two 2-hour evening sessions in order for a basic level of understanding to be established in the use of Excel. Interesting, the principal was present at these training sessions which caused some teachers (with low skill levels) to feel intimidated for fear of exposure. One teacher approached me outside the computer centre during a break to help explain several terms about Excel. She would rather do this than expose her low level of understanding of the tool.

5.2.1.2 Lesson Planning

Lesson planning was another administrative task that teachers used the medium for. Like administration, teachers claimed it was also time consuming. Teachers ranked it 3rd in order of importance of the different functions performed.

Only 28 out of 54 sample teachers noted that lesson planning was what they used computers for the most. At School A, lesson planning was an administrative task that teachers at the school were expected to perform. Eleven of the 25 teachers ranked it as something for which they used computers frequently.

At School B, six of 13 teachers ranked lesson planning as a function they used the medium for mostly. Three teachers noted on their survey responses that daily lesson preparations had been made easier with computers although not all programs were user-friendly. Another teacher pointed out that data storage had also become less cumbersome. There was no need to keep piles of old books at home if all your information was stored on disc. While in the long run, it made this task easier, some programmes, like mathematics, seemed to be more time-consuming.

At School C, eleven of 16 teachers ranked lesson planning as something that they used computers for mostly. In interviews at the school, teachers were asked if their workload had changed since starting to use computers for lesson planning. T(2) stated: "*I am more organised but this takes longer.*" One young teacher with knowledge of the various operating softwares noted that the added work burden was not that large. T(1) suggested *"I have always used planning software on the computer so organising lessons doesn't take that much extra effort."* Teachers with less computing experience and who knew a little about the different software applications complained of extra time spent in the computer room planning lessons. T(3) intonated *"I think my workload has actually increased as I don't know what to do."*

Five teachers noted on their survey responses that when using the medium for lesson planning there was so much less paper used.

It was clear that while the use of computers brought with it some anxieties and added to workloads, there have been positive aspects that have emerged. With time, tasks have become easier resulting in teachers feeling more organised. There was less paper use and the storage and retrieval of data has become less cumbersome.

5.2.3 Computers as an Educational Resource

Teachers ranked worksheet creation first and information searches fourth in their survey responses as functions they used the computer for most frequently in this category. Surprisingly almost as many teachers ranked information searching as something they seldom used the medium for as those that used it frequently.

5.2.3.1 Worksheet Creation

Out of the 54 teachers involved in the survey, 40 ranked worksheet creation as the function that they used computers for the most in this category.

At School A, seventeen of 25 teachers ranked worksheet creation as something they used computers for frequently. Four teachers responded on their surveys that using the medium had improved the overall quality of the handouts. Computers also allowed them to adapt and change items on the sheets with ease. One teacher claimed on a survey response that "It allows me to creatively engage with the material I use to teach my lessons with and I enjoy that".

At School B, ten of 13 teachers used the medium frequently for worksheet creation and at School C, thirteen of the 16 teachers ranked worksheet creation as what they used computers for the most. Seven of 13 teachers identified some benefits to using computers for worksheet creation. One teacher pointed out that it enhanced their professionalism. Typing work was neater and made the sheets easier to duplicate. She said "...preparing worksheets is quicker and neater you can make it more interesting with different pictures, fonts and borders".

While there was acknowledgement that the visual quality of learner handouts had drastically improved, this had however come at a time cost. During an interview at School C, a teacher (T4) responded by stating that

> *Once the children got used to always receiving neatly laid out worksheets that was all they expected. Now when I get home from school everyday that is all I do!*

This illustrates the interrelationship and inherent tension created between quality and time, which is a constant source of pressure for teachers.

5.2.3.2 Information Searches

In this category, of the 54 teachers involved in the survey, 26 of them ranked information searches as the function that they used computers for the most but 21 ranked it a function that they seldom used the medium for. At School A, ten of 25 teachers ranked it as something they used it for frequently but eleven teachers ranked it as something they seldom used the medium for. At School B, only five out of 13 teachers used the medium for information searches. At School C, this trend was different as eleven of the 16 teachers ranked it as a function they performed often.

At School A, only one teacher commented in a survey response about using the medium for information searches. He claimed that mathematical solutions were easy to find at preparatory level, thus implying a potential benefit in the use of the medium for this purpose. At School B, no teachers detailed using the medium for information searches in survey responses or in interviews. At School C, eleven of 16 teachers used the medium often to find information. In a survey response, one teacher claimed that the wide range of knowledge and pictures available on the Internet and the ease with which this knowledge could be downloaded and upgraded made using the medium for information searches extremely beneficial.

5.2.4 Computers as an Interactive Tool

The final category in this theme related to whether or not teachers used computers for communicative purposes. Surprisingly for me, many teachers ranked communication as the function that they used computers for the least. Unexpectedly almost as many teachers never used computers to communicate as did. School A and C had functioning intranets, which made the process quick and easy.

5.2 4.1 Communication

Out of the 54 teachers involved in the survey, 22 of them ranked communication as the function they used computers for most frequently but 20 ranked it as something they never used the medium for. In the three schools this pattern differed. For example, at School A, nine of the 25 teachers ranked communication as that which they used the medium for the most while 13 ranked it as something they never used it for. At School B, four of 13 teachers also used it frequently to communicate but five rarely used it and four never did. At School C, the pattern was different: Nine of the 16 teachers used the medium frequently to communicate, while only five teachers never used it to do so. This difference in the use of the computer for communication was largely due to the availability of intranet.

One teacher suggested that it was a real benefit to be in a position to communicate using the computer, as she could communicate with more than one colleague at a time via email.

"I love it! I often communicate in the evenings online and often there are more than 2 of us."

Another teacher pointed out that she could interact more easily with other teachers. In interviews at the school, two teachers pointed out that while they were aware of the benefits of interactivity there was no time to capitalise on them.

