STATE OF THE NATION:

a comparative analysis of teacher professional development with ICT between ICT PD clusters and non-ICT PD schools.

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Abstract

Professional Development programmes in Information and Communication Technologies (ICT PD) in schools have had significant growth since the development of successive national ICT strategies by the Ministry of Education. Since the late 1990s the Ministry has provided funding to clusters of schools to carry out professional development programmes in the use and the integration of ICT into teaching and learning. Research, looking at the impact this ICT PD is having on teacher skills and attitudes, has amassed large quantities of rich data. By the end of 2004 40% of New Zealand schools will have been involved in an ICT PD cluster. This research sought to make a comparative analysis of ICT PD and non- ICT PD schools. The project looked at data from those exiting an ICT programme, those about to enter a programme and those who had had no involvement in ICT PD cluster programmes. This project found that schools who had not been involved in ICT PD clusters had high levels of personal ICT skills and confidence on a comparable level to those who had completed three years of ICT PD. Differences in the cohorts were apparent in the amount of time teachers attempted to integrate ICT into their programmes for student's use. It appears that:

- ICT PD clusters are making a difference. The key difference is that they increase ICT usage by teachers and students.
- ICT PD clusters create high levels of anxiety for teachers on entry cluster programmes.
- Other ICT initiatives are having a positive effect on teachers unable to access ICT PD cluster programmes.

Introduction

There is a range of literature available on professional development, both specific and non-specific to ICT (Information and Communication Technology). This literature documents both successes and failures of programmes and helps to identify factors that contribute to successful implementation of initiatives as well as identifying possible limitations. Integrating technology into the curriculum can be difficult for teachers with lack of time, resources, support, and the knowledge of how to use technology effectively, all being cited as reasons for this (Lai, 2001; Trewern, 1996).

If we are able to paint a picture of what has occurred in the area of ICT professional development in the New Zealand context we would see that there has been a shift in recent years from simple skills teaching to a greater focus on pedagogical considerations. It could be stated that teacher beliefs, not necessarily skills, limit their ability to find solutions to pedagogical problems which incorporate ICT. The evidence is also growing that these beliefs affect the development of ICT effectiveness at the initial teacher education stage. Trumball (1987)

We have been able to paint this picture of ICT professional development in New Zealand because, in an effort to improve teaching and learning with Information and Communication Technology (ICT), the Ministry of Education has in recent years developed national strategy documents that have created a range of professional development initiatives. The Minister of Education (2002) states that these are aimed at *"seizing on the importance and practical benefits of digital technology as a key tool for 21st Century teaching and learning."*.

The ICT PD clusters have been one initiative that has come from these strategies. This initiative has seen clusters of schools come together for training and professional development with ICT. By the end of 2003 40% of New Zealand Schools had been involved in this initiative either as a lead school or as a school receiving support from a lead school. Their progress has been tracked since 1999 in an effort to measure the effect the professional development programmes being provided are having on skill level, confidence and usage within the

classroom context. In their examination of trends from 1999 – 2003 of schools involved in the ICTPD clusters Ham et al (2004), is suggesting that there are patterns emerging that are going to impact on future strategy implementation. While we have this wealth of data on these schools we know little if nothing on the skill level, confidence and usage levels of the 60% of schools who haven't been touched by this initiative. To date no data has been collected to find out what has happened in these schools. With a new strategy due it would seem an opportune time to examine the similarities and differences that exist within cluster and non - cluster schools in the areas of skills, confidence and usage. Such information will allow for a clearer picture that better reflects the state of ICT integration in New Zealand schools.

Literature Review

Professional Development

Professional development (PD) is a term used to describe a range of activities concerned with individual teacher development of knowledge and skills or linked to improving student learning within a school or systems context. This includes individual teacher reading, exploration of resources, action research in the classroom, individuals or groups attending conferences, groups of teachers working on specialist committees and individual reflective practices (Alberta Teachers' Association 2002). The terms in-service training and professional development are often used interchangeably, but have slightly different meanings. According to the OECD (the Organisation for Economic Cooperation and Development): Professional development signifies any activity that develops an individual's skills, knowledge, expertise and other characteristics as a teacher. These include personal study and reflection as well as formal courses. In-service education and training refers more specifically to identifiable learning activities in which practicing teachers participate. The widespread use of the term professional development when referring to training activities reflects the fact that most teachers see themselves as members of a profession. Like all members of professions, teachers need to be involved in a process of learning and reflection to improve their professional practice (ERO 2000). Professional development is now seen as an integral part of teacher's lives. Continuous improvement and on-going learning are concepts and expectations clearly articulated in teacher professional standards in the New Zealand education system (MOE 1998). Beeby states, "teachers are the most important factor in the effective implementation of any innovation in education. Without teacher supports, educational innovation is doomed to fail"

What is different today is our understanding of professional development and its impact on schools. Study after study is placing professional development activities at the centre of reform and instructional improvement (Elmore and Burney, 1999). There is considerable

evidence that individuals and organizations that continually access and process knowledge in terms of designated goals and indicators of performance, are successful (Fullan, 1999)

There is a range of literature available that describes the factors believed to contribute to effective professional development and training, as well as a range of models developed to describe how professional development is aligned to teacher types and stages of adopting the changes being promoted. Rogers (1983) argued that individuals in a social system do not adopt an innovation at the same time, therefore it is helpful to place individuals into adopter categories based on their degree of innovativeness. The innovativeness dimension, as measured by the time at which an individual adopts an innovation, can be partitioned into five adopter categories: innovators, early adopters, early majority, late majority, and laggards.

A number of researchers have come up with lists of characteristics which are seen to support effective professional development. Elmore and Burney (1999) have identified the following characteristics:

- focusing on concrete classroom applications of general ideas;
- exposing teachers to actual practice rather than descriptions;
- offering opportunities for observation, critique and reflection;
- providing opportunities for group support and collaboration; and
- involving deliberate evaluation and feedback by skilled practitioners.