T (5) claimed that

emailing friends at home sure but chatting online at school when?

While T (6) stated

when I do communicate online it is refreshing but photocopying, marking, and teaching don't leave much time for that

5.2.5 Teachers and the Role of Management

Management played a critical role at the three schools presumably due to the nature of private education, where cost and profit are influencing factors unlike public schooling. Their involvement, not always transparent or consistent and varied between the schools. Management's position was also influenced by school ownership. Ownership was separate from management at schools A and B[15]. At School C, owners managed the school.

Evidence of the importance of computers technology within the school curriculum emerged through school brochures and interviews with the three principals. Management placed the medium in the school and dictated teachers' involvement. Management's communication strategy was for computer technologies to be successfully implemented.

The role of management is discussed here as it pertains to three interrelated issues; namely, decision making in the computer classroom, the frequency of decision making and the relationship between management and teachers as collaborators in the use of computers.

5.2.6 Decision Makers in the Computer Classroom

Decision making was reflected in complex ways in respect of computer use. It could take the form of decisions made either by the management team (which for the most part, comprised only the principal and deputy principal); by the head of department; by the phase group or the grade group or by individual teachers. Table 6 below illustrates the form and frequency of the decision making process.

[15] The Jewish Board of Governors owns School A. The Anglican Church owns School B.

TABLE 7: DECISION MAKERS.

Decision Makers		Total (54)			School A (25)			School B (13)			School C (16)		
		mostly	rarely	never	mostly	rarely	never	mostly	rarely	never	mostly	rarely	never.
Management	Head of Department	**19**	**10**	**25**	8	3	14	5	4	4	6	3	7
	School Management	**5**	**17**	**32**	3	4	18	1	5	7	1	8	7
Teachers	Phase	**12**	**13**	**29**	4	4	17	4	5	4	4	4	8
	Grade	**17**	**15**	**22**	7	5	13	5	4	4	5	6	5
	Individual	**26**	**7**	**21**	10	1	14	6	4	3	10	2	4

The results suggest that the general pattern of decision making was varied. The table illustrates that teachers experienced some form of relative autonomy in decisions regarding the use of computers in classrooms. This is exemplified not only in the number of individual teachers citing that they made decisions, but also in the number of phase and grade categories. An interesting feature of this process is that while management's role in deciding about the use of computers in schools was found to be an important element in the way the school was advertised (through external advertisements and recruitment), their role in decision making about what happened in the computer classroom seemed small. It would seem in general, regarding decisions by management, that Heads of Department took many of the decisions.

When viewed per school, a similar pattern of individual teachers making decisions was observed. Many teachers at School A and C did decide what to teach in computer lessons they gave. At School B the pattern varied: the incidence of individual teachers making decisions was not as high as the other two schools but still more teachers responded that they decided individually than management or grade or phase teacher groupings.

5.2.7 Frequency of Decision Making

Teachers were asked how often a forum was provided to make decisions as to what was taught in the computer classroom. Were decisions made on a weekly, monthly and quarterly basis or were they never made at all? The evidence above suggests that the majority of teachers decided themselves what was taught in the computer classroom thus one would expect management to provide forums creating opportunities for teachers to communicate ideas with each another and reach teaching decisions that were structured, age-applicable and linked to the grade curricula.

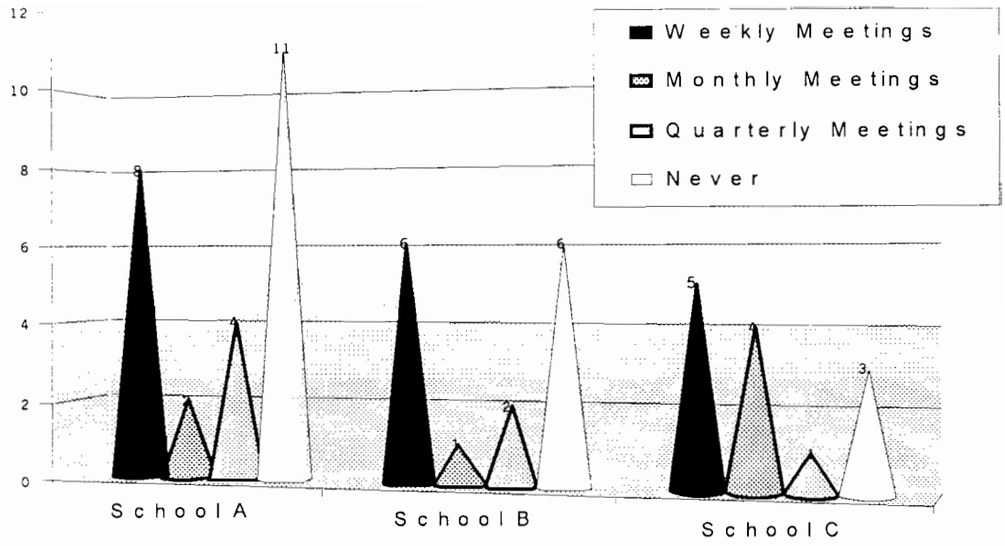


TABLE 8: FREQUENCY OF DECISION MAKING

Out of the 54 teachers, twenty noted that decisions were made on a weekly basis, a further seven identified that decisions were made on a monthly basis while seven more noted that decisions were made on a quarterly basis. Twenty responded that decisions were never made at all.

The responses from the individual schools were similar to those above. At School A and C contradictory survey responses suggested that teachers were unsure as to the frequency of decision-making with regard to computers. More teachers (11 in A and 6 in C) felt that decisions were actually not made, than those that felt they were made (8 in A and 7 in C). This pattern was different at School B but still not conclusive as to how often the meetings actually occurred. Five teachers responded that decisions were taken on a weekly basis while four noted they were taken on a monthly basis and three believed that no meetings took place.

5.2.8 Management and Teachers as Collaborators

At all three schools, evidence suggests that teachers themselves decided what to teach in computer lessons. Management appears to have had a fringe involvement in the decision-making but it seems provided staff with limited forums to discuss decisions. Even with the varied skills levels between staff, classroom observations point to learning taking place.

One must raise the question of how? Was it through teachers sharing ideas on informally in the staffroom, subtlety influencing each other? Or was it because technological goals were discussed in regular staff meetings?

Using computers in the classroom presents a challenge for most teachers. Aside from the difficult task of mastering the various computer programs needed to teach, there is also the issue of what kinds of activities to do with the learners to foster an interest in the medium.

The medium is interactive and dynamic and teachers can "never know enough", as programs and software applications constantly change. If computers are going to succeed then a collaborative teaching environment one can surmise is a necessity. If individual teachers were working in a vacuum then ultimately the learners may suffer. Successful computer classroom ideas and valuable, informative websites are crucial information that should be shared.

Teachers as a group were very responsive to the concept of sharing ideas. In response to the question, "are you happy to share ideas in the classroom?" All 54 teachers involved in the survey answered affirmatively.

Teachers at School A were unanimous in their response to the question. They were all comfortable with sharing ideas. This was highlighted by a teacher's survey response "I think this is the only way - 90% of a teachers' ideas have to come from someone or somewhere else." Another teacher said in her response that, "I would encourage teachers to share ideas. Unfortunately there is not enough time but teachers need other ideas from staff to cope with new demands in the classroom such as coping with learning disabled and using new technologies."

In an interview, one Grade 6 teacher (7) praised "sharing ideas" She continued to say

> *With increasing workloads there was seldom enough time to engage constructively with other staff members to exchange them.*

Teachers at School B were also open to sharing ideas. One teacher pointed out in her survey response that the interaction must be a mutual one. Another noted on her survey response, "I think that it is essential. It can only improve your teaching and must help prevent stagnation and overuse of old stagnant ideas and methods."

In the only interview at the school, a Grade 5 teacher (1) claimed

> *Ideas are to teachers what bricks are to builders.*

She continued that management should not encourage, but insist that they are shared.

All teachers at School C also expressed a willingness to share ideas. In a survey response, one teacher explained that "As a result of sharing ideas, I am now interested in Web design and using Front Page." Another noted "I am always willing to share ideas but get fairly upset when others withhold ideas."

In a formal interview in her classroom, a Grade 4 teacher (3) pointed out that several teachers at the school might claim that they share ideas but in reality this seldom happened. She gave an example of a dinosaur project that the learners were doing. It was a grade task so teacher co-operation was crucial. She continued

> *There were time constraints but some teachers ignored her questions when asked what they were doing in the computer classroom.*

While teachers at all three schools were more than happy to share ideas, their approach to computers was not always influenced by them. When teachers were asked, "How have your approaches to computers had been influenced by others?" answers revealed not all shared ideas were put to practical use. Only 19 out of 54 teachers indicated on their surveys that other staff members influenced their approaches in the computer classroom.

Only six of 25 teachers at School A felt that their approaches in the computer classroom had been influenced by other staff members. In responding to the survey question, one teacher noted that she was always keen to learn so she turned to others and lost her fear of computers. Another teacher claimed on her survey that she was taught by a staff member and had been inspired by another teacher, "I have been encouraged and challenged by seeing what can be produced by applying basic programs."

At School B, only three out of 13 teachers' approaches in the computer classroom had been influenced by other teachers.

At School C, ten of 16 teachers' approaches in the computer classroom were influenced by other staff members. A grade 7 teacher(6), influential in technology at the school, pointed out to me in an interview.

> *But they are not influencing each other enough*

The level of influence was highlighted in a classroom observations (Ts2,3,4) as well. The school had four Grade Four classes that were observed in the computer classroom during the same day: completing a font and page border task on Word. Each teacher followed a different path during the lessons. The two younger teachers seemed less intimidated by the medium and were enthusiastic to experiment and allow the learners to as well, even if mistakes were made.

However, they struggled to comply with the set structure agreed to in staff meetings as they found them very limiting for the learners. The two older teachers clearly felt quite uncomfortable using the medium, as they struggled to answer learner questions, but were regimented in following the simple set tasks that were required. Each teacher's approach was different.

Observations (Ts 2,3,4)
T1- used page borders on Word with ease. Encouraged learners.
T2 Struggled with learner questions-not sure of command functions and lucky to have learner assistance.
T3 Could not answer questions. Focused on the easy problems, ignored the tricky ones. Very difficult lesson.
T4-Wow she knew exactly what to do. Easy lesson.

Teacher responses to the survey question provided some understanding of the classroom observation. One teacher noted "A large discrepancy exists between those that are confident users and those that are not. Sometimes one feels threatened or out of touch if it is not your preferred area of interest." Another pointed out that "Other staff members have taught me a lot regarding the use of the computer. I have also been encouraged to look up certain sites for information and communication between staff members is so much easier now."

The need to aid and influence each other was further emphasized when teachers were asked whether technological goals were discussed in regular staff meetings.

Teacher responses to the question point to a contradictory understanding of managements role in placing where computers fit in schools. If goals are not discussed, teachers may not know what is required of them in computer classes. If they had a computer in their classroom what kinds of practices should be encouraged as well as those that were not acceptable "In what ways are technological goals discussed in staff meetings?", thirty-two out of 54 teachers answered that goals were not discussed at all.

At School A, twelve out of 25 teachers answered that goals were not discussed at all, while 5 noted that they were offered encouragement to use the medium but not given any direction. One teacher pointed out that, "More time was spent talking about computer room timetabling clashes than other issues such as training needs or management expectations." Another teacher indicated that, "Problems such as poor Internet service providers and the upgrading and maintenance of the machines was also not dealt with enough in staff meetings."

At School B, 10 out of 13 teachers answered that technological goals were not discussed at staff meetings.