Professional Development is about change or innovation. Interventions in the form of professional development and training must be logically related to the needs of teachers and the use of the innovation. As Davis (1997) suggests, the process of professional development is approached from two interacting dimensions; the individual's personal view and the social context within which that person works.

Individuals find it hard to develop in static schools. Schools are unable to develop without teachers changing what they do. If teachers do develop professionally, but individually, they may not be able to change teachers who do not change with them.

Through communication and information transfer, individuals begin to network informally about the possible benefits of the innovation. Effective professional development requires cooperative relationships that break down the isolation and increase the professional knowledge of the staff.

This professional development needs to ensure that the overriding focus is on increasing student learning. (Darling-Hammond, 2000 cited in Fullan and Mascall, 2000; Joyce and Showers, 1988). Consensus is also emerging that the knowledge and skills of education can be increased substantially through collegial opportunities to solve authentic problems that span the gap between student performance and expectations (Hawley and Valli, 1999). Andragogical theory suggests that adults' vast reservoir of experience in multiple settings constitutes a powerful resource for learning (Brookfield 1986, Knowles 1990). Brookfield promotes the notion that "when adults teach and learn in one another's company, they find themselves engaged in a challenging, passionate, and creative activity" (p. 1). Also as Taylor (1998) observes, adults in interaction constitute a community of knowers as well as a community of learners.

Professional Development (PD) is not new to education. Professional Development or what was known as in-service training has long had a place in this country's education system. Teachers have long been involved in professional development or training after their initial pre-service teacher education programmes. Information and Communication Technology (ICT), some would argue has been around almost as long as professional development programmes. With a rapid change in the speed of technological development since the late 1980s there has been a growing need for teachers to access professional development to support the use of ICT, as schools have invested heavily in new technologies, primarily computers, to place in classrooms to support student learning.

ICT System Reform – A Brief History

Co-ordination of ICT use in New Zealand schools began to evolve in the early 1990's with the publication of the Consultel Report: "The use of telecommunication technologies for the enhancement of educational services." The Consultative Committee on Information Technology in the school curriculum was chaired by Professor Philip Sallis and was charged with making recommendations to the government about policy goals for information technology within the curriculum. The report;

- warned against uncoordinated and unsupported implementation of new technologies into learning environments.
- stressed the need for educators using the technology to be adequately trained.
- called for implementation to be well coordinated and funded.

A common theme amongst those interviewed by the authors was that technology in itself was not the answer. The technology was described as a tool that had to be matched to educational methods in a way that 'augmented' or added value to learning to be successful. It maintained that, "new technologies are teaching and learning tools. They do not substitute for teachers but technology developments provide an additional means by which learning can take place."

While there were a range of initiatives involving ICT in the mid-1990s with both business and the Ministry of Education it was not until December 1996 that the new Coalition Government announced it would be developing and implementing an "Information and Technology in Learning" strategy that would ensure all New Zealand children are equipped for the information age by an education system which is fully attuned to New Zealand in the 21st century.

Interactive Education: *An Information and Communication Technologies (ICT) Strategy for Schools* was launched by the New Zealand Government in October 1998. It was supported with a

budget of $14.5 million over three years. The strategy was a concerted effort by the government at a national level to integrate ICT into teaching and learning programmes in primary and secondary schools using a range of initiatives. A key focus of the strategy was to change teacher practice to make better use of Information and Communication Technologies in their teaching and learning programmes. Its four key objectives were to:

- improve student learning outcomes;
- improve the teaching of ICT through the curriculum and to reduce their time spent on administration tasks;
- support principals to manage their ICT professional development needs;
- Increase opportunities for schools, business and government to work together to improve educational opportunities.

The Minister of Education behind the strategy believed that ICT use should be part of every teacher's toolkit and that ICT skills are essential for work and life in the modern world. (Brown 2003). It is suggested that the 1998 strategy and subsequent 2002 strategy document, Digital Horizons, details to some degree the developmental process by which teachers will successfully integrate ICT into their teaching and learning programmes. Brown (2003) argues that missing from the literature is a description of what the development process is actually like for regular teachers who have limited resources. There is an almost implicit expectation that the early adopters of ICTs into their classrooms will need to play a key role in school based reforms. This is of concern given that there is some research to suggest that teachers with more computer and pedagogical experiences do not always use ICTs more often and more flexibly than other staff (Becker and Ravity 1999). Also designers of new educational technologies know that early adopters of new technologies have different experiences from late adopters and therefore the process of use and understanding of the new technology by these groups can be quite different. (Bruce 1999).

The ICT PD Clusters was one initiative that developed out of the strategy documents. Clusters of schools were provided with resources over a three year period to support the integration of ICT into their schools through cluster based professional development programmes. This

initiative has seen clusters of schools come together for training and professional development with ICT. By the end of 2003, 40% of New Zealand schools had been involved in this initiative either as lead schools or as schools receiving support from a lead school. Their progress has been tracked since 1999 in an effort to measure what effect the professional development programmes being provided is having on skill level, confidence and usage within the classroom context. Ham et al (2004) in their examination of trends from 1999 – 2003 of schools involved in the ICTPD clusters is suggesting that there are patterns emerging that are going to impact on future strategy implementation.

There is a range of literature available on professional development, both specific and non-specific to ICT (Information and Communication Technology). This literature documents both successes and failures of professional development programmes and helps to identify factors that contribute to successful implementation as well as identifying possible limitations.

There is a large body of research that states that teachers play a critical role in implementing ICT into teaching and learning (Brown 1998, Lai 1993, Selby and Ryba 1999). Lai (1999) draws attention to the importance of teachers being knowledgeable and clear about their beliefs and practices in teaching and learning before they are able to integrate the use of the Internet and ICT into the curriculum. Mouza (2002) states "that technology-related professional development programs need to provide teachers with a variety of activities such as modelling, discussion, brainstorming of ideas, hands-on actions and just-in-time support". In his study all teachers noted that hands-on activities were very helpful in learning to use technology. In-classroom support during the enactment of technology-enhanced lesson plans was also mentioned as an important aspect. Much of these initiatives had a focus on professional development and training for teachers in an effort to develop their confidence and capability in using these new technologies.