At School C, ten out of 16 answered that technological goals were not discussed at staff meetings. One teacher pointed out that it was often technological jargon and, at times, not understandable, there was never any consistency nor were discussions constructive.

> *They are discussed in spurts of interest that seem to dwindle. Those that are in the know often speak way above the heads of those that are not. The result of this was that those that are not up to date with the latest developments often keep quiet to avoid showing their ignorance.*

Another teacher highlighted that there was seldom any follow through after discussions by intonating that there was "Lots of talking but no action". She continued her response with "Ideas and goals are discussed but implementation strategies are not".

It was clear from interviewing teachers, watching them use the medium in the classroom and reading their survey responses that not all teachers embraced computers. Some felt intimidated by it. Management's involvement with the medium at all three schools was unclear, which left some teachers feeling frustrated. One would expect this to impact negatively on student learning and their enjoyment of the medium. Observing them in action in the classrooms this was not the case.

5.2.9 Student Learning

This study focussed on teachers' responses to computers but one cannot ignore the possibility that technological change may have also an impact on student learning. This section of the findings will look at teachers' understandings of how student learning may have changed since the introduction of computers into teaching practice. There will also be a discussion on some of the activities for which learners use the medium. The sample results will be discussed in the following order:the full complement of teachers and then individual teacher responses from the three schools.

5.2.9.1 Changes in Student Learning

Teachers were asked whether there had been changes in student learning with the introduction of computers in the classroom. Of the 54 teachers involved in the study, 41 had noticed changes in student learning.13 had not but of this number, only four teachers had ever used the medium in their teaching.

At School A, eighteen out of 25 teachers were aware of changes in student learning. One teacher had never taught without a computer while 6 teachers had not noticed any changes in student learning.

Some Teachers at School A were amazed at the learning benefits the medium offered. This was expressed in interviews at the school as well as in the survey responses, and the benefits were demonstrated in classroom observations.

In one classroom observation T(1) a Grade 5 teacher[16] demonstrated how inclusive the learning experience had become. During a Human and Social Studies lesson, the class was learning about religious holidays and the symbolism behind them. A worksheet compiled by the teacher was required to be completed. The learners were encouraged to finish quickly so that they could begin the next task, which was to use a site on the Internet to find further information about religious holidays. The site was fully interactive. It showed pictures of different religious ceremonies, explaining why there were religious holidays. The teacher had previously downloaded an accompanying sound file. The interest sparked by the different computer-based activities inspired learners to complete the worksheet speedily. As learners viewed the site and heard the accompanying sounds, so spontaneous discussion began around religion. Not only did the learners reflect on Internet information, but also what they had learnt from completing the worksheet.

Survey responses from teachers further highlighted the effect of the medium in the classroom. Eight teachers pointed out that learners had become lazier. One teacher's response reflects this "They use books less for research. They become lazy, as information is too easy to get so they do not look further. They are however enthusiastic about what they find and researching topics in lesson time is far more voluntary." Four teachers noted that learners with difficulties benefited. A teacher pointed out that it had become "Much easier for children with handwriting and spelling problems to use a computer," while another commented that "Learners who are less academically inclined may excel in computer lessons". Three teachers identified that school work had changed. One teacher summed it up, "School work has become more exciting and group work has become easier as each learner is enthused by the medium"

At School B, ten out of 13 teachers were aware of changes in student learning. One teacher had never taught without a computer, while two teachers had not noticed any changes in student learning.

Teachers' survey responses suggested that computers had refreshed the learning experience. One survey response was "Children seem to have a natural affinity with

[16] The classroom was equipped with a computer

computers thus learning with more enthusiasm and creativity." Six teachers noted that plagiarism had become a problem while five complained that learners had become lazier. Four teachers pointed out that learners had become more independent. Interactivity had also added another dimension to the learning experience. A teacher responded with "They benefit from things like PowerPoint presentations - adds a visual dimension to learning. They can do work independently, learning to work on their own rather than being given everything by the teacher. They find learning more interesting."

One teacher succinctly described the changes which were not only positive, "Children have ready access to a far wider range of information, are more sophisticated in their knowledge base, but do need to develop sharper skills of discrimination and awareness of audience and purpose of writing. They are lazier to use books as research tools. Spelling has deteriorated to some extent as has sophistication of language use."

At School C, thirteen out of 16 teachers were aware of changes in student learning. Two teachers had never taught without a computer, while one teacher had not noticed any changes in student learning.

Four teachers noted that without adequate typing skills, the benefits of the medium were not significant. Two teachers attributed this to how the medium was being used at home.

One teacher's response highlights these problems and others, showing ambivalence to the changes, "Students have become more independent and confident especially those who have computers at home. It is an excellent tool for extension exercises. Those whose parents do not assist them or who do not have the technology at home, tend to shy away from the computer, as they feel inadequate. Reading and research skills have suffered. Pupils are no longer prepared to read through a variety of books and withdraw the information, presenting it in a logical way."

Other teachers were more positive: three teachers answered that the learning experience was no longer as teacher-centred. The medium has also become a motivating tool in the classroom. "Since most children enjoy computers, I believe that it has become a great motivating tool for a lot of children, especially with the advent of the Internet and multimedia programmes these days. Obviously this is not true for all children, but it is for most."

What did emerge from teachers' responses was that learners' computer skills were enhanced when the medium was in the classroom but there was no cognitive learning through it.

5.2.9.2 Internet Based Activities Utilised in the Classroom

There was such a varied response to the survey question "What activities do you use the Internet for?" from the teachers, that it's difficult to categorise. Research, however, was the most common one but what was surprising however was out of the cohort of 54 teachers, only 35 used the Internet as a source of information. Teachers at School B used it the least for this purpose. Another pattern to emerge from the data was the low frequency the Internet being used as a communication tool. Teachers were not asked in the survey whether they encouraged learners to use the Internet to communicate but out of 54 teachers, only three mentioned communication as an activity that the used the Internet for in lessons.

At School A, eighteen of 25 teachers used the medium for research purposes. At School B, 7 out of 13 teachers used computers to research, while at School C, 10 out 16 teachers used it for the same purpose.

Five teachers at School A used the Internet as an extension activity to follow up class ideas. One pointed out that there was a wide spread of mathematical activities available, ranging from graphs to educational games and fun activities. Only 2 teachers encouraged learners to use the Internet to communicate.

Teachers at School B also used the Internet for a myriad of purposes ranging from interactive lesson sites to games. One teacher tried to use the Internet for Afrikaans poetry but found sources were sparse. Four teachers noted that it was difficult to use the Internet effectively.Not one teacher encouraged learners to use the Internet as a communication tool.

Teachers at School C responded in a similar way. One teacher noted that project pictures were accessible and easy to import. Five teachers used the Internet for spelling and numeracy extension activities such as drill games. Another teacher highlighted that any Internet-based activity was going to improve reading skills of even reluctant readers.Only 1 teacher encouraged learners to use the Internet as communication tool.

5.3 Summary

Teachers used computers as a tool for a variety of tasks at the schools. This usage did vary between the schools. Teacher responses highlighted the administrative expectations placed upon them since the introduction of assessment and reporting software. Teachers also used computers to aid learning through worksheet creation

and information searches. Worth noting was that teachers did not use computers frequently to communicate.

Teachers did express frustration towards computers as often new software applications took time to learn. Another trend to emerge was that there was a lack of clarity around the decision making process of what to teach in the computer classroom. Many but not all Teachers at all three schools all suggested in survey responses that often they decided what to teach in the computer classroom without management, teachers as a grade or phase being involved. Survey responses also highlighted management as not communicating technological goals clearly either.

All Teachers hinted in survey responses that they were enthused by the concept of sharing ideas however further evidence emerged to suggest that they seldom these concepts. Some rationale surfaced as to why this occurred. One reason that many teachers raised was a lack of time. Teachers felt that management at the schools did not afford them opportunities to exchange ideas while another may have been a lack of skills. Teachers also felt that there were no clear technological goals presented to them by management rather potential meetings for management to put forward strategies were used to solve organizational issues around accessibility and any other problems that surfaced.

Teachers were impressed by the way in which learning experienced was enhanced by the use of the Internet. However they noticed that while computer were a valuable tool in the classroom, some learners plagiarised while others were lazier opting to cut and paste activities rather than completing themselves. Several teachers noted the benefits of computer technology when working with weaker learners.

Chapter 6: Analysis of Results

All teachers involved in the survey have felt the impact of technological change on their professional lives. Computers have permeated both academic and administrative responsibility and placed new demands on teachers' daily routines. These demands however extend beyond those brought by the technology itself to management expectations, which are constantly changing as they become increasingly aware of benefits of computer technologies.

The demands are thus external and internal in origin and yet intertwined as they fuel each other. Evidence collected point to these new demands as a source of anxiety for teachers, redefining their identities and changing the work they do.

6.1 Schools in the Market-place

Throughout the research period, a variety of evidence emerged to make it apparent that each of the schools in the study was focused on marketing what they had to offer to learners with the aim of expanding their respective client bases. Glossy school pamphlets were visually appealing while computer-designed school reports were filled with images of learner enjoyment at School C. Interviews with the principals corroborated that growth in student numbers was critical. Smyth et al (2000) argue that this is a characteristic of schools in the globalised age. Competition for market share amongst independent schools in the Western Cape cannot be underestimated. Further evidence of this emerged in the form of a telephonic and email response from a principal who would not allow me to do research in his school for fear of losing market share though a loss of ideas to School C, where I was employed as a teacher and located in the same vicinity.

Hargreaves (2000) has argued that teachers in the post-modern period would experience new stresses from the marketing of education and redefined parent-teacher relationships. Schools have become businesses. They market themselves and appeal to client needs. Marketing schools has also become simpler through the use of computers. Ryder (1996) points out that computer technology has made every user a publisher.

Hargreaves (2000) focuses on changing teacher identities but does not pay attention to how identities of school principals may have also changed in the post-modern period. Shifting identities will obviously alter existing relationships with teachers and bring new expectations which both have the potential to reshape teachers' professional identities; making the work they do more complex and demanding. One cannot underestimate the role of the school principal in defining these relationships that often create greater

parental expectation. Two of the three principals intonated in interviews that they have an open door policy with parents.

Computers are a driving force of these changing relationships, instigating new external and internal pressures on teachers work. The external strains are a foundation for many of the internal ones. External forces are a consequence of a globalising world in which private schools now market themselves through brochures and computerised reporting. School brochures at each of the three schools advertise computer skills as something that learners will attain and the clientele (parents) therefore expect this. Survey responses illustrated the pressure teachers feel bearing the responsibility of teaching computer skills (internal) as often they are expected to do so without the necessary skills, guidance or backup.

Secondly, the internal pressures are both administrative and pedagogical. Teachers at the three schools communicated more with parents via comprehensive computerised reporting as school managements strive to incorporate (and show that they have incorporated) computer technology into their schools. Computerised reporting may have improved communication with parents but has become something they now expect. Hargreaves (ibid) believes that teachers will have more inclusive relationships with parents and communication will be vital. Better communication with parents is to the benefit of learners but is also another strategy to maintain client base. Teachers are also expected to keep up this side of the business. Using computers as a tool for reporting affords teachers opportunities to inform on learner progress but also creates anxiety as the administrative burden of having to learn the skills behind utilising computerised reporting packages[17] is added to the burden of reporting on learners progress.