The ICT PD clusters programmes, part of the Ministry of Education ICT Strategy have used a wide range of models and approaches to professional development. While there was some criticism of this approach, it allowed individual clusters to contest for funding in this way rather than adopting a national model based on equitable distribution. Skerman et al (2000) Individual clusters have developed models, organisational structures and varying expectations of participation which included:

- Using a combination of fulltime and part-time facilitators from both within and outside the cluster.

- Varying the degree of centralisation of expertise and leadership within clusters.

- The use of a 'trickle down' effect of professional support for individual schools and teachers.

- Changing composition of clusters effecting the duration schools/ teachers spent in the cluster receiving professional support.

- The level of expectation on teachers to participate.

- The emphasis of professional development ranging from skills training to pedagogical consideration to developing administrative efficiencies.

- Using different professional development strategies to engage teachers and principals in the programme. (Ham et al 2001)

We have started to accumulate in New Zealand, a substantial body of research data on ICT PD. We have data collected by the Education Review Office as well as ITAG reports. Some of the most insightful work has been completed through successive evaluations of the ICT PD Cluster Schools. Christchurch College of Education was contracted by the Ministry of Education to undertake an evaluation of the original 23 ICT PD programmes and have since gone on to evaluate further cluster programmes. The increasing demand for teachers to

integrate ICT into their teaching and learning programmes has resulted in a similar demand for ICT Professional development. In the last two years applications for ICT PD Development Cluster funding from the Ministry of Education Strategy has been significantly oversubscribed. The research team has tracked these clusters and has arrived at a range of factors that support effective ICT professional development.

While we have this wealth of data on these schools we know little of what has been occurring in the 60% of schools who have not been touched by this initiative. To date, excluding a recent ERO report (2005), no data has been collected to find out what has happened in these schools. With the current strategy due for revision it would seem an opportune time to examine the similarities and differences that exist within cluster and non- cluster schools in professional development opportunities in ICT. Such information will allow for a clearer picture that better reflects the state of ICT integration in New Zealand schools.

Research Questions and Methodology

This project compared the ICT professional development opportunities in ICT PD and Non-ICT PD Schools.

Given that data has been collected continuously since 1999 on ICT PD clusters the first task was to answer the question, what does ICT professional development look like in Non- ICT PD Cluster Schools compared to ICT PD Cluster Schools?

- What type of access to ICT professional development did teachers in Non-ICT PD Cluster Schools have?

- What has been the type and duration of ICT PD events in Non-ICT PD Cluster Schools?

Once the profile of Non-ICT PD schools had been created comparisons could then be made with ICT PD schools. We were then able to examine;

- What differences and similarities exist in the skills, confidence and classroom usage levels of ICT with teachers from ICT PD Cluster and Non- ICT PD Cluster Schools?

Methodology

The research took the form of a survey. The survey collected data which helped to define ICT PD events occurring in Non-ICT PD schools as well as items from the ICT PD School Cluster Professional Development Programme Entry Survey and the ICT PD School Cluster Professional Development Programme End of Project Evaluation. The timing of data collections was as follows:

Non-ICT PD Schools Survey	**Collected Term 4 2004**
ICT PD School Cluster Entry Survey	**Collected Term 1 2004**
ICT PD School Cluster End of Project Evaluation 02-04	**Collected Term 4 2004**

The Non–ICT PD school's profile is discussed in greater detail later in this paper. The ICT PD School Cluster Entry cohort is the group we know least about. Unlike the ICT PD School Cluster End of Project cohort, who have spent three years involved in professional development which is well documented, the Entry cohort was expected to be similar to the non ICT-PD schools cohort in that they have yet to be involved in cluster based ICT professional development. If ICT PD clusters are making a difference then we would expect to see this difference when comparing results with this cohort and the two others. We do not know what professional development opportunities have been afforded this group in their efforts to become involved in an ICT PD cluster. In the application process for the ICT PD programme, clusters of schools need to identify and demonstrate what they have done as a cluster in preparing themselves for the ICT PD contracts. This may involve significant work in the area of ICT PD, but there is little data to determine this.

Sample

The quality of this research is dependent upon the suitability of the sampling strategy. For survey style research, a large sample is required if inferential statistics are to be calculated. (Cohen et al 2000). It is suggested that a sample size of no fewer than 30 cases be used for correlational research and that for survey research there should be no fewer than 100 cases in each major subgroup.

Given that the population of Non-ICT PD Schools is around 60% of New Zealand schools a stratified sample of primary and secondary teachers was required. This ensured that both primary and secondary schools were represented within the sample and that the sample size was large enough. The sample size is defined in the following table.

Summary	Totals	Primary	Secondary	Intermediate	Composite	Kura
Number of schools	1711	1486	225	85	81	30
Number of schools surveyed	349	186	163	8	37	30
Percentage of schools	20%	13%	59%	9%	46%	100%
Number of surveys	1484	741	743	40	113	40
Number of returns	431	211	220	17	44	3
Percentage of returns	29%	28%	30%	43%	39%	8%
				included within primary and secondary		

This project sampled 349 (20%) of Non-ICT PD schools. The selected sample was to reflect, where possible, the national characteristics of the New Zealand school population and that within the sample all deciles and geographical regions were represented. A random selection of 186 primary and 163 secondary schools were identified. The schools were compiled from the Ministry of Education list of schools which had not participated in ICT PD Cluster programmes. The anonymity of the participants was protected as the survey didn't require personal details to be disclosed. While demographic information was collected and surveys were coded, this was only for determination of subgroup analysis and to eliminate multiple submissions by individual participants. Entry of data was through survey coding with no reference to specific schools. The data was stored on a password protected non networked computer with returned surveys kept within a locked filing cabinet.