Teachers at the three schools attested to this when they identified assessment procedures as time consuming and requiring further skills development to master the software applications such as Microsoft Excel and generic reporting packages. As teacher-researcher at school C, the anxieties around learning how to utilise these programs were obvious at a training session where a teacher expressed her lack of program knowledge during a break rather than in the laboratory out of fear that the principal would realise her lack of skills. Here an irony arises which is perhaps one of the core concerns around computer technological integration in schools and a cause of teacher anxieties and managerial misunderstanding. Teachers being afraid to show

[17] Not to mention regular information losses, with beginner computer users, that result in having to redo reams of work.

their lack of skills and consequentially school managements believing that they possess all the skills necessary to use computer technology successfully.

6.2 Collaboration

Teachers expressed the desire to collaborate but survey responses exposed limited opportunities to do so because administrative and pedagogic burdens were so time consuming. Survey responses also intonated that management was not consistent in creating time and space for these interactions. When asked how often meetings to discuss technological goals took place, teachers gave contradictory evidence. A deduction could be made that a lack of collaboration may also have to do with managerial will as principals at the three schools may not have been convinced of the need for teachers to interact with one another and share technological ideas and consequentially did not establish the forums for these interactions. Hargreaves (2000) believes that school managements have to be convinced of the need of teachers to work together.

One cannot underestimate how valuable it is for teachers to collaborate with each other. Successful ideas can be shared and unsuccessful ones discarded. Inclusive strategies amongst teachers can also be formulated to tackle complex issues such as greater parental involvement in school life or how to incorporate computer technology successfully into the curriculum. Theorists (Becker and Riel, 1999; Carvin, 1999; Hargreaves, 2000) argue that collaborative practice is a necessity, making a vital contribution to teachers' work often fuelling them with the skills to cope with issues such as technological demands. Data revealed that all the teachers involved in the study embraced the idea of collaboration as they were willing to share ideas. Although, this was contradicted by one teacher who pointed out the difficulties she had had in getting teachers to share their ideas and almost twenty teachers who claimed that they seldom used shared ideas. Although reasons for this may be far greater, I would speculate that teachers need more time to elaborate and develop ideas so that they can be used. It does, however, seem that teachers may also need convincing of the need for and uses of collaboration.

Further substantiation that teachers were not collaborating enough with each other stems from responses to the survey question around computer usage. Teachers ranked communication as something they used the tool for the least. Writers (Ryder, 1996; Carvin, 1999; Zhao *et al*, 2002) have argued that this is one of the real benefits of computer technology. There may have been external contributing factors such as computer availability that could have limited computer communication. Observational evidence does points to this practice being easier at Schools A and C where networks existed but again teacher responses suggest that the tool was not used frequently for

this purpose. Instead using computers to communicate may have been a source of stress for teachers. This was highlighted in some teachers' survey responses that a lack of skills to successfully use computer as a tool is a potential anxiety for them.

It has been argued (Becker, 2001; Zhao, *et al* 2002) that using computers to communicate may lead to a growth in skills. School managements should be encouraging teachers to use computers as a communication tool, even offering incentives for them to publish and post ideas on the Internet.[18] This practice Becker (2001) argues elevates levels of teacher professionalism and enhances their professional identities. Hargreaves (2000) has argued that this is a symptom of the post-modern professional era of education. Teachers are being more isolated from their colleagues and slipping back towards previous periods where they taught in isolation and there was little collegiality amongst them.

6.3 Decision-making

Contradictory evidence emerged as to the decision-making role of school heads and heads of department. Teachers were also unsure of the role of phase or grade teachers in the decision making about what to teach in the computer classroom. If teachers are unclear about who is making these decisions one could conclude that there is a lack of collaboration amongst teachers because if they were receiving instructions or debating the issues, they would know where the final decisions were coming from. A lack of collaboration points to a possible re-emergence of the autonomous individual in the classroom. Hargreaves (2000) argues that this is another consequence of the age of post-modern professionalism. Furthermore it points to school principals not having a clear understanding of the need for their guidance or support in making space for clarity and / or consultation in decision-making with regard to what is taught, how it can be taught and why.

Evidence from survey responses showed that many teachers at the three schools placed themselves as decision makers in that they selected what to teach in the computer classroom. Pedagogical implications arise around the issue of individual teachers deciding what to teach in the computer classroom. If teachers were not discussing this or discussing it infrequently then they would not be sure what was being

[18] Becker and Riel (1999) believe school culture shapes teacher interaction. School culture was not focussed on in the survey or interviews but documentary data and personal observation suggest that the school cultures may have been professional rather than bureaucratic (Becker and Riel, 1999). Professional school cultures should embrace teacher consultation but the evidence does not indicate this. Rather one can intimate that each of the schools displayed some characteristics of a bureaucratic culture, particularly School B.

taught in grades above and below them and in what ways it was being taught resulting in a lack of continuity and gaps in learners knowledge.

Teachers' responses to decision-making frequency question pointed a further lack of structure in decision and thus increasing the role of individual teachers in the process adding to teacher anxiety. Teachers indicated that technological goals were not being discussed constructively which was another source of insecurity and frustration, obviously undermining their professional identities in terms of the work they did. They felt that computers were not being positioned in the curriculum by the principals and that often teachers used the forums as a place to raise complaints about organisational issues rather than pedagogical ones.

Another salient issue to emerge from the data was that the principals themselves were slow to take up on issues raised in meetings around technological goals. A number of teachers' claims were summed up by one teacher's retort that there was lots of talking but no action from principals in responding to computers and teachers suggestions for strategies to incorporate the technology. With technological goal not been addressed by principals who also failed to establish regular forums for teachers to discuss computers confirms Russell *et al*'s (2003) position that teaching and school cultures have not incorporated computer-based technologies. One can speculate here about the extent to which it has influenced teachers' professional identities. Teachers, already feeling anxious having to make many decisions as to what to teach, were further isolated by a lack of opportunity to gather and communicate with colleagues. Furthermore when goals were discussed, implementation was slow or not at all.