Of the 349 schools surveyed 3 were on the wrong list, having participated in ICT-PD. Included in the sample of schools surveyed were Intermediate, Composites and Kura. A small response from kura may have been the result of an over representation in New Zealand research studies. One principal from one of the kura who returned incomplete surveys explained that the kura had received 10 requests for their school to be involved in some research task in the first week of the term. Overall the response rates were low with only 29% of all surveys sent completed and

returned. This level of response may place limitations on the validity of the results. Crotty (1998, p32) states that, "internal validity refers to the extent to which a question or variable accurately reflects the concept the researcher is actually looking for. External validity refers to the generalisability of the findings gathered in the research. Five copies of the survey were sent to principals at each of these schools to distribute to teaching staff. Some of the primary schools and kura selected had less than five teachers. In these schools the number of surveys sent was equivalent to the number of teaching positions identified through Ministry of Education staffing allocations. In these schools the principal was classified as one of the teaching staff.

While the sample of schools was randomly selected the randomness of teacher selection within these schools was assured. The principal determined which teachers received the survey. While the letter to principals asked for a random sample of staff, there was no direct control on how this was administered in individual schools.

The Non-ICT PD cohort data had a greater secondary response (51%) to primary (49%). Secondary responses made up only 35% of the entry cohort and only 18% of the exit cohort. Given the differences between sector organization and resourcing, the areas of difference highlighted in this research report between the different cohorts could be affected by the variances in sector representation.

The Non-ICT PD Cluster Profile

Sex	Totals	Primary	Secondary
Male	135 (32%)	46	89
Female	287 (68%)	174	113
Not stated	9		

Years of Service	0=2	3=5	6=10	11=15	16=20	21=25	26=30	30+	NR
	40	73	71	45	49	60	45	30	18

The surveys returned include responses from all decile levels as well as a range of responses from teachers with varying teaching experience. The sex representation closely reflected the other two cohorts surveyed. Male responses ranged from 23-32% over the three cohorts with female responses ranging from 68-77% ($X^2 = 2.05$, $P= 0.359256$, Chi =13.8). The years of service for this cohort was very similar to the other two cohorts in terms of distribution. The difference across all three cohorts for each age band ranged between 1% and 5%.

Results

Non-ICT PD Professional Development

ICT PD hours within last 36 months	0	1 to 9	10 to 49	50 to 99	100 to 499	500 to 999	1000+	NR
Secondary	43	49	84	15	11	3	1	5
Primary	43	59	63	19	8	1	0	18

The amount of time respondents had spent on ICT Professional Development ranged from 0 to 1472 hours. Any respondents in the 500 + categories as well as a significant number within the 100 – 499 hours category were undertaking tertiary studies in the area of ICT. These studies took up the bulk of hours of their ICT PD as detailed in the survey.

ICT PD Events	Personal	Dept / Synd	Curriculum	Whole	Cluster
Secondary	163	39	35	106	23
Primary	146	36	19	106	25

The survey tried to get a sense of how the time spent on professional development events was organised and by whom. In Non-ICT PD schools, individual or personal professional development was the primary form of training that took place. This was followed by whole school sessions. This result was somewhat predicted given that these schools are not involved in cluster professional development which often requires school wide professional development approaches. There is also an expectation of schools about to enter into ICT PD clusters to demonstrate prior professional development experiences in ICT.

The distribution of event types was similar across sectors. Departmental / curriculum specific professional development was greater within secondary schools. This reflects secondary schools organizational structures.

ICT PD Type	Software	Hardware	Integration	Theory	Teaching and Learning Principles
Secondary	35%	15%	19%	13%	18%
Primary	30%	17%	25%	11%	17%

The focus of the ICT professional development was distributed across a range of types, with an equal share directed to software and hardware use compared to teaching and learning theory and integration. Secondary teachers spent more time on PD which had a focus on software use. Primary teachers spent more time on integrating ICTs into teaching and learning. A similar pattern of distribution emerged when defining the professional development types as either supporting teacher administration or supporting classroom use. We see a pattern of greater software use and administration PD in secondary, compared to integration and classroom use in primary PD.

ICT PD Type	Admin	Classroom use
Secondary	51%	49%
Primary	45%	55%

To create a general sense of this group of schools we are calling Non-ICT PD schools we can define them in the following ways.

Non-ICT PD Schools:

- Reflect the teaching population as a whole being made up of both males and females with a wide range of years of teaching experience.
- ICT PD experiences are more likely to be of a personal, individual nature followed by whole school experiences

- ICT PD experiences within the last three years would be more likely to total less than 10 hours in duration for 46% of teachers. Twenty percent of this group have had no ICT PD in the last three years.
- Spend approximately equal amounts of time of their ICT PD on administrative use and classroom use.

Skills

Using the same questions and continuums with all three cohorts allowed for a direct comparison in a range of areas. These included skills, confidence, concerns and usage. The descriptors used in the survey described varying degrees of skill which ranged from no use of ICT to advanced levels of use. The three cohorts varied in size from 4018 to 420 respondents.

Word Processing	ICT PD Entry	Non-ICT PD	ICT PD Exit
No use	1%	1%	1%
Basic use	15%	7%	7%
Intermediate use	45%	34%	26%
Proficient use	39%	57%	61%
	n=4018	n=424	n=1239

Internet	ICT PD Entry	Non-ICT PD	ICT PD Exit
No use	5%	1%	2%
Basic use	29%	19%	22%
Intermediate use	59%	50%	54%
Proficient use	7%	15%	23%
	n=3986	n=423	n=1178

Spreadsheets	ICT PD Entry	Non-ICT PD	ICT PD Exit
No use	41%	22%	20%
Basic use	39%	41%	41%
Intermediate use	15%	27%	29%
Proficient use	5%	10%	10%
	n=3908	n=420	n=1163

File Management	ICT PD Entry	Non-ICT PD	ICT PD Exit
No use	3%	1%	1%
Basic use	23%	13%	10%
Intermediate use	34%	29%	28%
Proficient use	40%	57%	61%
	n=3993	n=422	n=1182

The pattern, one would assume from three years of co-ordinated professional development in the area of ICT would be an increase in the personal skill level of participants. Ham et al (2001) provides a summary of the type of ICT PD events that occurred for teachers involved in these clusters. Many of the programmes offered provided training in the use of software application and management. The collated results indicate that the skill level is significantly greater for teachers who have been involved in ICT PD clusters than those who are about to enter such programmes. This would be an expected result given that one of the key objectives of the ICT PD programme was to increase skills among teachers across a range of educationally useful ICTs. If we look at Ham et al's (2004) report on the 2002-2004 cluster programme we are able to see the significant improvement of skill level of the exit 2004 cohort.

The results from Non-ICT PD schools stand out from the data comparisons. The perceived skill level of teachers in Non-ICT PD schools shared a closer relationship with the Exit cohort than the Entry cohort. What then can we infer from such results? Does this suggest that teacher's personal ICT skill level will develop regardless of whether or not they are in ICT PD clusters? We can expect that successive Entry cohorts will have an ever increasing skill level. Ham et al (2005) proves this to be the case. We would also expect there to be a similar pattern in the Entry cohort to that of the Non-ICT PD cohort. Any difference could be a result of a greater level of anxiety on teachers about to enter ICT PD.

Does it suggest that it is individual schools that drive the need for teachers to develop personal ICT skills? Again one would expect a similar pattern of results in the Entry and Non-ICTPD cohorts. Could it be that as teachers are exposed to professional development in ICT, their perceptions of their own capabilities reduce given this greater exposure to the possibilities of ICTs and the skills required to realize these possibilities? Are the Non-ICT PD schools in a situation of *"you don't know what you don't know"*? Is it that their skill level is based on consideration of their capabilities in relation to their teaching peers in their schools as opposed to ICT PD schools which may place themselves and their capabilities against a wider cohort through the use of cluster based PD?

What impact has the other initiatives that sit within recent ICT strategies had on the personal skill level of teachers? ICT PD clusters is just one of a range of initiatives which have been developed to increase confidence and capability in teachers in the use of ICT. It is possible that some schools have had more opportunity for ICT professional development as part of some other project which has evolved out of the strategy than those in ICT PD clusters.

Concerns

The three cohorts were surveyed on the degree of concern they held for a range of issues surrounding the use of ICT in education. While this research is a comparative analysis of the different groups it is worth noting that a sizable group of teachers within each of the cohorts see many of these issues as being of concern. That includes teachers who have had opportunities for large amounts of professional development as well as feeling confident in their skill and usage levels with ICT and its integration into teaching and learning programmes.

Technical Problems	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	8%	14%	10%
Some Concern	34%	39%	35%
Significant Concern	58%	47%	55%
	n=4017	n=425	n=1127

Lack of Time	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	11%	12%	19%
Some Concern	37%	35%	41%
Significant Concern	52%	53%	40%
	n=4036	n=425	n=1125

Access for Student Use	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	16 %	18%	20%
Some Concern	35%	33%	39%
Significant Concern	49%	49%	41%
	n=4045	n=425	n=1108

The most significant issue for both the Entry and Exit cohorts was dealing with technical problems. The Non-ICT PD cohort did not rank this as highly as a significant concern. They

identified lack of time as the most significant issue for them. The percentage differences for each cohort were relatively small in the three most significant areas of concern. All three cohorts recorded the same three issues as their most significant concerns, although order in which they placed these three areas differed slightly. Ham et al (2005) identifies technical problems as the most significant concern highlighted by teachers entering ICT PD since they began collecting data in 1999. The trend also exists over this time with lack of time and access for students, being the second and third most significant concerns held by teachers since 1999.

The greatest concern expressed by the Non-ICT PD cohort was lack of time. This was a surprising result given the small amount of time on average this cohort has spent on professional development in ICT over the last three years. This response could be the result of the time constraints placed upon teacher demands and that further professional development in the area of ICT use could be seen as additional work. Unlike the other two cohorts who have committed their schools to ICT professional development as part of the ICT PD clusters or in preparation for joining a cluster.

The three areas which scored as the least significant concerns were; lack of keyboard skills, change of teaching style and that ICTs don't improve learning. Again all three cohorts scored these in their bottom three least significant concerns.

lack of keyboard skills	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	66%	76%	73%
Some Concern	25%	19%	22%
Significant Concern	9%	5%	5%
	n=4038	n=425	n=1113

Change teaching style	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	53%	53%	61%
Some Concern	38%	40%	34%
Significant Concern	9%	7%	5%
	n=4039	n=425	n=1103
ICTs don't improve learning	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Concern	61%	60%	67%
Some Concern	31%	31%	26%
Significant Concern	8%	9%	7%
	n=4018	n=421	n=1109

All three cohorts do not see a lack of keyboard skills as a significant concern. This response was expected given the wide range and use of technologies which require little in the way of keyboard activity.

The other two areas with the least significant concern are interesting results as they are both areas which have been debated widely in recent years. Both in Ministry of Education documentation as well as literature in the ICT field there has been much written about the need to focus on pedagogical changes that are required for the potential of ICT in teaching and learning to be realized. Talk of new paradigms and the need for teachers to drastically change the way they organize and deliver curriculum have been promoted (Reynolds et al 2003). Yet less than 10% of respondents in each of the cohorts saw this as a significant concern. Those having just finished ICT PD, those who about to start and those who have had none all consistently agree that changing their teaching style to incorporate ICT is not a significant issue.