6.4 Lack of Skills

The level of skills possessed and the kind of training received by the teachers involved in this study was surprising. Survey evidence revealed a low number of teachers having received any training at all and many having learnt through informal arrangements such as trail and error. One can deduce that teachers were not adequately equipped to respond to the demands brought by computers into their professional lives. For many teachers involved in the study this may have generated anxiety. Ertmer (2002) links teacher efficacy to this lack of skills, resulting in a lack of teacher confidence when using the medium. Teachers not having the skills to use computers in the classroom was a major reason why teachers in the United Kingdom seldom taught learners new skills or engaged their higher order thinking ability according to the National Grid for Learning Study (2001).

Researchers, Becker and Riel, 1999; Zhao *et al*, 2002; and Taylor, 2004 have found collaboration amongst teachers is a possible effective strategy in aiding computer skills

development amongst teachers. Evidence surfaced suggesting that teachers themselves were open to this concept but classroom demands along with a lack of time to meet limited the kind of interaction needed for collaboration to be an effective strategy.

Teachers, lacking skills, were left feeling anxious and isolated by school cultures that did not embrace collaborative practices and by managements who may have failed to understand how complex modern computer technology is and just expected teachers to perform using the technology regardless of whether they were employed to do so.

Here a contradiction arises that will possibility define the success of the computers in schools. Documentary evidence highlights each school's aim to teach computer technology to enrolled learners (but not to teachers in employ). Many teachers do not possess the skills to do this. Schools' skills development strategies lack structure or outcomes and appear reactionary to the push of computer technology (that is if they had skills upgrading procedures in place). Various skills development maps have been suggested by theorists (Welch *et al*, 2001; Zhao *et al*, 2002) to close the skills gap but these require both time and finances that are always in short supply.

As a teacher-researcher at one of the schools I experienced only two 2-hour training sessions during the course of a year. From interview evidence with the principals it emerged that at School A there was an aim to apply for a Microsoft site licence to teach the International Computer Drivers Licence but this was not yet in place. Currently staff development at the school was infrequent while there was no staff development at School B. Welch *et al* (2001) speculate that these skills upgrading processes will even further alienate the teachers as what they call "one-shot workshops" leave teachers with low skill levels leaving them feeing even more isolated. Kent and McNergney (2000) believe that previous technologies such as Instructional Television have failed in the classroom because of this. Skills development is therefore crucial however evidence points to this as being a management claim rather than a reality in place.

6.4.1 Teachers and Student Learning

Evidence suggests the impact technology has had on student learning. Although this was not a focus of the study, survey responses did highlight learner enthusiasm, but coupled with plagiarism. The evidence also suggests that the added visual dimension that came with computer technology was a motivator for learning.

The debate around the effect of technology on student learning is both complex and extensive. Strommen (2003), argues that education has not kept up with technological change as our children are now used to instant access to knowledge, supported with

vivid imagery which they control. The reality is that many teachers have had to come to terms with a very different educational landscape to the one they learnt in. Data pointed to the potential change in the relationship between teacher and learners. Lessons may become learner-centred, which Davis *et al* (1997) believe to be the aim. Learning that occurs through an active engagement by learners with what is encountered, results in better incorporation into their general understanding. The interactivity that the Internet affords supports this approach. It is tragic that so many teachers are ill equipped to take advantage of the possible benefits.

6.5 The Role of the Principal

Principals at these three schools were no longer responsible for traditional responsibilities only, but also for the marketing of schools which included the maintenance of a parent / client base. Evidence of this redefined identity emerged during interviews with the respective principals as brochures were handed over in the same manner that they would be passed onto perspective client-parents. Two principals also pointed out their open door policies for parents should any problem arise. Satisfying customer demands particularly in these three independent schools (and one can assume it would be similar in other independent schools) appears a new responsibility for the principals. Schools, being marketed and operated as businesses have brought commercial factors to bear which influence and change the role and hence identity of the principal. This has implications for teachers' professional identities. Smyth *et al* (2000) argues that schools will focus more on profit, consequentially teachers work is redefined as it becomes linked to productivity.

One particular customer demand is related to computer technology and it is here that a contradiction arises. Parents walking into each principal's office would see a computer as I did as a researcher. Marketing strategies like school brochures and computerised reporting further highlight the position of computers in each school. Clients have come to expect a certain level computer competency to be taught to their children. Principals have transferred the demands created through marketing on to teachers, expecting them to adapt to the external and internal pressures related to computer technology. The problem arises in that they have not created the required structures into place for teachers so that computer teaching can be successful. This includes vocalising technological goals, supplying resources; skills and creating the necessary collaborative structures in their respective schools to ensure that computer integration is smooth. These factors have combined to create anxious teachers who feel that their professional identities have been compromised.

6.6 Summary

The processes of computer integration at the three schools has been unstructured and lacked leadership. These factors in combination with a lack skills and little collegial support has resulted in anxious and frustrated teachers. Furthermore managerial expectations extend beyond pedagogical demands to administration and marketing of the school, changing the work teachers do, impinging on their professional identities.

Teachers now find themselves in a troubled space as a consequence of computer technology. The irony is that computers should be empowering teachers positively enhancing their professional identities and not being the source of anxiety for them.

Chapter 7: Conclusion

The aim of the study was firstly to gain a deeper understanding into how teachers have responded to the integration of computers into their work and to grasp what impact the technology may have on their professional identities.

Over the last 20 years the world has experienced a technological revolution that has affected all professions. Education has been exempted, on the contrary, teachers have had to learn to teach with the medium in the classroom as well as use it in their daily work lives. This has become crucial as new indicators such as computers per person and bandwidth availability dictate countries competitiveness on the global stage. Countries that ignore the realities of the new technologies face an opening a digital divide. Teachers are thus at the forefront of equipping future generations with the skills to cope with the realities of a digitised world.