The issue that ICTs do not improve learning is also clearly not a concern for most teachers in all three cohorts. They were positive in general about ICTs. Of all the concerns that were surveyed, the question that presented an unanticipated response was the concern that ICTs don't improve learning. One would have suspected that the group who would have the greatest concern would have been the Non-ICT PD cohort. This suggests that there is a general belief that ICTs are contributing to improved learning. What this is based on and how this belief is arrived at is not clear.

So when we look to compare the Non-ICT PD Cohort with the other two cohorts in this study we also see that;

- They identify as having a high personal skill level in the use of a range of computer applications (word processing, e-mail and Internet use)
- They show less concern about the need to change existing teaching practices to include ICTs into their teaching and learning programmes

Confidence

The teachers in each cohort were asked how confident they were in using ICTs personally and in their classrooms.

Teacher Confidence	ICT PD Entry 2004		Non-ICT PD 2004		ICT PD Exit 2004	
	Personal	Class	Personal	Class	Personal	Class
Very Confident	14%	8%	25%	17%	25%	17%
Confident	43%	30%	44%	42%	54%	50%
Neutral	26%	34%	20%	27%	18%	25%
Not Confident	14%	25%	10%	13%	3%	7%
Anxious	3%	3%	1%	2%	0%	1%
	n= 4018	n= 4018	n= 424	n=423	n=1108	n=1103

The results create a similar pattern to those recorded in the skills section of this report. There is an identical percentage of teachers in the Exit and Non-ICT PD cohorts who are very confident users of ICTs, both personally and in their classrooms (25% and 17%). This differs to that of the entry cohort (14% and 8%). This in some ways is expected given that both groups believe they have higher personal skill levels in core ICT software applications compared to the entry cohort. Does a higher personal skill level translate to a greater level of confidence in personal use of ICTs and to a lesser extent use within the classroom?

The Entry cohort has 17% and 28% of teachers either not confident or anxious about personal and classroom ICT use respectively compared to the Non-ICT PD cohort with 11% and 15%, and the exit cohort with 3% and 8%. One could suggest from these results that the effect of ICT PD may in fact not only increase the confidence of teachers but more importantly decrease the concern and anxiety teachers exhibit towards ICT use.

Usage

The surveys collected data on the current use of ICT with students. The data asked teachers to indicate the frequency with which they used a range of ICTs with their students. Usage reflected patterns which were similar to those in the skills section of this report. This pattern saw the Exit cohort record the greatest amount of student ICT use, followed by the Non-ICT PD cohort and with the Entry cohort recording the least amount of usage.

WP - Creative	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Response / Not Used	24%	16%	7%
Once-Twice / Year	20%	15%	12%
Once-Twice / Term	29%	31%	39%
Once-Twice / Week	19%	24%	30%
Daily	8%	14%	12%
	n=3568	n=416	n=1127

Multimedia	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Response / Not Used	81%	58%	26%
Once-Twice / Year	13%	27%	32%
Once-Twice / Term	4%	12%	32%
Once-Twice / Week	2%	3%	7%
Daily	0%	1%	3%
	n=3542	n=425	n=1120

One variation occurred in the use of spreadsheets and databases. In this question the Non ICT cohort scored significantly higher than the other two cohorts. This variation could be attributed to the higher percentage of secondary school teachers in this cohort and the greater use of such tools in secondary schools programmes compared to primary schools.

Spreadsheets / Databases	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Response / Not Used	73%	58%	75%
Once-Twice / Year	16%	18%	17%
Once-Twice / Term	7%	16%	6%
Once-Twice / Week	3%	6%	2%
Daily	1%	3%	0%
	n=3541	n=416	n=1124

Two areas where the Entry cohort aligned more closely across the range of categories than in other areas was in the use of e-mail and Internet.

E-Mail	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Response / Not Used	59%	39%	41%
Once-Twice / Year	22%	27%	30%
Once-Twice / Term	12%	25%	21%
Once-Twice / Week	5%	5%	6%
Daily	2%	4%	2%
	n=3523	n=415	n=1127

Internet	ICT PD Entry	Non-ICT PD	ICT PD Exit
No Response / Not Used	23%	15%	16%
Once-Twice / Year	18%	12%	12%
Once-Twice / Term	32%	39%	35%
Once-Twice / Week	20%	23%	25%
Daily	7%	11%	12%
	n=3585	n=416	n=1115

The alignment of responses to the email question could be explained by the general high response of low usage by all of the cohorts. With no cohort regularly using e-mail (Once a week or more) there appears to be a consensus across the cohorts that there is little place for e-mail in classrooms at this point in time.

Given a similar alignment in Internet use but with a greater frequency of use one could infer that teachers can see greater opportunities integrating the Internet into their classroom programmes. Given also the higher usage levels in the Entry cohort one could also suggest that teachers can see the possibilities of this technology without ICT PD.

When teachers were asked to what extent they were integrating ICT into their classroom programmes the results again saw a closer relationship between the Non-ICT PD cohort and the Exit cohort than to that of the Entry cohort.

Current Use of ICT with Students	ICT PD Entry	Non-ICT PD	ICT PD Exit
No units	81%	6%	4%
One or two units	13%	27%	24%
Several units	4%	40%	30%
Most units	2%	13%	27%
All or almost all units	0%	14%	15%
	n=3516	n=423	n=1120

The Exit cohort recorded 42% ICT use with students in all or most of the units that were taught compared to 27% for the Non-ICT PD cohort and 2% of the Entry cohort. This suggests that the greatest impact of the ICT PD clusters compared to those who have yet to be involved in these programmes is the impact the professional development appears to be having on teachers attempting to integrate ICTs into units of work. Teachers in the Exit cohort are using ICTs more with students. Put simply, this is the direct benefit of the ICT PD clusters. The intentions of the ICT strategy in terms of teacher and student use are being realised.