As schools confront technological change new pressures emerge which have an impact on teachers' professional identities. New software applications need to be learnt and used administratively and academically. Previous technologies have failed in the classroom because of a lack of consultation with teachers about where and how to place them in the curriculum and in the classroom. This is not an option with computers.

The impact of technological change on teachers' professional lives thus cannot be ignored. Teachers' professional identities have evolved significantly over the last 100 years. The current post-modern period however has the potential to undermine many of the consultative and collegial practices, which have redefined teachers' professional identities over the last 30 years.

Aside from negotiating technological impulses, education has become increasingly corporatised with parents becoming clients and needing to be appeased.

Educational research initially failed to keep track with the rapid rate of technological change. Later investigations began to reflect the complex nature of the relationship between schools, teachers and computers. Early studies focussed on skills that teachers would have to learn in order to use computers in the classroom. Only later did researchers begin to focus on the impact the medium may have on teachers' professional lives. Other research has focussed on the conditions necessary for successful technological integration and the impact of teacher practices and school culture on this incorporation.

This study was done in three independent primary or preparatory schools in Cape Town and included teachers from Grade 2 to 7.One of the schools was the researchers employer where he worked as a computer and grade teacher. Data was gathered through an integrated methodology of both qualitative and quantitative approaches. A survey was the main instrument but interviews and classroom observations were also carried out. This evidence was backed up with documentary sources as well.

Through a careful process of interpretation, including triangulation, a set of results emerged, offering a window into how and what computers were being used for at each school.

Several trends emerged from the data, which have implications for teachers' professional identities. Each of the schools involved in the study allowed teachers a level of freedom, especially in computer classrooms, which may have laid the foundation for meaningful learning to occur. However, several factors materialized that had a negative impact on teachers' professional lives.

At all three schools, teachers, expressed frustration and insecurity with regard to technological pressures which are seen by some as external to their work. Effectively the work that teachers do has intensified, potentially undermining their professional identities through increased workloads as a result of the incorporation of computers into administration and pedagogical demands.

It appears that principals at the three schools may not be aware as they could be of the complexities that come with the integration of new technologies into teachers' professional lives. Teachers may lack skills to use the technologies or not have an understanding of operating systems nor knowledge of possible pitfalls like computer malfunction. These pressures further exacerbate teacher stress and push two more issues to the fore: system design and enabling conditions. There should be consultation with teachers around the system design of the reporting packages. Previous studies found this to be a reason for the failure of technologies such as these.

The administrative process would be more efficient if teachers were more aware of the conditions required to simplify it as Zhao *et al* (2002) note. They argue that a human infrastructure is needed to enable teachers. This infrastructure includes all staff at the school involved with technology, from administrative staff through to technicians. At each of the schools involved in the study, no evidence surfaced to suggest that such an infrastructure existed.

Administrative expectations have also merged with pedagogical ones. Management expectations that teachers use software applications recently learnt through administrative processes in the classroom results in additional internal expectations on teachers. Evidence from the study suggests that this as another source of anxiety for teachers.

At all three schools, the role of computers was not clear. School managements seldom involved themselves in decision-making processes as to what was taught in the computer classroom and grade and phase teacher grouping had an ambiguous role. Most teachers decided individually as to what was taught. This lack of structure and cohesion in decision-making often lead to uncertainty and frustration. All teachers expressed the desire to share ideas as to how and what to teach in the computer classroom but seldom did they use these ideas. Often this was a result of a lack of skills. Teachers were also not given the forum to share ideas that may lead to meaningful change in the classroom.

These factors all have implications for teachers' professional identities. Computer integration is difficult. School managements need to take responsibility for the changes required for computers to succeed. They need to define their expectations and future visions, putting the right structures in place so that teachers no longer have any uncertainty towards computers. Consequentially skills shortages need to be addressed. A "one-size-fits-all", the current strategy, used by the schools fuelled frustration amongst teachers, especially those with either low or very high levels of computer skills. Management needs to ascertain what skills are missing and devise a strategy that addresses these shortages. To facilitate new teachers, a pastoral scheme may need to be considered.

Teachers need to take responsibility too. They cannot expect school managements alone to shoulder all the responsibility for technological integration. They should also take the initiative to address their own skills shortages. This would lead to less uncertainty toward computers and intrinsically enhance their professional identities. With any change comes the pain of adapting. Either the change is embraced and the pain is short-lived or the change is resisted resulting in more pain for a longer period of time until there is acclimatisation.

Chapter 8: Appendices

8.1 Research Instrument

University of Cape Town, Department of Education.

Masters Thesis Survey compiled by Marc Bristow (BRSMAR004)

Please read through the questions and answer them as clearly as possible.

1) How old are you?
   a) 20- 30
   b) 31 – 40
   c) 41-50
   d) Older than 50
2) Circle
   a) Male
   b) Female
3) How long have you been working as a Teacher?
   a) 0-5 years
   b) 6-10 years
   c) 11-15 years
   d) 16-20 yrs
   e) 0ver 20yrs+
4) Do you have a computer(s) in your class? Please circle the right answer.

   Yes

   No
5) Please circle the number of computers that are available to your class in your school.

   5 10 15 20 25 or more
6) Do you use a computer in your day-to-day teaching or preparation activities?

   Yes

   No
7) What do you use computers for at school. (Please rank them accordingly)

	Mostly	*Rarely*	*Never*
a) Lesson planning			
b) Information searches			
c) Communication			
d) Administration			
e) Worksheets			

8) Have you received any formal computer training? Circle the answer.

Yes

No If you haven't please describe how you learnt to use a computer.

9) Explain how you think your workload has changed since you have started using computers in your practice?

10) Explain in what ways you think student learning may have changed since the introduction of computers into classroom practice.

11) In what ways has your approach to using technology been influenced by other staff members?

12) How do you feel about sharing new classroom ideas with other teachers?

13) In what ways are technological goals discussed in staff meetings?

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