Discussion

It is important to note that interpretations of data can be viewed from different perspectives. We can consider the results from that of *optimist-rhetoric* and also of *pessimist-rhetoric*. Reynolds et al (2003) argues that a large body of *optimist-rhetoric*, couched as research, supports the idea that ICT raises standards of pupil achievement. Much of this work, they suggest, requires carefully-designed methods of instruction on the part of teachers. Guile (1998) a strong advocate of optimistic views of ICT argues that teaching with ICT is not suited to the traditional pedagogical styles where teachers are "solely managers and didactic teachers". Teachers will need, he explains, to ensure that "different types of learning (i.e. transmission and inquiry-based) are clearly differentiated and carefully related to the proposed use of ICT." Only this fundamental change will "ensure ICT can fulfil its potential as a resource to make learning more intrinsically satisfying and meaningful." Guile believes vehemently in the huge potential of ICT for the improvement of education, but he also believes that a revolution is required in the way teachers plan and deliver their lessons in order for the changes to occur. His emphasis throughout is on the role of the teacher in the centre of the process, stating that gains in achievement "occur primarily because teachers have designed new contexts as well as new learning processes to support learning with ICT." Conversely there is the *pessimist-rhetoric*. One sector of *pessimist-rhetoric* is opposed in principle to the use of any form of computer technology in schools. The pessimists link this to their perceptions of how society should develop, what should be its goals, its purpose,

and its ethical underpinnings. Reynolds et al (2003) states that the pessimists have been supported to some degree from academic research which has challenged the impact ICT has in improving learning over a number of years.

While this research did not find out if ICT improves student achievement, the results in some ways suggest we have a positively optimistic teaching profession with regards to the place ICT plays in teaching and learning. We can suggest such a position given the degree of concern, or lack of, held by the three cohorts regarding the need to change their teaching style and the degree to which they disagree with the statement that ICTs may not improve learning for students.

Entry and Exit cohorts have either been or are about to be actively involved in ICT PD. The focus for these groups is on ICT PD. It could be inferred that for these cohorts some thought and consideration has gone into the place of ICT in teaching and learning. This thought may in fact generate a greater degree of concern brought on by a greater awareness of ICT. One would expect this concern to be greater in the Entry cohort given that they are about to embark on a three year programme of professional development in an area which for many of the teachers has not been part of their lives

The Concern-Based Adoption Model (CBAM) was developed by Hall, Wallace and Dossett in 1973. The concept of "concerns" has been described as "the composite representation of the feelings, preoccupation, thought, and consideration given to a particular issue or task. Depending on the personal makeup, knowledge, and experience, each person perceives and mentally contends with a given issue differently; thus there are different kinds of concerns" (Hall & Hord, 1987, p. 59). This model views change as a process rather than an event and examines the various motivations, perceptions, attitudes, and feelings experienced by individuals in relation to change (Hall et al., 1973). Concerns theory and research reveal that concerns change over time in a fairly predictable, developmental manner (Hall & Hord, 1987; Hord et al., 1987). If we can predict how concerns will change throughout the phases of the

change process, we can design in-service and other intervention activities to address those needs (Dooley, 1995).

This theory could support the position that a lack of preoccupation with ICT on the part of Non-ICT PD schools would reduce levels of concern. This cohort may not have to content with a number of issues that ICT appears to be generating for schools where ICT PD is or will become a focus. Thus, a lack of thought or consideration for ICT issues helps to reduce concerns teachers may have. What this theory does raise which needs further consideration is that the concerns for a number of these issues do not reduce after extended periods of time for teachers involved in ICT PD. While they are generally lower in the Exit cohort they still hold concerns about the same things. Some concerns still scored highly for the Exit cohort. The theory suggests that appropriate professional development should help to address such issues over time. While the significant concerns held by the Exit cohort are less than those held by the two other cohorts the level still remains high. The areas which are of significant concern may not be addressed in the course of the professional development offered. Technical issues (55%) for example could be a site-based issue and is in no way influenced by the professional development being offered. Other issues which score as significant concerns are student access to equipment (41%), lack of time (40%), lack of support (24%) and the ongoing need to up-skill (24%). These concerns are, in some ways, on the peripheral of what is described by Ham et al (2002) as ICT PD events delivered by clusters. There are other initiatives within the government strategy which go some way towards addressing these issues.

The relatively high skill levels of the Non-ICT PD cohort was an unanticipated result. One possible explanation could be the possible impact of other ICT initiatives as part of the National ICT Strategy.

In the ICT in Schools 2003 Report (Fink Jensen et al 2003) found that:

- Overall, schools more commonly reported 80% or more of their computers were connected to the Internet.

- The ratio of computers to students is now one computer for every four secondary/composite students, and one computer per seven primary school students. In special schools, the ratio of computers is one computer per three students.

- More schools are networked. A total of 66% (cf. 49% 01) of schools can be described as "fully networked" (80% or more classrooms linked). Networking was prominent in both primary and secondary/composite schools.

In the area of professional development it was found that;

- More than two-thirds of principals have attended a professional development programme in the last 12 months. In particular, 70% of secondary/composite principals reported attending a programme, as did 68% of primary and 60% of special school principals.

- Half of primary and special schools had 50% or more of their teaching staff attend a programme, whereas only 39% of secondary/composite schools had 50% or more of their staff attend.

- Expectations of future teacher attendance is high with 70% of secondary/composite schools expecting 50% or more of their teachers to attend programmes in the next 12 months. This was followed by 64% for primary schools and 42% for special schools.

The impact of ICT professional development outside that of the ICT PD clusters could affect results for the Non-ICT PD schools cohort. One such initiative has been the laptops for teachers scheme (STELA and TELA). This programme has rolled out leased laptops to teachers since 2002. The programme initially began with senior secondary school teachers and now covers all full-time teachers from Year 1 upwards. Part of the agreement with the supply of laptops is that teachers will undertake a certain number of hours of personal PD in

the use of the technology. While there appears to be no monitoring of this requirement in schools by the Ministry of Education, providing access to technology in the form of a personal laptop one should expect an increase in the personal skill level of teachers as a result of this type of access to technology. The laptop programme is independent of the ICT PD cluster programme. This could help explain the high level of personal ICT skills on the part of Non-ICT PD schools.

There are people who challenge the gains made in the name of ICT given the amount of capital expenditure. Cuban (1999) in his book argued that "the billions of dollars already spent on wiring, hardware, and software have established the material conditions for frequent and imaginative uses of technology to occur. Many students and teachers have acquired skills and have engaged in serious use of these technologies. Nonetheless, overall the quantities of money and time have yet to yield even modest returns or to approach what has been promised in academic achievement, creative classroom integration of technologies, and transformations in teaching and learning" (p 189). The results from the data for Non-ICT PD schools suggest that we have, through the provision of technology and professional development, enabled teachers to develop a core set of ICT skills. What is not clear is whether this has been matched with an understanding of effective teaching methodologies that support ICT integration into teaching and learning. Over 50 % of Non ICT respondents had no concern about having to change their teaching style or how they would integrate ICT into their teaching programmes. Over 70 % had no concern about their lack of keyboard skills with ICT yet 48% of all respondents had received less than 10 hours of professional development in ICT in the last 36 months, of which approximately half of this had a focus on classroom use. The level of *"very confident"* personal and classroom users of ICT is identical in the Non-ICT PD and Exit cohorts. Have we created teachers who through their involvement or not in ICT PD, believe they possess appropriate skill sets to not only use ICT both personally but also integrate it within the classroom environment as part of their teaching and learning programmes?

Another interpretation could be that Non-ICT PD schools are unaware of the world beyond their current schools in relation to ICT and teaching and learning. That based on their experiences, they have judged their skills to be of a high level and their integration of ICT into their teaching and learning to be at a similar level. As a cohort they have higher ICT skills and less concern about the impact of ICT on their teaching style than the cohort who have spent three years in ICT PD. Even the advocates who positively support ICT and its place in teaching and learning programmes are arguing that fundamental changes in teaching style and delivery are required to "ensure ICT can fulfil its potential as a resource to make learning more intrinsically satisfying and meaningful." Guile (1998, p 153)

Does this issue have the potential to create a divide between schools? Does this create greater challenges in getting teachers to consider changes to their teaching practice in schools that are still yet to enter ICT PD programmes given the perceptions they currently hold relating to their skills, confidence and concerns.

Conclusion

So what is the state of the nation? What has in fact changed in schools as a result of the ICT PD cluster programmes which are part of the national strategy?

The Ministry of Education's ICT Strategy (2003) has, as one of its goals, that "learners have systematic opportunities to develop digital and information literacy and enjoy using ICT creatively, constructively and critically in extending their horizons and growing as lifelong learners". For this to occur it requires teachers to "become confident and capable users of ICT, use ICT to support professional growth and administration and integrate ICT flexibly and effectively within the curriculum to enhance learners' knowledge, skills and attitudes.

Those teachers who have had systematic opportunities to develop their digital capabilities through ICT PD clusters have reduced their levels of concern compared to the other two cohorts. They are generally more confident than the other cohorts in the use of ICT with their students. This is part of the effect of ICT PD clusters. As this group critically examine

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the teaching horizon based on the experiences they have gained through ICT PD, their concerns have lessened although some issues still remain at a high level. This suggests that ICT PD clusters are making a difference to the goals set for teachers and students in the strategy. For those who are about to enter into ICT PD clusters we appear to be creating greater degrees of concern for these teachers as well as lowering their levels of confidence and perceived capability in their use of ICT. We can, to some extent, map the impact of entry into an ICT PD cluster if we compare the Entry cohort and the Non-ICT PD cohort. The only difference between the two cohorts is that one is about to enter into an ICT PD cluster and the other has not given it consideration. It would be worth examining how long it takes, after entry into the ICT PD cluster programme for the Entry cohort to return similar levels of skills and confidence as those displayed by the Non-ICT PD cohort.

The percentage of teachers who are very confident in both personal and classroom use of ICT is identical in the Non-ICT PD and Exit cohorts. Entry into ICT PD clusters appears to change this level of confidence in a negative way quite significantly. Yet the impact of ICT PD clusters is clearly evident. They are making a difference to the level of ICT use within classrooms. So how do we explain the Non-ICT PD phenomenon? Why to they share a closer relationship to the Exit Cohort than to the Entry Cohort in terms of skills, confidence, and usage of ICTs?

Ham (2004) suggested that there is a relationship between skill level and usage early on in ICT PD cluster programmes. This relationship disappears after about 6 months and that the correlation between confidence and usage was more important as this relationship or pattern remains throughout the three years of the programme. Could it be that with such a wide range of ICT initiatives delivered by the government as part of its ICT strategy in recent years that we are creating the same conditions that exist for ICT PD clusters without the anxiety associated with entry into a cluster?

ICT has a relatively short history. The first e-mail was sent by Ray Tomlinson in 1971. Apple released its Apple I computer on April 1st 1976. In 1998 56k modems had surpassed slower 28K models as the new standard for Internet access. By the time this survey was

completed in 2004 the ICT in School's Report was telling us that our schools were already very much "digital" in terms of their infrastructures. The landscapes that we call schools are changing rapidly in response to the world around them. Technology pervades so much of our lives that what we sought to measure in terms of advanced ICT skills in 2000 are now possibly seen as essential basics or possibly obsolete skills. Teachers have developed a range of core ICT skills with or without support of a co-ordinated ICT PD cluster programme. The majority of teachers have a positively optimistic belief that ICTs improve learning. The state of the nation looks healthy in relation to the ICT strategy's goals. ICT PD clusters are making a difference to the state of the nation. The effect of this difference is that they increase ICT usage by teachers and students. Does this improve outcomes for students? This project did not set out to answer that question. However, if one holds a positively optimistic view about what ICTs are doing to improve student outcomes then one would want one's students to have the opportunity to work with teachers who had been part of an ICT PD cluster.

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